ABSTRACTS

OF LECTURES AND POSTERS

EUROPEAN ORTHODONTIC SOCIETY 88th Congress Santiago de Compostela, Spain, 2012 18-23 June The authors of abstracts marked *** have indicated, or have failed to indicate, that they have a financial interest.

Oral Presentations

1 COMPARISON OF FACEMASK AND SKELETAL ANCHORAGE THERAPY WITH INTERMAXILLARY ELASTICS IN PATIENTS WITH MAXILLARY RETROGNATHISM

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AIM: To compare the dental and skeletal effects of facemask (FM) and skeletal anchorage therapy with intermaxillary elastic (SA) in skeletal Class III patients with maxillary deficiency in the pre-pubertal stage.

SUBJECTS AND METHOD: Fifty patients with a skeletal Class III malocclusion divided into two groups. FM (mean age 11.21 ± 1.32 ; 13 females, 12 males) applied by a bite plate (400 g for each side). In the SA group (mean age 11.75 ± 1.23 ; 13 females, 12 males) mini-implants were inserted between the maxillary second premolar and first molar area and miniplates between the mandibular lateral incisor and canine. A bite plate was used in the upper arch and Class III elastics were applied between the miniplate and mini-implant (200 g for each side). Treatment duration was 0.53 ± 0.10 years in the FM group and 0.76 ± 0.09 years in the SA group. A *t*-test was performed for comparison of changes between the two groups and an independent *t*-test for inter-group differences.

RESULTS: The crossbite and concave soft tissue profile were eliminated in all subjects. After treatment statistically significant increase of SNA, ANB, SnGoGn, Co-A, CoGn, A-Nperp appraisals and reduction of SNB were observed in both groups. Changes in these parameters were similar in both groups. Maxillary incisor protrusion was observed in both groups, while statistically significant differences were found between the two groups. A statistically significant reduction in the FM group and an increase in the SA group were observed in mandibular incisor inclination. These different movements of the mandibular incisors between groups were statistically significant.

CONCLUSION: Treatment effects of FM and SA therapy were similar except for lower incisor inclination. Skeletal effects can be achieved by skeletal anchorage therapy, which could be an alternative to extraoral appliances in patients with maxillary retrognathism.

2 PRE-SURGICAL TREATMENT PLANNING FOR MAXILLARY CANINE IMPACTION USING TWO- VERSUS THREE-DIMENSIONAL IMAGING

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AIM: To compare surgical treatment planning for impacted maxillary canines between two-dimensional (2D) versus three-dimensional (3D) diagnostic radiographs, and to evaluate the influence of the imaging modality on treatment planning.

SUBJECTS AND METHOD: Thirty-two subjects (19 females, 13 males) with a mean age of 25 years (SD 14 years). In total, 39 impacted canines were referred for surgical intervention. Two sets of radiographic information were obtained. The first set was panoramic radiographs and the second 3D volumetric images obtained from a cone beam computed tomography (CBCT) scan. Both 2D and 3D pre-operative

radiographic diagnostic sets were produced and subsequently analyzed by four orthodontists and two oral surgeons. Peri-operative evaluations were conducted by the treating surgeon. A short post-operative recall after one week was recorded.

RESULTS: The observers had a significantly higher level of confidence in their CBCT image-based therapy plans than the 2D radiograph-based plans (P < 0.001). The radiographically based diagnosis of type of impaction, canine crown position in the sagittal and axial planes, contact relationship, and lateral incisor root resorption were significantly different between the 2D versus 3D datasets. In contrast, pre- and peri-operative evaluations were not significantly different when using 2D or 3D information. The use of 3D images resulted in extra diagnostic information compared to 2D in 31 per cent of the cases. The evaluation of this study recommended the use of CBCT in 61 per cent of the impacted canine cases. In 79 per cent of the evaluations, the observers changed the therapeutic approach based on 3D information. CONCLUSION: CBCT is recommended for the surgical intervention in canine impaction and root resorption of adjacent incisors.

3 A NEW ORTHOPAEDIC TREATMENT APPROACH FOR CLASS III MALOCCLUSIONS USING A RAPID MAXILLARY EXPANDER AND MINISCREWS

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AIM: To evaluate dentoskeletal changes in Class III preadolescent subjects concurrent to the use of a banded rapid maxillary expander (RME) followed by intraoral maxillary protraction, using miniscrews in the anterior part of the mandible.

SUBJECTS AND METHOD: Twelve subjects (9 boys, 3 girls, mean age 11.8 \pm 1.2 years). All had an anterior crossbite, a Class III molar relationship, maxillary skeletal retrusion, but no mandibular deviation. The subjects were instructed to activate the hyrax RME device twice daily for one week, deactivate twice daily for the following week and thereafter activate until the upper palatal cusps were in contact with the lingual slopes of the lower buccal cusps. After expansion, self-drilling miniscrews (diameter 1.7 mm, length 8-10 mm) were placed bilaterally between the roots of the lower lateral and canine teeth. Intraoral maxillary protraction was started on the day of screw placement using latex elastics with a force of 150-200 g on each side for 12-14 hours/day, mainly at night. Six subjects were omitted because of screw failure. Protraction was continued until a positive overjet was established .Two pre- and posttreatment lateral cephalograms were taken and 18 linear and angular parameters were traced and measured. Data were analyzed using paired *t*-tests.

RESULTS: A significant increase in SNA $1.65 \pm 0.60^{\circ}$ ANB $2.11 \pm 0.38^{\circ}$, Cd-A 3.30 ± 0.85 mm, Ao-Bo 3.5 ± 0.98 mm, N-Me 3.5 ± 0.63 mm, S-Go 2.45 ± 0.76 mm, SN-MP $1.45 \pm 0.53^{\circ}$, Ui –NA $1.12 \pm 0.6^{\circ}$, Ui –NA $2.1 \pm 1.23^{\circ}$, overjet +5.1 ± 0.97 mm, and a significant decrease in SNB $1.11 \pm 0.39^{\circ}$, SN-PP $0.3 \pm 0.8^{\circ}$ and SN-OP $1.38 \pm 0.055^{\circ}$ were observed.

CONCLUSION: In selected cases RME plus intraoral maxillary protraction using miniscrews produced dentofacial changes including forward movement of the maxilla, backward movement and rotation of the mandible, improvement of the maxillomandibular relationship and an increase in lower face height and overjet.

4 DOES BONE CEMENT AFFECT MINISCREW STABILITY?

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AIM: Bone cements consisting mainly of polymethylmethacrylate are widely used in orthopaedic surgery. The purpose of this study was to determine if bone cement increases the resistance of miniscrew against pull out forces.

MATERIALS AND METHOD: Thirty commercially available miniscrews divided into three groups (n = 10) were placed into bovine bone samples (one on each) at a 90 degree angle, using a custom made orientation jig that held a torque (30N-cm) and rotation (20 rpm) controlled rechargeable screwdriver. The miniscrews were placed using three different methods; self-tapping (group A), predrilling (group B) and predrilling with bone cement application (group C). The pullout strengths were tested with a pullout testing machine. Non-parametric Kruskal-Wallis tests were used for comparison because of the small sample sizes of the groups.

RESULTS: The pullout tests of the miniscrews placed with bone cement had a significantly higher maximum force at failure (624.92 ± 75.17 N; P < 0.05) than all other test groups. Group B (568.76 ± 80.40 N) showed a higher maximum pullout force compared with group A (475.76 ± 40.47 N). The loading curve for all three pullout test groups was largely linear until immediately before failure. The miniscrews separated from the bone, with cortical splinters of bone projecting upward in the direction of the pullout test.

CONCLUSION: This study is the first to demonstrate the effects of bone cement on the stability and resistance to failure at the bone-miniscrew interface. The findings show that the application of miniscrews together with bone cement is a promising method that may extend the limits of force application.

5 RESISTANCE TO SLIDING: SELF-LIGATING BRACKETS VERSUS TUBES USING AN ORTHODONTIC SIMULATING DEVICE

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AIM: To compare the resistance to sliding (RS) of self-ligating brackets (SLB) and tubes from different manufacturers with different archwire widths using an orthodontic simulation device.

MATERIALS AND METHOD: One active SLB (In-Ovation R, one passive SLB, Damon 3mx, a dual SLB, SmartClip and three tubes from different manufacturers (GAC, Ormco and 3M Unitek) were used along with one archwire, 0.019×0.025 inch stainless steel (SS). The study was performed at 0 degrees of angulation. An orthodontic simulation device in conjunction with 100 N load cell attached to an Instron universal testing machine was used to measure RS. Each attachment/archwire combination was tested seven times. Statistical comparisons were performed using two-way analysis of variance followed by Dunn's multiple comparisons. The level of statistical significance was set at P < 0.05. Scanning electron microscopic (SEM) images from the slots of the brackets and tubes were taken to determine visual differences.

RESULTS: There was a significant difference in RS between brackets and tubes from the same manufacturers with a 0.022 inch slot coupled with a 0.019×0.025 inch SS at 0 degrees of second order angulation. Visual differences could be appreciated in the SEM images.

CONCLUSION: In this *in vitro* study, when testing the RS of the posterior versus the anterior segments, SLB resulted in higher RS values than tubes from the same manufacturers coupled with a 0.019×0.025 inch SS wire.

6 PERIODONTAL CHANGES FOLLOWING MOLAR INTRUSION WITH MINISCREWS

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AIM: To evaluate periodontal changes accompanying molar intrusion.

SUBJECTS AND METHOD: Ten female patients in whom maxillary molar intrusion was achieved by inserting two miniscrews in the mesiobuccal and mesiopalatal aspects of the alveolar process. A 0.17×0.25 inch TMA spring was used, which exerted a force of 50 g on each side of the tooth. Crestal height changes were evaluated by obtaining parallel periapical radiographs with bite-blocks at three intervals: baseline (T0), end of active treatment (T1) and six months after retention (T2). Other variables, including probing depth, gingival recession, attachment level and bleeding on probing, were evaluated by clinical measurements at the three time intervals.

RESULTS: Supra-erupted molars were successfully intruded a mean of 2.1 ± 0.9 mm during active treatment (T0-T1) and some relapse occurred during the retention period. Mean bone resorption of 0.9 ± 0.9 mm at the mesial crest and 1 ± 0.8 mm at the distal crest occurred during total treatment (T0-T2). A mean of 0.6 ± 1.4 mm of bone was deposited on the mesial crest during the retention period (T1-T2) following tooth relapse. An average attachment gain of 0.8 ± 0.4 mm was obtained. Gingival margin coronalized a mean of 0.8 ± 0.6 mm throughout the entire treatment. Probing depth showed no significant change during treatment.

CONCLUSION: Not only was periodontal status not significantly affected by intrusion, but there were signs of periodontal improvement, including attachment gain and shortening of clinical crown height.

7 EVALUATION OF FRICTION OF SELF-LIGATING BRACKETS AND CONVENTIONAL BRACKETS LIGATED WITH DIFFERENT LIGATION METHODS

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AIM: With the increasing aesthetic concerns of patients, manufacturers have developed brackets made of ceramic, copolymer and composite that cause more friction than metal brackets. In order to overcome this friction, they have produced self-ligating brackets (SLBs) claiming that they are both aesthetic and have low friction. The aim of this *in vitro* study was to evaluate the frictional values of SLBs and conventional brackets ligated with different methods in a crowded configuration.

MATERIALS AND METHOD: Three SLBs [Clarity SL (3M Unitek), Innovation C (GAC), Damon 3(Ormco)] and four conventional brackets [Mini Taurus (RMO), Signature III (RMO), Inspire Ice (Ormco), Leone Logic Line (Leone)] were used. Archwires, 0.014 inch nickel titanium, were ligated in the bracket slots on the metal plates and canine brackets were placed 2 mm superiorly and buccally. All conventional brackets were ligated with metal, elastomeric or non-conventional elastomeric ligatures (Leone Slide). The pulling speed of the wire was set to 10 mm/minutes for 30 seconds for each sample.

RESULTS: Clarity SL and Damon 3 brackets showed significantly lower frictional resistance than conventional brackets when ligated with metal ligatures, except for Leone Logic Line. Brackets ligated with the Leone slide ligature showed lower friction due to the design of the ligature, which converts the bracket into a tube.

Clarity SL, Damon 3 and Leone Logic Line brackets showed significantly lower frictional resistance when compared with SLBs and conventional brackets ligated with elastomeric ligatures.

CONCLUSION: The Leone Logic Line-Leone Slide ligature combination had the least frictional resistance, whereas monocrystalline ceramic (Inspire Ice) revealed the highest resistance. Conventional brackets ligated with non-conventional ligatures showed similar frictional resistance to passive SLBs and lower frictional resistance compared with active SLBs.

8 DENTOSKELETAL CHANGES FOLLOWING SURGICALLY ASSISTED RAPID PALATAL EXPANSION

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AIM: To perform a three-dimensional analysis of dentoskeletal changes associated with surgically assisted rapid palatal expansion (SARPE) using cone beam computed tomography (CBCT).

SUBJECTS AND METHOD: A prospective pilot study of 10 patients (6 males, 4 females; median age: 25.7 years) undergoing SARPE. Inclusion criteria were transverse skeletal maxillary deficiency and radiologically closed midpalatal suture. CBCT scans (IS i-CAT 17-19, Imaging Sciences International, Hatfield, Pennsylvania, USA) were scheduled pre- and post-operatively. SARPE was performed with pterygoid disjunction using a dental-borne expander. Evaluation criteria were defined after a systematic review of the literature. Osirix software was used to measure dental inclination, cross-sectional area, and transverse dimensions at the bony and dental levels. Statistical analysis was performed with the Statistical Package for Social Sciences (15.0.1, SPSS Inc., Chicago, Illinois, USA). Wilcoxon's test for paired samples was used for comparisons.

RESULTS: Selected measurement points were found to be reliable on CBCT. Linear transverse dimensions of the maxilla increased systematically. The cross-sectional area increased a median of 1.23 cm^2 at the hard palate level and 2.1 cm^2 at the crown level. At the canine region, a median increase of 0.53 cm occurred at the apex level and 0.95 cm at the crown level. These dimensions were 0.52 and 0.69 cm, respectively, at the molar region. Dental inclination to the buccal was detected (median of 9.92° at the canines and 5.73° at molars). The changes were statistically significant.

CONCLUSION: Dentoskeletal changes after SARPE have been traditionally analyzed through cephalometric analysis or dental casts. However, CBCT has provided a reliable evaluation tool with a non-invasive, low-radiation, fast scan. This pilot study confirms SARPE is effective to correct a transverse discrepancy above 5 mm in non-growing patients. Though dental inclination to the buccal occurs, especially at the canine region, significant expansion of the maxilla at the skeletal and dentoalveolar levels is confirmed.

9 SKELETAL AND DENTOALVEOLAR CHANGES IN RELATION TO TIMING OF TREATMENT IN CLASS II SUBJECTS

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AIM: To study the skeletal and dentoalveolar changes in Class II patients treated with the mandibular locking unit appliance (MaluTM) in relation to the start of treatment, before/during or after the pubertal growth peak.

SUBJECTS AND METHOD: Twenty-seven consecutive Class II patients treated using the MaluTM appliance. Cephalograms were taken of each patient before (T1) and after (T2) treatment and analysed using standard cephalometrics and the sagittal occlusion analysis. The cervical vertebral maturation method was used to analyse the skeletal maturation stage of the subjects to classify them into two groups according to their pubertal growth stage. Group 1 (n = 15, mean age 13.3 ± 0.7 years) consisted of patients before/during pubertal growth peak (CS1-CS3) and group 2 (n = 12, mean age 16.4 ±1.4 years) had passed their pubertal growth peak (CS4-CS6).

RESULTS: The cephalometric values showed no significant differences between the groups before treatment. All patients were treated to a Class I occlusion with a normal overjet and overbite. The treatment results in group 1 showed more skeletal (44%) and less dental (66%) correction as compared with group 2 (30% skeletal, 70% dental). ANB angle decreased significantly from 5.7 ± 1.4 degrees to 3.7 ± 1.7 degrees in group 1 and from 6.8 ± 1.5 degrees to 5.1 ± 1.3 degrees in group 2. Significant labial tipping of the lower incisors was observed in both groups.

CONCLUSION: Both dental and skeletal changes were found to contribute to the correction of a Class II malocclusion in subjects treated with a Malu[™] appliance, but the skeletal component seemed considerably higher if treatment was started before/during the pubertal growth peak.

10 DEVELOPMENT OF A RAT MODEL FOR MUSCLE REGENERATION AFTER SURGICAL REPAIR OF THE SOFT PALATE

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AIM: After surgery, cleft palate patients often experience persistent speech problems because of defective muscle healing in the soft palate. Muscle healing and function might be improved using techniques based on tissue engineering. Research on muscle regeneration has been limited mainly to limb and cardiac muscles in animal models. The aim of this study was to establish an *in vivo* model for the study of muscle regeneration in the soft palate in rats.

MATERIALS AND METHOD: In a pilot study, 12 male adult Sprague Dawley rats (250-350 g) were randomized into two experimental groups (A and B). In group A, excisional wounds (1 mm ϕ) were made in the soft palate, and in group B incisional wounds (4 mm). The wound area was evaluated after 7 days. Paraffin sections were stained with haematoxylin and eosin (H&E) and AZAN staining for general tissue survey. In addition, satellite cells (Pax7+), macrophages (CD68+), and fast and slow muscle fibres were stained by immunohistochemistry. Stained sections were qualitatively analyzed.

RESULTS: All animals survived surgery and showed no weight loss. All wounds showed clinical evidence of healing. Macroscopically, two major muscles were identified in the soft palate: tensor veli palatini, and tensor levator veli palatini. In the posterior region, the soft palate consisted of a superficial oral mucosa, a thick layer of salivary glands, a muscle layer, and a nasopharyngeal mucosa. H&E and AZAN staining demonstrated extensive granulation tissue in the wound area, and initial regeneration of muscle fibres and salivary glands. Satellite cells were present in the regenerating muscle fibres, and macrophages had infiltrated the wound area.

CONCLUSION: Both an excisional and incisional wound model can be performed in the rat soft palate. Muscle regeneration is apparent after 7 days. These models enable further studies into muscle regeneration in the soft palate and the development of new treatment modalities based on tissue engineering. 11 EFFECTS OF A CHINESE MEDICINE AND ESSENTIAL OILS MOUTHRINSES ON PATIENTS WITH FIXED ORTHODONTIC APPLIANCES Y Chen¹, R Wong¹, J C Seneviratne², U Hägg^{1,3}, C McGrath⁴, Departments of ¹Orthodontics, ²Oral Biosciences and ⁴Dental Public Health. Faculty of Dentistry, University of Hong Kong, China and Faculty of Health Sciences, University of Copenhagen, Denmark

AIM: To investigate the effects of a Chinese medicine (CM) mouthrinse and an essential oils mouthrinse on gingival health and microbial profiles in orthodontic patients with fixed appliances.

SUBJECTS AND METHOD: This randomized, single-blinded, parallel controlled trial consisted of 90 patients treated with fixed orthodontic appliances. The participants were randomly assigned to three equal groups: 1) CM mouthrinse (main ingredient is Fructus mume extract); 2) Listerine® (essential oils mouthrinse) and 3) control group. Subjects in the experimental groups were instructed to use the mouthrinses twice a day for six months. Clinical examination and saliva sample collection were conducted at baseline and after 3 and 6 months (T1, T2 and T3). Clinical examination included the Modified Gingival Index (MGI), Bleeding Index (BI) and Plaque Index. Salivary microbial quantification included total aerobic and anaerobic bacteria, *streptococci* and *lactobacilli* counts.

RESULTS: BI was significant reduced in groups 1 and 2 compared with group 3 at T3 (P < 0.001). At T2, MGI showed greater reductions in both mouthrinse groups than at baseline (P < 0.05). The numbers and proportions of total aerobic and anaerobic bacteria, *streptococci* and *lactobacilli* were not significantly changed at T2 and T3 compared with T1 among three groups (P > 0.05).

CONCLUSION: The CM and essential oils mouthrines improve gingival health for orthodontic patients without causing significant alterations of microbial profile.

12 ASSESSMENT OF TOOTH STRUCTURES AFTER DEBONDING OF ORTHODONTIC BRACKETS.

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AIM: Nowadays, patients have increased aesthetic demand not only related to the final outcome, but also to the aesthetics of orthodontic appliances. The aim of this study was to assess *in vitro* a tooth structure after debonding of metal and porcelain orthodontic brackets using transillumination and scanning electron microscopy (SEM).

MATERIALS AND METHOD: Selected human premolars (n = 35) extracted for orthodontic purposes. The hard tissues of the teeth were assessed using transillumination. SEM was applied three times: before bonding of an orthodontic bracket to exclude teeth with any signs of enamel defects; after debonding of an orthodontic bracket and after removal of the adhesive resin using a low-speed bur. The premolars were divided into two groups: first group (n = 17) included teeth bonded with metal brackets (0.022 inch, SWLF Synergy, RMO) and the second group (n = 18) included teeth bonded with porcelain brackets (0.022 inch, SWLF Synergy LUX, RMO). A light-activated bonding system (Monolok2, RMO) was used as the adhesive. The brackets were debonded after 24 hours with orthodontic pliers. Bond failures were recorded at the adhesive-enamel, adhesive-adhesive and bracketadhesive interfaces. The area of each interface was measured in square millimetres. The adhesive remnant index (ARI) was used to assess adhesive remnants after debonding.

RESULTS: Statistically significant differences in enamel damage were present in the second group. ARI was significantly higher in the first group indicating more adhesive left on the tooth surface after debonding. After removal of the adhesive resin using a low-speed bur, damage to the enamel surface was mostly covered by adhesive remnants. Fractures of the brackets were observed in both groups.

CONCLUSION: The extent and frequency of enamel damage is higher after debonding of porcelain brackets. Metal brackets may be advocated for bonding teeth with enamel defects and large restorations.

13 HOUNSFIELD UNITS: A NEW INDICATOR SHOWING MAXILLARY RESISTANCE IN RAPID MAXILLARY EXPANSION CASES?

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AIM: In the literature, there is no specific study that predicts the need for corticotomy before rapid maxillary expansion (RME) due to sutural maturation. The aim of this study was to find if a correlation exists between midpalatal suture density (MPSD) in Hounsfield units (HU) and the amount of dental tipping or alveolar bending, and if the patient will need a corticotomy before any appliance application.

MATERIALS AND METHOD: Computed tomographs (CTs) of 11 patients with a mean age of 14 years who underwent RME treatment were randomly chosen. For each patient there were two sets of CTs that included pre-RME and 3 months after retention. Dental and alveolar tipping amounts were measured on coronal sections at the level of trifurcation of the right and left first molars, by calculating the difference between pre- and post-RME CTs using three-dimensional prototyping software. MPSD was also was measured at three different reference points on sagittal sections of pre-RME CTs. Correlation between sutural density and the amount of dental and alveolar tipping was determined with Pearson's correlation analysis. The variables that showed a positive correlation were also analyzed by linear regression analysis to observe the relationship between them.

RESULTS: Alveolar bending and dental tipping was observed in all subjects. A positive correlation between MPSD and the increase of the inner alveolar bone angle was observed (P < 0.05), and in linear regression analysis the relationship of the above mentioned variables was significant (R2 = 0.213; P = 0.031). No statistically significant correlation between MPSD and dental tipping was found.

CONCLUSION: Median palatal suture density may be a helpful diagnostic indicator for evaluating the amount of alveolar bending; this may lead to a decision concerning whether or not a corticotomy should be undertaken before RME.

14 ADOLESCENTS' EXPERIENCES OF USING A REMOVABLE FUNCTIONAL APPLIANCE TO REDUCE A LARGE OVERJET

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AIM: To explore and describe experiences of using a removable functional appliance and to gain knowledge of adolescents' motivation for treatment of a large overjet.

SUBJECTS AND METHOD: A multicentre, prospective, randomized clinical trial (RCT) was conducted in 12 general dental practices in Sweden, in order to assess the reduction in a large overjet, using two different functional removable appliances. During treatment some patients succeed and some fail in using these appliances. Fifty adolescents from this RCT, who had treatment with a removable functional appliance

for at least 6 months, were invited to participate. In-depth individual interviews focusing on adolescents' experiences of using a removable functional appliance were held with 21 adolescent who agreed to participate in the study. The 'success' group consisted of 11 subjects (6 girls, 5 boys) and the 'failure' group 10 subjects (6 girls, 4 boys). Their mean age was 13.1 years (range 11-15 years). Interviews were transcribed verbatim and analysed according to a qualitative research approach, phenomenography.

RESULTS: The importance of parental and dentist involvement for adolescent's compliance in using a removable functional appliance was indicated. Additionally patients seem to have a high level of inspiration for treatment at the very beginning, hence extra support from the dentist at forthcoming appointments is needed. If compliance cannot be ensured through adolescent commitment and parental support and involvement, it seems to be better to delay treatment until adolescents and parents are motivated to collaborate.

CONCLUSION: Adolescents' experiences of using removable functional appliances appear to have a large variation, comprising of an individual approach, dentist role and external support. The dentist's ability to pass on enthusiasm, interest and knowledge play a major role in the success of treatment.

15 CATECHOL-O-METHYLTRANSFERASE GENE POLYMORPHISMS AS RISK FACTORS IN TEMPOROMANDIBULAR DISORDER PATIENTS!!

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AIM: Temporomandibular disorders (TMD) are major causes of non-dental pain in the orofacial region. Catechol-o-methyltransferase (COMT) enzyme can modulate pain perception and has been suggested to contribute to the pathogenesis of several chronic pain states, including TMD. Furthermore, COMT genetic variants have been involved in the identification of patients whose risk of developing TMD is heightened following orthodontic treatment. The aim of this study was to evaluate the role of COMT gene variants as potential risk factors in a group of patients with chronic TMD pain.

MATERIALS AND METHOD: The COMT gene was sequenced in 182 Italian subjects (50 with TMD, 132 controls). Genotype frequencies were calculated by allele counting, and departure from Hardy-Weinberg expectation was evaluated by chi-square analysis. The association of the single nuclear peptides (SNPs) with categorical variables was performed by the chi-square test (P < 0.05). Moreover, binary logistic regression analysis was used to assess the association between SNPs and the presence of TMD.

RESULTS: Forty SNP variants (18 novel), and three SNPs, all located in the promoter regions, were detected more frequently in cases than in controls (rs4646310 P = 0.018, rs165656 P = 0.001, rs165722 P = 0.007). After false discovery rate correction, rs165656 remained significantly associated with TMD (P = 0.049). In addition, rs 4646310 (AG versus GG, P = 0.015) and rs 165656 (GG versus CC, P = 0.001) were at binary logistic regression analysis independently associated with TMD, conferring a risk disease of 2.6 [confidence interval (CI) = 1.2-5.6] and 5.3 (CI = 2.0-13.7), respectively.

CONCLUSION: The data extends the number of SNPs present in the promoter region that could play a regulatory role in the COMT gene and suggest that the genetic polymorphisms, rs165656 and rs4646310, exert a role in TMD susceptibility.

!! Winner of the Houston Oral Research Award.

16 COMBINING CONE BEAM COMPUTED TOMOGRAPHS, DIGITAL STUDY MODELS AND THREE-DIMENSIONAL PHOTOGRAPHY M Dalstra, T K Pedersen, B Melsen, Department of Orthodontics, Aarhus University, Denmark

The digital age has provided new three-dimensional (3D) visualization modalities, such as cone-beam computer tomography (CBCT), digital study models and 3D photography, improving the basis for diagnosis and treatment planning. For virtual surgery planning, however, these imaging techniques by themselves are not sufficient as CBCT does not give an exact representation of the crown surfaces and digital study models do not contain bony information. The aim of the study was therefore to develop a method for the virtual simulation of maxillo-facial surgery based on the integration of multiple image modalities.

Software has been developed which enables the import of DICOM files and digital study models. In order to superimpose both data formats, a point-to-point registration is used based on corresponding characteristic points on the crown surfaces. The accuracy of this procedure was checked by performing it twice and measuring the translational and rotational errors between the two placements. Subsequently, the 'DICOM-crowns' are removed using the program's cutting tool. The model is then ready for simulated surgery and the appropriate cuts performed. The cut part(s) is/are then moved to the desired position using 6 degrees of freedom. A check of the new occlusion is performed and final adjustments to the new position made. Finally, the necessary splints are produced using CAD procedures and printed on a 3D printer. At present, patients scheduled for surgery have their CBCT and digital model taken for virtual surgery 2 weeks before and 2 months after surgery for follow-up purposes.

The success of an integrated approach with multiple image modalities stands and falls with the accuracy of the superimposition. The error of the method of the registration procedure used in this study was well below the limit of clinical relevance (<0.2 mm translational error; <0.5 degree rotational error).

17 CLINICAL IMPLICATION OF A BOLTON INDEX REAPPRAISAL

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AIM: To determine the size of individual permanent teeth together with Bolton's ratios in an Italian population, and to compare the distribution of clinically significant tooth size discrepancy (TSD) according to both Bolton's rule method and a millimetric method.

MATERIALS AND METHOD: Dental casts of 150 Italian subjects (90 females mean age 15.9 \pm 6.4 years, 60 males 14.5 \pm 4.2 years). TSD was calculated considering both Bolton's index [mean \pm standard (SD)] and millimetric discrepancy. RESULTS: Overall and anterior Bolton's ratios (%) were 91.3 \pm 2.0 and 77.9 \pm 2.7, respectively. According to Bolton's rule, the normal range set is within the mean \pm 2 SD range, 5.3 and 20.0 per cent in the overall and anterior Bolton ratios, respectively, were out of such normality. However, greater frequencies of 52.6 and 21.4 per cent in the overall and anterior millimetric discrepancies, respectively, were above 1.5 mm. By merging the overall and the anterior millimetric discrepancies, up to 56.7 per cent of the sample presented a value of at least 1.5 mm. No differences between genders were seen.

CONCLUSION: There were relevant differences in the interpretation of the degree of TSD between Bolton's index rule and absolute millimetric discrepancies. The rule of

the 2 SD range was not able to detect all clinically relevant TSDs. An underestimation of TSD using the current Bolton rule may not lead to optimal case finishing at the end of fixed orthodontic treatment.

18 HYBRID-HYRAX AND MINIPLATE: TREATMENT EFFECTS IN GROWING CLASS III PATIENTS

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AIM: Patients with a skeletal Class III malocclusion usually require early treatment. The hybrid-Hyrax is a dental- and skeletal-borne rapid maxillary expansion (RPE) device that can be combined either with a facemask or a supramental miniplate (MentoPlate). The aim of this prospective study was to analyse the skeletal effects of these appliance combinations when performing simultaneous RPE and maxillary protraction.

SUBJECTS AND METHOD: Twenty-eight patients (15 males, 13 females) with a skeletal Class III (mean Wits: -5.9 mm) and a retrognathic maxilla. The mean age was 10.6 years. All patients received a hybrid-Hyrax mounted on two paramedian mini-implants inserted in the anterior palate. In 17 patients a facemask was used for maxillary protraction and in 11 a MentoPlate was inserted supramentally. In these cases, protraction force was generated by Class III elastics (2 N). Cephalograms were taken at the beginning of treatment (T1) and after 1.8 years (T2).

RESULTS: In all patients RPE was successfully performed. Neither implant losses, wound infections nor other complications were encountered with the MentoPlate. The reverse overbite was corrected in all patients. Cephalometric analysis (T2-T1) revealed an average improvement of the Wits appraisal by 3.7 mm in the facemask group and by 4.1 mm in the MentoPlate group. SNA increased while SNB remained stable.

CONCLUSION: The hybrid-Hyrax appliance allows application of orthopaedic forces to the skeletal structures of the maxilla. Dental side effects such as unwanted mesialization of the upper molars can be completely avoided. The MentoPlate tranfers orthopaedic forces directly to the mandibular skeleton. Combining the hybrid-Hyrax and the MentoPlate eliminates the need for extraoral traction devices. Both appliance combinations appear to produce comparable skeletal effects in growing Class III patients.

19 FACTORS RELATED TO THE AMOUNT OF ORTHODONTICALLY INDUCED TOOTH MOVEMENT

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AIM: To investigate the variation in orthodontically induced tooth movement between individuals, and factors such as age, gender, and tooth location that may influence the amount of tooth displacement.

SUBJECTS AND METHOD: In standardized experimental orthodontic tooth movement in 30 subjects, 58 premolars were moved buccally during 8 weeks with application of a force of 1 N. Forty-three contralateral premolars, not subjected to orthodontic tooth movement, served as the controls. Plaster models from before and after tooth movement were digitized and superimposed, in order to evaluate the amount of tooth movement. Differences in tooth movement between the experimental and control group were tested by an unpaired *t*-test. For the experimental teeth, subject related factors, such as age and gender and tooth related factors, such as location and presence of an obstacle (neighbouring-touching teeth or

occlusion), were examined by ANOVA. At the individual level, the correlation between the amount of tooth movement for matched teeth without obstacles, was tested by Pearson's correlation coefficient.

RESULTS: Each subject contributed at least two experimental and one control premolar. The displacement of the orthodontically moved teeth was 2.38 mm (range: 2.12-2.77 mm). Younger subjects (<16 years, n = 36) showed significantly more tooth displacement when compared with older subjects (>16 years, n = 20), (2.7 \pm 1.3 mm versus 1.9 \pm 0.7 mm; *P* < 0.01). Whenever an obstacle was present, the amount of tooth movement was significantly less (2.7 \pm 1.3 mm versus 1.9 \pm 0.8 mm; *P* < 0.008). Gender and tooth location (mandible or maxilla) had no effect. Within the same subject, the amount of tooth movement was comparable for both experimental teeth when no obstacle was present, and varied substantially between the subjects (minimum 0.6 mm, maximum 5.8 mm).

CONCLUSION: In the present study, 'slow' and 'fast' movers could be identified. Age and the presence or absence of an obstacle, may affect the amount of tooth movement.

20 ACTUAL VERSUS THEORETICAL TORSIONAL PLAY IN CONVENTIONAL AND SELF-LIGATING BRACKET SYSTEMS H Eriksen, M Dalstra, B Melsen, Department of Orthodontics, Aarhus University, Denmark

AIM: To investigate and measure the actual amount of torsional play in nine selfligating (BioQuick, Damon MX3, Damon Q, Discovery SL, Empower Interactive, Empower Passive, In-Ovation R, Smart Clip and Speed) and three conventional (American LP, Mini Diamond and Victory) 0.022 inch bracket systems when inserting a 0.019 \times 0.025 inch stainless steel (SS) archwire *in vitro*, and to compare the results with the theoretical amount of play.

MATERIALS AND METHOD: The testing machine used was a Force-System-Identification apparatus, which allows measurement of the three-dimensional (3D) force system for movement with 6 degrees of freedom. Measuring was undertaken with a multi-axis force/torque transducer while twisting a straight piece of 0.019×0.025 inch SS wire seated in the closed/steel ligated bracket slot in increments of 0.5 degrees until a linear moment curve was registered. This was repeated in the opposite direction to ensure full torsional expression of the wire in the slot. Ten upper central incisor brackets were collected from each of the 12 different brackets systems, and five brackets from each of the 12 systems were randomly selected for measuring.

RESULTS: Laboratory testing clearly showed that wire/slot play was much larger than would be expected from the nominal value of 14.5 degrees. The play ranged from 19.8 to 36.1 degrees for the worst bracket system. The variation in the measured play values tended to be smaller for the conventional brackets.

CONCLUSION: The findings do not favour the use of self-ligating brackets in absolute torque control. The actual play is larger due to oversized slots and the inability of self-ligation brackets to press the archwire into the bottom of the slot. In conventional brackets the steel ligatures press the archwire onto the slot bottom. Consequently oversize of the slot is less critical as torquing moments will be present almost immediately when twisting the wire.

21 THE EFFECTS OF BENZOCAINE 20 PER CENT PATCHES ON ORTHODONTIC PAIN RELIEF.

L Eslamian¹, H Zia'edini², M R Badiyi¹, A Jafari³, Departments of Orthodontics, Dental Schools, ¹Shahid Beheshti University of Medical Sciences, ²Kerman University of Medical Sciences, ³Azad University, Iran AIM: Pain control is important for both orthodontists and their patients. Several methods and drugs that have their own advantages and disadvantages have been proposed. The present study assessed the effect of a 20 per cent Benzocaine patch on reducing orthodontic pain.

SUBJECTS AND METHOD: In a blind randomized clinical trial, 30 patients (15-30 years of age) were assigned to have 20 per cent Benzocaine and placebo patches for pain control, in a split mouth design. Elastic separators were placed on the first permanent molars. Twenty per cent Benzocaine and placebo patches were used above or below the right and left first molar teeth on the free and attached gingiva. The patients reported their pain score on a 10 part visual analogue scale (VAS) immediately after 2, 6, 12, 18 and 24 hours and also on days 2 and 3 after placement of the separators. The patches were used each 8 hours. The data were analyzed by Wilcoxon's signed rank test. A Mann-Whitney U test was used to compare the pain by jaw and by gender, and Spearman's correlation test to assess the differences of age. RESULTS: There was a significant difference between the VAS pain score by groups at all recorded times (except immediately) after placement of the patches (P < 0.05). Generally the pain score in the control group was 2.28 ± 2.38 and 1.63 ± 1.56 in the experimental group, with a significant difference (P < 0.004). The highest pain score was reported by the control group on day 2 (3.3 ± 1.45) . There was no significant group difference between the two jaws and the two genders.

CONCLUSION: Twenty per cent Benzocaine patches are effective on orthodontic pain.

22 APPROXIMATION OF ALVEOLAR CLEFTS IN UNILATERAL CLEFT LIP/PALATE PATIENTS BY INTERDENTAL DISTRACTION OSTEOGENESIS F Fahim¹, S Shahin², M El-Kassaby³, D El-Boghdady¹, W Abd El-Kader¹, ¹Department of Orthodontics, Faculty of Dentistry, Cairo University, ²3D CBCT Designer and ³Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Ain Shams University, Cairo, Egypt

AIM: Approximating wide alveolar clefts by interdental distraction using a new archwire-borne distraction device with three-dimensional (3D) control of the transport segment, instead of conventional alveolar iliac crest grafting.

SUBJECTS AND METHOD: Ten patients (7 females, 3 males) that had unilateral alveolar clefts. The age range at the time of interdental distraction was 12-22 years (mean 16.9 ± 2.8 years). Vertical interdental and horizontal complete osteotomies were performed to incorporate the maxillary canine and first premolar in the transport segment. Cone-beam computed tomographic (CBCT) scans were obtained just before and immediately after interdental distraction. The wide alveolar cleft was reduced using an archwire -borne distractor on 0.019×0.025 inch stainless steel wire. A new reference system was designed for 3D analysis after automatic superimposition of the two CBCT scans. Intra-operator reliability was performed to measure the digitization error of all dental and skeletal points used in the study. Linear and angular measurements were performed on 3D CBCT for the maxillary canine and first premolar teeth in the transport segment in the anteroposterior and mediolateral dimension. The volume of the alveolar cleft pre- and post-distraction was also measured in cubic millimetres and compared with each other by paired *t*-test.

RESULTS: High intra-operator reliability was found. The permanent maxillary canine was transported in a bodily movement forward, while the maxillary first premolar experienced slight tipping. The alveolar cleft volumes were significantly decreased post-distraction at P = 0.006.

CONCLUSION: The archwire-borne distractor used in this study was efficient in the approximation of wide unilateral alveolar clefts.

23 SWALLOW PRESSURE PROFILES ARE INDIVIDUAL-SPECIFIC AND REPRODUCIBLE OVER TIME.

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AIM: Intraoral pressures acting on the dentition have orthodontic implications for the aetiology, treatment and stability of dental malocclusions. The aim of this study was to analyse the pattern and consistency of pressure changes across the hard palate while swallowing substances of differing viscosity.

SUBJECTS AND METHOD: Individual swallows were assessed in 10 healthy volunteers (5 males, 5 females; 22-42 years) with a full permanent Class I dentition. A custom made appliance with seven miniature pressure transducers located along the mid-line and lateral palate was used to measure absolute pressure during 10 ml water and honey-viscosity swallows. The subjects performed six command swallows for each liquid on two subsequent days, yielding a set of 12 swallows per individual for each liquid. Data were analysed using a general linear model.

RESULTS: Each individual displayed a remarkably consistent 'signature' pressure pattern, however, marked differences were observed between individuals. By aligning the initial pressure peak of the mid-palatal channel, a pattern common to all subjects was found. Dividing this pattern into four stages: preparatory, primary propulsive, intermediate and terminal, facilitated a descriptive analysis of profile changes allowing individual responses to bolus changes to be sub-classified. The mean duration of swallows was positively related to viscosity as it increased from 1080 to 1440 milliseconds with increased viscosity (P = 0.017). However, at the individual level, this response varied markedly across subjects. Significant changes in pressure values were found at the individual level; however, these were highly variable with respect to region, polarity and the individual.

CONCLUSION: Individuals display a unique and consistent pressure pattern across swallows, but their duration and pressure markedly varies between individuals. This marked inter-individual variation emphasises the difficulty in making generalisations regarding individual swallowing patterns.

24 FUNCTIONAL RESPONSE TO RAPID MAXILLARY EXPANSION

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AIM: To assess the functional response to rapid maxillary expansion (RME) through the evaluation of changes in muscular activity and mandibular range of motion.

SUBJECTS AND METHOD: Thirteen children (mean age, 10.3 ± 3.5 years) with moderate to severe maxillary hypoplasia who required RME treatment. Electromyokinesiography was carried out before (T1) and 2 weeks (T2) after the use of the Hyrax-type expander, with an average expansion rate of 6 ± 1 mm in 4 ± 1 weeks. Activity of the anterior temporal and superficial masseter muscles was recorded at rest and during clenching on a cotton roll; maximum vertical motion during swallow (freeway space). Maximum unassisted opening and midline opening deviation were also evaluated.

RESULTS: The mean electromyographic activities of all muscles were changed, but no statistical or clinical significance was found due, moreover, to the lack of homogeneous behaviour both at rest and during clenching on cotton rolls. All kinetic parameters showed notable differences between T1 and T2: midline opening deviation decreased 16.32 per cent; freeway space increased 29.05 per cent; maximum unassisted opening showed a statistically significant increase of 11.71 per cent (P = 0.0012).

CONCLUSION: RME affects masticatory function, increasing the range of motion and reducing the midline deviation during mandibular movements. These findings suggest that RME should improve functional matrix development, thus promoting correct and desirable patterns of skeletal growth not only in the maxillary region.

25 A HISTOMORPHOMETRIC AND RADIOGRAPHIC STUDY OF REPLANTED HUMAN PREMOLARS

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AIM: To investigate time related dental tissue reactions to tooth reimplantation in mature and immature human premolars by histomorphometric and radiographic methods.

MATERIALS AND METHOD: Eighty-three permanent first premolars at different stages of dental development. Twenty-three teeth were extracted and immediately fixed for histological preparation and 60 were extracted and immediately replanted (T0). Extraction of the replanted teeth took place 1, 2, 3, 6, 12 or 24 weeks later (T1). Periapical radiographs were taken at T0 and T1 in all extraction groups except for the 24 week group. Paraffin-embedded teeth were sectioned buccolingually at 5 μ m, stained with haematoxylin-eosin and prepared for histological analysis. Qualitative evaluation of pulpal and cementum tissue changes was performed on histological sections only. Root length, crown length and apical opening measurements were recorded on both radiographs and paraffin sections.

RESULTS: Initial degeneration of the odontoblast layer, disturbance of vasculature and normal architecture of the pulp was seen in both mature and immature teeth. The odontoblast layer reappeared from week 3 and was commonly accompanied by tertiary dentine formation in immature teeth between 6 and 12 weeks posttransplantation. At 24 weeks, most immature teeth had pulps partly or completely obliterated. Surface root resorption was found in 59 per cent of immature and in 84 per cent of mature teeth. Most lesions were small and showed signs of repair by cellular cementum. Only major alterations such as apical root resorption could be seen on the radiographs from T0 to T1. Abundant tertiary dentine observed on the histological slides was not easily seen on the radiographs.

CONCLUSION: The dental pulp of immature teeth has the potential for differentiation of new odontoblasts and production of tertiary dentine subsequent to reimplantation. Tertiary dentine and lateral root resorption was rarely seen on the radiographs until week 12.

26 MAXILLARY MOLAR DISTALIZATION THERAPY IN ADULT PATIENTS: A MULTICENTRE STUDY

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AIM: To evaluate dentoalveolar and skeletal effects following conventional anchorage molar distalization therapy in adult patients.

SUBJECTS AND METHOD: Forty six patients (34 females, 12 males) who were recruited from four Board Certified Orthodontists and selected according specific inclusion criteria: 1) non-growing subjects; 2) full Class II molar relationship; 3) no skeletal discrepancy; 4) SN-GoGn angle less than 37 degrees 5) no premolar

extractions; 6) no use of skeletal anchorage devices. The mean age was 24.9 ± 4.2 years at the start of treatment and the mean treatment period was 3.1 ± 0.7 years. All subjects underwent molar distalization therapy according to different conventional-anchorage distalizing mechanics. Cephalometric headfilms were available before and at the end of comprehensive treatment. The initial and final measurements and treatment changes were compared by means of a paired *t*- or Wilcoxon's test.

RESULTS: Class II and overjet correction were achieved in all patients. The correction can be mainly attributed to maxillary molar distalization (P < 0.01) and, in a minor percentage, to mandibular molar movement (P < 0.001). Overjet correction was mainly achieved by dentoalveolar changes: the maxillary incisors retroclined (P < 0.01), whereas the lower incisors proclined (P < 0.001). A clockwise mandibular rotation and an increase in vertical facial dimensions were observed (P < 0.001).

CONCLUSION: Premolar extraction treatment is one of the most common strategies to correct a dental Class II malocclusion in non-growing subjects. However, maxillary molar distalization therapy could be considered a viable treatment option, even if this procedure should be carefully considered in high-angle Class II patients.

27 THREE-DIMENSIONAL DENSITOMETRIC ANALYSIS OF MAXILLARY SUTURAL CHANGES INDUCED BY RAPID MAXILLARY EXPANSION

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AIM: To prospectively evaluate the density of the midpalatal and transverse sutures as assessed by low-dose computed tomography (CT) before rapid maxillary expansion (RME; T0), at the end of active expansion (T1) and after a retention period of 6 months (T2).

SUBJECTS AND METHOD: Seventeen prepubertal subjects (mean age 11.2 years) with constricted maxillary arches. The total amount of expansion was 7 mm in all subjects. Multi-slice low-dose CT scans were taken at T0, T1, and T2. On the axial CT scanned images six regions of interest (ROIs) were placed along the midpalatal and transverse sutures (MpS Ant, MpS Mid, MpS Post, MpS/TS, TS left, TS right) and two in the maxillary and palatal bony areas. Density was measured in Hounsfield Units. Mann-Whitney U test and Friedman ANOVA with Tukey's *post-hoc* tests were used (P < 0.05).

RESULTS: The three ROIs in the midpalatal suture showed a significant decrease in density from T0 to T1, a significant increase from T1 to T2, and lack of statistically significant differences from T0 to T2. Both ROIs located in the transverse suture showed a significant decrease in density from T0 to T1 that was followed by a non-significant increase in density from T1 to T2.

CONCLUSION: At the end of T1 a significant reduction in density along the midpalatal and transverse sutures was observed in all subjects. The sutural density of the midpalatal suture at T2 indicated reorganization of the midpalatal suture while the density along the transverse suture increased without reaching the pre-treatment values, probably due to different morphology between the midpalatal and transverse sutures. The findings support the hypothesis that orthopaedic stimulation of the midpalatal suture significantly influences the transverse suture, with clinical implications regarding the benefit of palatal expansion in subjects requiring maxillary protraction.

28 JUVENILE IDIOPATHIC ARTHRITIS: CONDYLAR AND MANDIBULAR THREE-DIMENSIONAL MORPHOLOGIC AND VOLUMETRIC CHANGES

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AIM: To show the importance of cone beam computerized tomographs (CBCT) to volumetrically quantify temporomandibular joint (TMJ) damage in patients with juvenile idiopathic arthritis (JIA), by measuring condylar and mandibular volumes.

MATERIALS AND METHOD: CBCT of 30 children with temporomandibular involvement by JIA. The mandible was isolated from other craniofacial structures and whole mandibular volume and its component volumes (condyle, ramus, emibody, emisymphysis on right and left sides) were calculated using a three-dimensional volume rendering technique.

RESULTS: There was a highly significant difference between volumetric values of the affected and normal sides, especially in the condylar region (P < 0.01). There was no significant difference between the right and left sides.

CONCLUSION: CBCT represents an improvement in the understanding of condyle and mandibular morphological changes, even in the early stages of JIA. Early initiation and optimal adjustment of aggressive therapy with disease-modifying antirheumatic drugs has been successful in preventing irreversible joint damage. Therefore, accurate and early diagnosis of JIA and monitoring of the disease process are essential. Advanced imaging technology capable of identifying the slightest trace of erosive joint damage may enable prediction of future structural and functional deterioration.

29 MANDIBULAR ASYMMETRY IN PATIENTS WITH TEMPOROMANDIBULAR DISORDERS

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AIM: To investigate the relationship between internal derangement (ID) of the temporomandibular joint (TMJ) and mandibular asymmetry in a group of subjects with temporomandibular disorders (TMD).

SUBJECTS AND METHOD: Thirty patients (17 males, 13 females, mean age 26.4 years) with TMD who had routine three-dimensional computed tomographs (CT). They were classified into two groups (group 1 muscle disorders, group 2 disc displacements) according to the Research Diagnostic Criteria for Temporomandibular Disorders. Ten anatomical landmarks were traced to compare both sides of the mandible and 15 asymptomatic subjects (7 males, 8 females, mean age 23.1 years) were used as the control group.

RESULTS: Subjects with TMJ ID on one side had a more asymmetric ramal height and body length compared with those with myofascial pain and asymptomatic joints. The degree of displacement was significantly related to the cant of the frontal occlusal plane.

CONCLUSION: The degree of mandibular asymmetry in the three dimensions is significantly correlated with TMJ ID symptoms.

30 ASSOCIATION OF GELATINOLYTIC ACTIVITY WITH SECONDARY PALATAL MORPHOGENESIS IN THE DEVELOPING MOUSE EMBRYO HEAD N Gkantidis, C Katsaros, M Chiquet, Department of Orthodontics and Dentofacial Orthopedics, University of Bern, Switzerland AIM: To assess the pattern of gelatinolytic activity and its potential association with specific matrix metalloproteinases (MMPs) and extracellular matrix (ECM) proteins during palatal morphogenesis.

MATERIALS AND METHOD: Wild type mouse embryos of embryonic day E13.5, E14.5, and E15.5 were examined. Gelatin zymography on SDS-polyacrylamide gels was used to detect the major enzymes that present gelatinolytic activity in the head. Furthermore, *in situ* zymography on cryosections, using a dye-quenched gelatin substrate, was combined with immunohistochemistry to detect the exact tissue distribution of activity and its potential association with specific MMPs and ECM proteins. Three ECM proteins [fibronectin (FN) laminin 111 (LN), and tenascin-c] and three MMPs important for gelatinolysis (MMP-2, MMP-9, and MMP14/MT1-MMP) were examined. Specificity of the gelatinolytic reaction was demonstrated using various MMP inhibitors (EDTA, phenanthroline, DMSO, MMP-2/MMP-9 specific inhibitor).

RESULTS: As shown by gelatin zymography, the major enzymes responsible for gelatinolytic activity in the developing mouse head wre MMP-2 and MMP-9. *In situ* zymography revealed that MT1-MMP, which activates MMP-2, is also largely involved as it co-localizes with the activity in certain areas of increased gelatinolysis. During palatogenesis, gelatinolytic activity co-localized with the above mentioned MMPs only at E14.5 and E15.5 with increasing magnitude. It was associated mainly with the epithelial basement membrane of the nasal hinge region of the elevated palatal shelves, but also with the midline epithelial seam during epithelial to mesenchymal transition. FN and LN showed co-localization with activity in these sites.

CONCLUSION: The present results strengthen the evidence from linkage studies and *in vitro* palate cultures with MMP inhibitors, which indicate that ECM remodelling through gelatinolysis has a major role in morphogenesis related to palate elevation and shelve fusion.

31 RE-ASSESSING THE INCLINATION OF THE LOWER ANTERIOR INCISORS – DOES ONE REFERENCE VALUE SUFFICE?

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AIM: The inclination of the lower incisors is assessed in most cephalometric evaluations and compared with reference values. The aim of this study was to identify whether the inclination of the lower incisors to the mandibular plane (LI/MP) is influenced by skeletal pattern or symphyseal anatomy.

MATERIALS AND METHOD: Retrospective analysis of 1263 cephalograms of 884 untreated subjects (423 females, 461 males, aged 8-16 years) of a growth study was performed. Descriptive statistics, a Student's *t*-test to disclose deterministic differences between the genders, the Kolmogorov-Smirnov-test to examine the assumption of normality of the variables, and Pearson correlation coefficients to evaluate correlations between LI/MP and an individual's skeletal pattern or symphyseal configuration were performed for all age groups.

RESULTS: No deterministic differences between the genders were found and all variables followed normal distribution. The inclination of LI/MP increased with age [8 years females: 93.9 (95% CI 92.3; 95.7) and males: 93.3 (95% CI 91.8; 94.9) to 16 years females: 96.1 (95% CI 94.1; 98.2) and males 97.1 (95% CI 95.6; 98.6)]. LI/MP correlated with the divergence of the jaws (SpaSpp/MGo) for all ages significantly or highly significantly, except for boys and girls 9 years of age as well as for girls 11 and 12 years of age where only a tendency was observed. Similarly, a correlation between

LI/MP and gonion angle (MGo/Ar) could be observed. No correlation could be found between LI/MP and any of the symphyseal parameters (absolute measurements and ratios).

CONCLUSION: Age and skeletal pattern have an influence on the natural inclination of the lower incisors, i.e. divergent jaws and a wide gonion angle correlate with retroclined incisors. Hence, it is important to recognize that a single reference value for all skeletal patterns is insufficient. The symphyseal anatomy, however, does not seem to influence the inclination.

32 GENE ANALYSIS OF STRETCHING FACTORS IN THE MASSETER MUSCLE BEFORE AND AFTER ORTHOGNATHIC SURGERY

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AIM: Stretching of mastication muscles after orthognathic surgery could be one reason for relapse. The aim of this prospective study was to analyse the expression of these genetic factors in the masseter muscle before and after orthognathic surgery.

SUBJECTS AND METHOD: Forty adult patients (mean age 23.6 years) with mandibular prognathism, retrognathism and open bite. Four tissue samples were taken from the anterior and posterior parts of both masseter muscles before (T1) and six months after (T2) orthognathic surgery. As a first step, Miroarrays (42545 genes Micro-chip: SurePrint G3) of three prognathic and three retrognathic patients were used to identify genes with high regulation. Relative quantification of six genes and developmental myosin heavy chain mRNA (MYH3 and MYH8) was performed with real time polymerase chain reaction. Genes were analysed with the relative expression software tool. Absolute quantification using computed tomographic values was calculated. Values at T1 were correlated with those at T2

RESULTS: The genes, NFAT, Calcineurin, COX2 and FOXO3, which are important in the stretching cascade, showed at T2 significant up- and down-regulation, but specific for each malocclusion. COX2 in the Class III patients was down regulated 4 fold and in the Class II division 2 subjects upregulated 2 fold. COX2 was 6 fold upregulated in an open bite case with incomplete impaction of the maxillary bone and relapse. Developmental MYH also showed different regulations for specific malocclusions.

CONCLUSION: Functional changes in the masseter muscle lead to different regulation of stretching factors and developmental MYH, depending on the malocclusion. COX2 seems to be a marker gene in the stretching cascade. The different regulation in the Class II and Class III groups could be a sign of genetic differences of MHC in individuals with under- or overdevelopment of the mandible. Condylar growth of the mandible should be targeted in young Class II patients dependent on individual muscle capacity.

33 CORTICOTOMY-ASSISTED ORTHODONTIC TREATMENT – A SYSTEMATIC REVIEW

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AIM: To review the effectiveness in reducing treatment time, indications, possible complications and long-term stability of corticotomy-assisted orthodontics.

MATERIALS AND METHOD: Medline, Embase and Cochrane databases were searched to identify relevant publications using the following keywords: surg* assisted tooth movement, rapid tooth movement, corticotomy AND orthodontics, accelerated tooth movement, (piezosurgery OR piezocision) AND orthodontics, regional acceleratory phenomenon (RAP) AND orthodontics, RAP AND orthodontics, accelerated osteogenic orthodontics, corticotomy-assisted orthodontics. For all potentially relevant hits, full text articles were retrieved. Two observers assessed the publications for eligibility: articles in languages other than English, German or Dutch, expert opinions, mere descriptions of technique, reviews, *in vitro* studies or *in vivo* studies without clinical measurements and studies with group sizes of less than five subjects were excluded. The studies were graded for methodological quality.

RESULTS: Thirty-four publications, of which 14 concerned animal experiments, met the inclusion criteria. All studies reported increases in tooth movement and reductions in treatment time varying from 30-70 per cent. Corticotomies can be useful in maximum anchorage extraction cases, adults with generalized crowding and thin alveolar bone, arch expansion, moving ankylosed teeth and impacted canines. Root resorption and periodontal problems were minimal. However, with dental distraction techniques, tooth sensibility was questionable in some cases and vitality should be further investigated. No randomised controlled trials concerning long-term dental stability were found.

CONCLUSION: There is considerable agreement among studies that treatment time can be significantly reduced by corticotomy techniques. Unless extensive bone grafting procedures are necessary, minimally invasive techniques are preferred to minimize discomfort and morbidity, whilst still accelerating bone turnover.

34 EFFECT OF GRAPE SEED SOLUTION ON THE SHEAR BOND STRENGTH OF BRACKETS BONDED TO BLEACHED HUMAN ENAMEL Z Ileri¹, N Karacam¹, S Aksakalli¹, S Can², Y Sener², Departments of ¹Orthodontics and ²Pedodontics, Faculty of Dentistry, Selcuk University, Konya, Turkey

AIM: To investigate the effect of grape seed (a natural antioxidant) solution on the shear bond strength (SBS) of metal brackets bonded with composite resin to human enamel after bleaching with hydrogen peroxide (HP).

MATERIALS AND METHOD: Sixty freshly extracted human premolars were randomly divided into four equal groups. The specimens in group A (control) were not bleached before bonding. The teeth in the other three groups were first bleached with 40 per cent HP according to the manufacturers' recommendation. The specimens in group B were bonded immediately after bleaching, while those in groups C and D were bleached, then treated with 10 per cent sodium ascorbate and 5 per cent grape seed solution, respectively, and then bonded. SBS was measured and recorded in Megapascals (MPa). Adhesive remnant index scores were determined after the brackets failed. Data were analyzed with Kruskal-Wallis, Mann-Whitney U and chisquare tests.

RESULTS: The mean SBS of group B (6.43 ± 2.10 MPa) was significantly lower than that of group A (mean: 9.91 ± 4.04 MPa; P < 0.05). The bond strengths of groups C (mean: 15.57 ± 8.68 MPa) and D (mean: 15.34 ± 7.75 MPa) were significantly higher than group A (P = 0.05). No statistically significant differences in SBS were noted when group D was compared with group C (P > 0.05).

CONCLUSION: Bleaching with 40 per cent HP immediately before bonding reduces the bond strength of composite resin to enamel. Treating the bleached enamel surface with 10 per cent sodium ascorbate or grape seed reverses the reduction.

35 COMPARISON OF TWO PROCEDURES FOR MAXILLARY PROTRACTION: BONE ANCHORS VERSUS FACEMASK

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AIM: Numerous devices have been introduced for correction of maxillary deficiency. However, no study has been conducted regarding the use of miniplate anchorage combined with Class III elastics and a facemask in the correction of maxillary deficiency. The aim of this study was to compare the effects of the facemask and miniplates combined with Class III traction in treating maxillary deficiency in growing patients.

SUBJECTS AND METHOD: Twenty patients with maxillary deficiency and a normal mandible. Ten patients with a mean age of 11.6 ± 0.7 years were treated using Class III elastics connected from two mandibular miniplates to an upper removable appliance. Two miniplates were inserted bilaterally in the anterior part of the mandible in the canine area under local anaesthesia. Class III elastics were connected from the mandibular miniplates to hooks on the upper appliance. Ten patients with a mean age of 10.5+1.5 years were treated with a facemask and upper removable appliance such that traction was applied from the facemask to the removable appliance. A Mann-Whitney test was used to compare the cephalometric data between the two groups.

RESULTS: SNA in the facemask group increased by 1.5 + 1.4 degrees (P < 0.006) and in the miniplates group by 2.4 ± 1.3 (P < 0.007).

CONCLUSION: Miniplates combined with Class III elastics can be a suitable alternative to extraoral appliances and major surgery in maxillary deficiency cases. Whilst the appliance is smaller than a bulky facemask and may increase patient compliance, treatment cannot be started as early as facemask therapy.

36 QUANTITATIVE COMPARISON OF THREE ENAMEL STRIPPING DEVICES *IN VITRO* – HOW PRECISELY CAN WE STRIP TEETH?

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AIM: Grinding interproximal tooth surfaces to reduce tooth size is a common orthodontic procedure. Many studies have focused on surface irregularities after grinding and polishing but there appear to be no studies that quantify the amount of stripped enamel. This *in vi*tro study aimed to investigate stripping predictability of three commonly used stripping devices on human premolars.

MATERIALS AND METHOD: Extracted human premolars were mounted and aligned in silicon. Tooth mobility was tested with a Periotest© (8.3 ± 2.8 units). The selected methods for interproximal enamel reduction were: A) Hand-pulled strips (Horico), B) oscillating segmental discs (O-drive-OD 30), C) motor driven abrasive strips (Orthofile). With each device the operator intended to strip (IS) 0.10, 0.20, 0.30 or 0.40 mm on the mesial side of 15 teeth. The teeth were scanned before and after stripping with a three-dimensional laser scanner. Superposition and measurements of stripped enamel on the most mesial point of the tooth were conducted with Viewbox© software, and confidence intervals were calculated.

RESULTS: A large variation between the intended and actual amount of stripped enamel and between stripping procedures was observed. For IS 0.10 mm the predetermined amount of stripping was exceeded only with the oscillating disc method (A = 0.07 mm, B = 0.12 mm, C = 0.09 mm). For all other depths and for all stripping methods the actual amount of stripping was below the predetermined stripping depth (IS 0.20 mm: A = 0.16 mm, B = 0.13 mm, C = 0.16 mm; IS 0.30 mm: A = 0.26 mm, B = 0.25 mm, C = 0.26 mm; IS 0.40 mm: A = 0.31 mm, B = 0.30 mm, C = 0.31 mm).

CONCLUSION: There is a variation in the stripped amount of enamel. The stripping technique does not appear to be a significant predictor of the actual amount of enamel reduction. In most cases, actual stripping was less than the intended amount of enamel reduction.

37 SUCCESS AND FAILURE OF MINISCREWS PLACED IN THE ANTERIOR REGION OF THE PALATE

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AIM: To examine the success and failure rates of miniscrews placed in the anterior region of the palate and of connected orthodontic devices.

MATERIALS AND METHOD: The records of 196 patients treated by one experienced clinician were retrospectively examined. The patients received 384 miniscrews (OrthoEasy®, Forestadent, Germany). In all cases, two 8 mm miniscrews were inserted in the same region of the palate following the same protocol. Immediately after insertion an impression was taken and one week later, an orthodontic appliance was connected to the screws. Two types of devices were inserted: the 'frog-appliance' was used to distalize the upper molars and the 'hybrid-maxillary widening device' for bone supported rapid maxillary expansion. Thirteen patients were excluded from the study as their treatment was still in progress when the data was collected. In total, 359 miniscrews in 183 patients were evaluated. Two types of failures were recorded: 1. loss of a miniscrew and 2. loss of function of the orthodontic appliance due to the loss of both miniscrews.

RESULTS: In total, only seven miniscrews were lost. This means a miniscrew loss of 1.9 per cent. Concerning the loss of function of the orthodontic appliance, only one case (0.6%) was recorded. The overall survival rate of the miniscrews (98.1%) during orthodontic treatment was very high. Only one case of loss of function of the orthodontic appliances used was reported.

CONCLUSION: The above findings clearly show that miniscrews combined with orthodontic devices placed in the anterior palate provide a highly predicable treatment option.

38 TWO-YEAR RADIOGRAPHIC ANALYSIS OF TOOTH MORPHOLOGY FOLLOWING USE OF A NOVEL CYCLICAL FORCE DEVICE

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AIM: To determine whether or not a novel device used in conjunction with orthodontic treatment produced root resorption over a 2 year period as shown on three-dimensional images generated from cone beam computerized tomographs (CBCT).

SUBJECTS AND METHOD: The subjects were actively recruited and those who received appliances for the first time were invited to participate. Patients who were assigned to receive a functioning device used the devices for 20 minutes daily for a 6 month period. CBCT images were taken of the dentition at the start of treatment, at the end of the study period and at least 2 years after first being recruited. Measurements of all teeth present were made from the mesial buccal roots of the first molar on the opposing side of the same dental arch. These measurements were recorded as linear lengths in

millimetres. A paired *t*-test was used to determine if significant differences occurred for root lengths at the end of treatment compared with the start of treatment for each of the individual tooth groups.

RESULTS: Fourteen out of a possible 17 subjects completed using the device during the study period. The mean age of the subjects was 20.3 years. No statistical differences were noted for root length changes above 0.5 and 1 mm at 6 months or 2 years, respectively.

CONCLUSION: No statistically significant findings were noted for root length change at the end of treatment compared with the start of treatment when using the robotic device. No significant differences were noted between the roots of the anterior and posterior teeth. No clinically significant changes between root lengths were noted above 0.5 mm.

39 ASSESSMENT OF ASYMMETRY IN A NORMAL OCCLUSION SAMPLE AND ASYMMETRIC PATIENTS WITH THREE-DIMENSIONAL CONE BEAM COMPUTED TOMOGRAPHY

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AIM: To characterize symmetrical features of patients with facial asymmetry and thus to find the most reliable horizontal reference lines easily used in threedimensional (3D) images. The hypothesis was that there is difference in the location of bilateral landmarks of the upper skull between a normal occlusion sample and skeletal Class III patients with asymmetry.

SUBJECTS AND METHOD: Group 1 (normal occlusion sample) comprised 20 Korean adults with normal occlusion and no noticeable asymmetry. Groups 2 to 4 were selected from patients diagnosed with a skeletal Class III malocclusion and grouped according to the extent of asymmetry (group 2: symmetric mandible, no maxillary cant; group 3: asymmetric mandible, no maxillary cant; group 4: asymmetric mandible, more than 4 mm maxillary cant measured at the maxillary first molars). 3D cone beam computed tomographic images were taken before treatment and bilateral landmarks of the skull were located and their vertical and horizontal differences were compared.

RESULTS: No statistically significant difference was noted in the position of bilateral landmarks between the groups, except for AG (P < 0.05). AG showed significant differences in the vertical (P < 0.001) and horizontal (P < 0.0001) dimensions between the groups. The mean of difference was clearly greatest at FM.

CONCLUSION: The hypothesis is rejected. All groups had a similar pattern of asymmetry in the upper facial third. Therefore, the transverse reference line of the bilateral Z or orbitale may be used even in patients with severe asymmetry of the maxilla with reference to the clinical photographs.

40 THE ROLE OF BONE MORPHOGENETIC PROTEIN 7 IN THE DEVELOPMENT OF THE SECONDARY PALATE

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AIM: The aetiology of oral clefts appears complex but genetic factors are shown to play a major role. In this study the mechanism by which deletion of the bone morphogenetic protein 7 (Bmp7), a member of the TGF β growth factor superfamily, causes a cleft of the secondary palate in homozygous Bmp7 null (-/-) mice was

investigated. A case of secondary palatal cleft due to Bmp7 mutation has already been reported in humans.

MATERIALS AND METHOD: Bmp7 null embryos were analysed at various developmental stages (E12.5-E16.5) using histological and immunohistochemical methods and *in situ* hybridisation. Organ culture methods were also employed to assess the ability for *in vitro* fusion of the palatal shelves from null embryos.

RESULTS: Bmp7 null mice demonstrated an inhibition in the elevation of the palatal shelves and a subsequent failure in shelf approximation and fusion to form an intact secondary palate. Analysis of the craniofacial skeleton of the Bmp7 null mice revealed a marked reduction in the length of Meckel's cartilage. No differences were found in the expression of key molecules involved in the processes of palatal shelf proliferation and fusion. Organ cultures of Bmp7 -/- palatal shelves indicated that they retain the ability to fuse normally when cultured in apposition.

CONCLUSION: Bmp7 may play an important role in the formation of the secondary palate. Lack of Bmp7 results in a marked reduction of the length of Meckel's cartilage, which might indirectly inhibit palatal shelf elevation.

41 IMPACTED CANINES: SURGICAL EXPOSURE AND IMPLICATIONS REGARDING ANKYLOSIS

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AIM: To assess whether the surgical exposure technique could be associated with ankylosis, one of the most undesirable side effects in the treatment of the impacted canine. A diagnosis of ankylosis was made when the neighbouring teeth were intruded and the canine remained immobile despite the application of any orthodontic force.

SUBJECTS AND METHOD: One hundred and twenty five orthodontic patients (75 females, 50 males) who presented 165 impacted canines (156 in the maxilla, 9 in the mandible) treated surgically and orthodontically by the first author over a period of 18 years. The patients' ages at the beginning of therapy ranged between 9.5 and 46.1 years. Forty-two canines erupted spontaneously after gaining space and the other 123 were treated surgically using an open (59 cases) or a closed (64 cases) surgical exposure technique. The use of skeletal anchorage, by mini-implants and temporary anchorage devices, avoided anchorage loss during canine traction. Three-dimensional diagnostics was used only in the severe impaction cases.

RESULTS: Eleven canines out of 123 presented the side effect of ankylosis *a priori* or during orthodontic traction. Four of them were finally extracted and the other seven were moved to their correct position in the dental arch with a healthy periodontium. The percentage of ankylosis with the open surgical exposure technique was 3.4 per cent (2 out of 59 cases), while for the closed technique it was 14.1 per cent (9 out of 64). The difference between these two percentages was statistically significant (two-sided *P* value = 0.031/95% confidence interval of the difference = 1.0-20.4%).

CONCLUSION: An association between the closed surgical exposure technique and ankylosis of the impacted canine is evident. However, further investigation of this matter will be more informative.

42 IMPACTED MAXILLARY CANINES AND ROOT RESORPTION OF NEIGHBOURING TEETH: A CONE BEAM COMPUTED TOMOGRAPHY STUDY

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AIM: A retrospective cone-beam computed tomography (CBCT) study, assessing the three-dimensional (3D) location of impacted maxillary canines as well as analysis of the frequency, extent and influencing factors for root resorption of neighbouring permanent teeth.

MATERIALS AND METHOD: CBCT images of patients who were referred between January 2009 and December 2010 for radiographic localization of impacted maxillary canines (uni-, or bilateral) and/or suspicion of root resorption of adjacent teeth. The exact 3D location of the impacted canines in the anterior maxilla, frequency and extent of root resorption, and potential influencing factors were analyzed. Interrater agreement was calculated using Cohen's correlation parameters.

RESULTS: One hundred and thirty four impacted canines from 113 patients with CBCT scans were included and analyzed retrospectively. Analysis showed that 69 impacted canines were located palatally (51.49%), 41 labially (30.60%), and 24 (17.91%) in the middle of the alveolar process. In 34 lateral incisors (25.37%), seven central incisors (5.22%), six first premolars (4.48%), and one second premolar (0.75%) root resorption was found. A significant correlation between root resorption on adjacent teeth and localization of the impacted canine in relation to the bone, as well as vertical localization of the impacted canine, could be found. Interrater agreement showed values of 0.546-0.877 (Cohen's kappa).

CONCLUSION: CBCT imaging provides accurate information about the 3D location of an impacted maxillary canine, prevalence of root resorption, and degree of root resorption, with good interrater correlation.

43 CONE BEAM COMPUTED TOMOGRAPHIC-GENERATED MODELS VERSUS DIGITAL MODELS: LINEAR MEASUREMENT AND SURFACE ACCURACY

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AIM: To determine the accuracy of cone beam computed tomographic (CBCT) generated digital models compared with OrthoCAD models for orthodontic diagnosis and treatment planning using linear measurements and surface area analysis.

MATERIALS AND METHOD: Two sets of maxillary and mandibular digital models of 30 individuals were obtained using OrthoCAD scanned impressions and by conversion of corresponding CBCT images with Anatomage software. Six linear measurements at predetermined landmarks were made on both the maxillary and mandibular image pairs. Each individual's matched pairs of maxillary and mandibular arches were then superimposed using the Rapidform software program, using a 'best-fit' algorithm to enable a surface-to-surface evaluation. Average differences between the two models at all points and surface correlation amount (%) at six tolerance levels were measured and recorded. The data was analyzed and compared using intraclass correlation (ICC) and Bland and Altman analyses.

RESULTS: A strong agreement was observed (0.86 < single measure ICCs < 0.99) between the two methods based on the six linear measurements performed on both the maxillary and mandibular pairs. Bland and Altman analysis suggested that the differences occurred within 2 SD of the mean were very small and not clinically important. However overall surface evaluation suggested that a correlation of 90 per

cent and greater was only possible at 1 and 1.25 mm tolerance levels in the maxillary and mandibular models, respectively. The average maxillary model linear difference was 0.28 to 0.60 mm, whereas the average mandibular model linear difference ranged between 0.34 to 0.61 mm.

CONCLUSION: CBCT-generated models and OrthoCAD models can be used interchangeably for diagnostic purposes and performing linear measurements. However, surface overlap amount (%) between the two methods are only considered fair within the limitations of this study.

44 TREATMENT EFFECTS OF THE QUADHELIX/CRIB APPLIANCE IN OPEN BITE PATIENTS: A PROSPECTIVE LONG-TERM STUDY

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AIM: To prospectively investigate the stability of early treatment of dentoskeletal open bites with the quadhelix/crib (Q-H/C) appliance.

SUBJECTS AND METHOD: Twenty-eight subjects (16 females, 12 males) with a dentoskeletal open bite due to thumb-sucking habits treated consecutively with the Q-H/C appliance. Lateral cephalograms were analysed before treatment (T1; mean age 8.2 ± 1.3 years), at the end of active treatment with the Q-H/C appliance (T2; mean age 9.7 ± 1.6 years) and about 5 years after treatment (T3; mean age 14.6 ± 1.9 years). The mean duration of treatment was 1.4 years ± 5 months. The T1-T2, T2-T3, and T1-T3 dentoskeletal changes were analysed with Friedman ANOVA and Tukey's *post-hoc* tests (P < 0.05).

RESULTS: The statistically significant T1-T2 increase in overbite during Q-H/C therapy (4.0 \pm 2.0 mm) overcorrected the amount of anterior open bite at T1 (-2.2 \pm 1.9 mm). During post-treatment observation no significant change occurred in the overbite (0.2 \pm 1.5 mm). Both the maxillary and mandibular incisors showed significant extrusion both during T1-T2 (2.7 \pm 1.6 mm and 1.8 \pm 1.1 mm, respectively) and T2-T3 (2.4 \pm 2.4 and 3.5 \pm 2.5 mm, respectively) intervals. The mandibular plane to FH and palatal plane to mandibular plane angles showed significant closure during the T1-T3 interval (-2.8 \pm 2.7 and -4.0 \pm 2.9, respectively). CONCLUSION: The Q-H/C appliance was effective in producing a stable correction of the dentoskeletal open bite in 86 per cent of growing subjects with thumb-sucking habits. Long-term correction of an anterior open bite was associated with extrusion of the upper and lower incisors and with favourable changes in vertical skeletal relationships.

45 MAXILLARY SINUS EXTENSION AND POSTERIOR TOOTH INCLINATION FOLLOWING EXTRACTION OF MAXILLARY FIRST MOLARS C Livas¹, D J Halazonetis², J W Booij³, N Pandis¹, C Katsaros¹, ¹Department of Orthodontics and Dentofacial Orthopaedics, University of Bern, Switzerland, ²Orthodontic Department, School of Dentistry, University of Athens, Greece and ³Department of Orthodontics and Oral Biology, Radboud University Nijmegen Medical Centre, Netherlands

AIM: To investigate the interaction between maxillary sinus floor extension and inclination of maxillary second premolars (P2) and second molars (M2) in Class II division 1 subjects orthodontically treated with extraction of maxillary first molars. SUBJECTS AND METHOD: Thirty-seven patients [18 boys, 19 girls, mean age 13.2 years, (standard deviation 1.62 years)], treated between 1998 and 2004 in a single orthodontic practice. The inclusion criteria were: Caucasians, Class II division 1

malocclusion, sagittal overjet of <4 mm, no missing teeth or agenesis, and maxillary third molars present. The treatment plan included extraction of the maxillary first permanent molars and one-stage full fixed appliance therapy. Standardized lateral cephalograms taken before/after treatment (T0/T1) and for an average follow-up period of 5.05 years (T2) were digitized. Maxillary posterior tooth inclination and lower maxillary sinus area (LSA) were defined in relation to the palatal plane. The data regarding gender, age, stage of treatment, inclination of molars and premolars and sinus area were analyzed using a mixed linear model.

RESULTS: Analysis showed that M2 inclination was the only variable significantly correlated with LSA, the coefficient being approximately -2. This means that for every unit increase of M2 inclination, LSA decreased by two units. The 95 per cent confidence interval of the estimated coefficient was -3.69 to -0.30 (P = 0.022).

CONCLUSION: There is a significant correlation between maxillary M2 inclination and lower surface area in the course of orthodontic treatment with extraction of maxillary first molars. Clinicians that undertake this Class II treatment strategy should be aware of this possibility, and incorporate the appropriate space closure and finishing mechanics.

46 PREVALENCE OF WHITE SPOT LESIONS DURING ORTHODONTIC FIXED APPLIANCE TREATMENT

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AIM: To determine the prevalence of white spot lesions (WSL) in growing patients with fixed and/or orthopaedic fixed appliances, before and after 6 and 12 months of treatment.

SUBJECTS AND METHOD: Group I contained 59 subjects treated for 6 months 3 weeks and group II, 64 patients-treated for 12 months 4 weeks. They were treated with a 0.022 inch slot preadjusted appliance and MBTTM prescription and wore a functional fixed appliance. Group 0 (controls) consisted of 68 subjects. The clinical examination was performed with a modification of the scoring systems proposed by Gorelick and Mizarhi, integrated with Smith and Knight's method. Fisher's exact test and Bonferroni were performed to study the prevalence of WSLs in each group. Intra-observer agreement was assessed by means of Cohen's Kappa statistics.

RESULTS: The prevalence of WSLs in group I was 40 per cent, and in the group II 43 per cent. In group 0, only 9 per cent of the sample had at least one WSL. The findings for groups I (P = 0.001) and II (P = 0.000) were significantly different from group 0. Group 0 had a lower prevalence of individuals with WSL than groups I (P = 0.02, Fisher's exact test) and II (P = 0.005). The 6- and 12-month groups were not significantly different from each other. A statically significant difference (P = 0.009) was noted in the prevalence of WSL between males and females in group II. The greatest prevalence of WSL was found on the mandibular first molars, the second premolars and the maxillary lateral incisor, in both orthodontically treated groups.

CONCLUSION: Early detection of WSLs during orthodontic treatment is important, as it allows clinicians to implement preventive measures to control the demineralization process before the lesions progress.

47 CELL ANALYSIS OF THE CYTOTOXICITY OF ORTHODONTIC MINI-IMPLANTS ON HUMAN GINGIVAL FIBROBLASTS AND MOUSE OSTEOBLASTS

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AIM: To evaluate the cytotoxic effects of orthodontic mini-implants (OMI) on human gingival fibroblasts (HGF) and osteoblasts.

MATERIALS AND METHOD: The OMIs used were: Orthodontic Mini-implant (Leone), MTN (MTN), Abso Anchor (Dentos), Imtec Ortho (3M Unitek), VectorTAS (Ormco). The materials were incubated in DMEM culture medium for 72 hours according to ISO 10993-5 standards (surface area to volume ratio of the specimen to cell-culture medium; $3 \text{ cm}^2/\text{ml}$). A real-time cell analyzer (RT-CES, xcelligence) was used to evaluate cell survival. After seeding 200 µL of the cell suspensions into the wells of the E-plate 96, gingival fibroblasts were treated with bioactive components released by metallic materials and monitored every 15 minutes for 190 hours. For proliferation experiments, one-way analysis of variance (ANOVA) and Tukey-Kramer multiple comparisons tests were used for statistical analysis.

RESULTS: There was no significant difference between the HGF cell indices of the control and study groups (P > 0.05). When evaluated at 27 and 96 hours, only Vector TAS showed a statistically significant decrease in the M3T3 cell index (P < 0.001) compared with the control group. There were no significant differences among the control and any study group (P > 0.05). Furthermore, Leone and MTN showed a statistically significant decrease (P < 0.001) at 190 hours. Vector TASTM also demonstrated a significant decline (P < 0.05) at the same time as in the M3T3 cell index.

CONCLUSION: These findings provide fundamental knowledge and new insights for future design and development of new biocompatible titanium alloys for OMI and temporary anchorage devices.

48 DENTOSKELETAL EFFECTS INDUCED BY MOLAR DISTALIZATION L Mariani, University of Insubria, Varese, Italy

AIM: To evaluate the treatment effects of the MGBM system (Maino, Giannelly, Bernard and Mura), a new intraoral device to treat Class II malocclusions with no patient cooperation by molar distalization.

MATERIALS AND METHOD: A retrospective study was conducted to compare the pre- and post-distalization cephalograms and dental cast of 30 patients (15 males, 15 females) with a Class II malocclusion treated with the MGBM system. The mean age at the start of treatment was 13.3 ± 3.3 years. Angular, horizontal and vertical changes were recorded to monitor skeletal and dentoalveolar changes. Molar movements in the horizontal plane were monitored by dental measurements on dental casts.

RESULTS: The MGBM system produced rapid molar distalization and the Class II relationship was corrected, on average, in 8 ± 2.05 months. The maxillary first molars were distalized 4.14 mm (Ptv-6 cementoenamel junction), associated with a significant distal axis incline of 9 degrees referenced to the palatal plane, and a significant intrusion of 1.35 mm. With regard to anchorage loss, the first premolar exhibited a significant mesial movement of 0.86 mm, associated with a significant mesial axis inclination of 2.46 degrees. No significant changes in either the sagittal or vertical skeletal relationships were observed.

CONCLUSION: The MGBM system is an efficient and reliable device for distalizing the maxillary permanent molars.

49 TREATMENT EFFECTS INDUCED BY A FATIGUE RESISTANT DEVICE COMBINED WITH FIXED APPLIANCES IN CLASS II GROWING PATIENTS

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AIM: To prospectively assess the dentoskeletal effects of comprehensive fixed appliance treatment combined with the Forsus fatigue resistant device (FRD) in Class II patients.

SUBJECTS AND METHOD: Fifty-four patients (27 females, 27 males) with a Class II malocclusion treated consecutively with the FRD protocol. Lateral cephalograms were taken before therapy (T1, mean age 12.5 ± 1.2 years), before the application of the FRD (T2, mean age 13.6 ± 1.1 years), at the removal of the FRD (T2, mean age 14.1 ± 1.1 years), and at the completion of comprehensive therapy (T4, mean age 14.8 ± 1.1 years). The mean duration of the levelling and aligning phase with fixed appliances (T1-T2 interval) was 1.1 ± 0.4 years. The mean duration of treatment with the FRD (T2-T3 interval) was 0.5 ± 0.1 years while the mean duration of comprehensive treatment (T1-T4 interval) was 2.3 ± 0.4 years. Statistical comparisons were carried out with repeated measures ANOVA with Tukey's *post-h*oc tests (P < 0.05).

RESULTS: The FRD protocol induced a significant restraint in the sagittal skeletal position of the maxilla (SNA -0.6°), a significant mandibular advancement (Pog to N Perpendicular +1.5 mm) and a significant improvement in maxillomandibular sagittal skeletal relationships (Wits -1.8 mm). At the dentoalveolar level a significant reduction in overjet (-4.1 mm) and overbite (-3.0 mm) and a significant improvement in molar relationship (+3.5 mm) were found. The lower incisors were significantly proclined (L1 to mandibular plane +6.2), while the lower first molars moved significantly in a mesial direction (+2.6 mm). The greatest contributions to these significant skeletal and dentoalveolar T1-T4 changes occurred during active treatment with the FRD (T2-T3 interval).

CONCLUSION: The FRD protocol is effective in correcting Class II malocclusions in growing patients with a combination of skeletal (maxillary and mandibular) and dentoalveolar (mainly mandibular) modifications.

50 CAN INSERTION OF TRANS-CORTICAL MINI-IMPLANTS PREVENT ATROPHY OF THE ALVEOLAR PROCESS IN AGENESIS?

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AIM: Maintenance of the alveolar process following loss of primary teeth in patients with premolar or lateral incisor agenesis can be a problem as implants cannot be inserted before cessation of growth. In the case of ankylosis, a lack of development in height is seen and a reduction both in height and width may be the result of removal of the primary tooth. The aim of this study was to evaluate the impact on alveolar height and width after insertion of a horizontal trans-cortical mini-implant.

MATERIALS AND METHOD: Four beagle dogs in which two premolars and two incisors were extracted on both sides in the upper and lower arch. Trans-cortical screws were inserted on one side and the dogs were observed for 6 months before sacrifice. The jaw bones were excised and sectioned according to the placement of the mini-implants. These sections were then embedded in blocks of methylmetacrylate, which were trimmed to fit the sample holder (\emptyset 37 mm) of a

table-top microcomputed tomographic (μ CT) scanner (Scanco μ CT 40). The blocks were scanned with a resolution of 36 μ m and the single-slice images were exported in TIF-format for assessment of dimension and density. Histomorphometry was done on undecalcified sections prepared following μ CT scanning.

RESULTS: Insertion of a trans-cortical mini-implant prevented atrophy of the alveolar process making it possible to maintain the width and allowing continuous vertical development. Apart from maintenance of the outer diameter of the alveolar process, the density of the trabecular bone adjacent to the screws became higher and the cortex surrounding the body of the mini-implant tended to become thicker.

CONCLUSION: The insertion of a trans-cortical mini-implant may prevent atrophy of the alveolar process in areas of agenesis.

51 LONG-TERM TREATMENT RESULTS OF SURGERY ASSISTED FACEMASK THERAPY

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AIM: To evaluate the treatment changes between initial, after protraction and 5 years follow-up results of surgery assisted facemask therapy.

SUBJECTS AND METHOD: Sixteen patients treated by corticotomy assisted maxillary protraction. Four were excluded from the study because distraction osteogenesis, surgery and a second stage of facemask therapy were implemented in the later stages of treatment. The remaining 12 patients were recalled after 5 years; nine were re-examined and cephalometric films were retaken. The mean age of the patients at the beginning of treatment was 12 years. The study was carried on cephalometric films taken before treatment, immediately after maxillary protraction and after 5 years. The data were statistically evaluated.

RESULTS: In the short-term, significant skeletal and soft tissue changes were obtained (SNA, R2-A, R2-UI, R2-UM P < 0.01; Max.der, Nper-A P < 0.05). However after 5 years, clinical examination revealed a well maintained soft tissue profile and dental relationships; cephalometric examination showed compromised sagittal relationships, an increase of the vertical dimension, a stable soft tissue profile and increased incisor inclinations (SNA, ANB, R2-A P < 0.05; Max.depth P < 0.05).

CONCLUSION: After 5 years, although the profile and dental relationships were clinically well maintained, cephalometric data indicated that the sagittal improvement had slightly relapsed. For both jaws, remaining growth was redirected and instead of sagittal, vertical growth took place. Careful patient selection is required when using this protocol since especially occurrence of relapse is inevitable for patients who are in the pre-peak and peak stage. This protocol is indicated in post-peak Class III maxillary retrognathic subjects, with a normal to low vertical growth pattern and a deep bite.

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52 MULTIFUNCTIONAL USE OF PALATALLY INSERTED MINI-IMPLANTS

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AIM: The major problem of orthodontic mini-implants is the still too high failure rate. The literature reports mean overall failure rates of 16 per cent. This might be the reason why mini-implants are regarded as temporary anchorage devices to be used

only for a single treatment goal. Utilizing the anterior palate as the insertion region success rates have proven to be much higher (94.4%). The aim of this study was to determine if it is possible to utilize palatally inserted mini-implants for multiple simultaneous or consecutive treatment goals?

SUBJECTS AND METHOD: The orthodontic treatment of 43 patients was investigated. Eighty mini-implants were inserted in the anterior palate. In 19 cases mini-implants were used as anchorage for two consecutively applied mechanics (group A). Simultaneous use of two mini-implant borne mechanics was performed in 24 cases (group B). In group A 34 mini-implants were used (i.e. 1.79 mini-implants per patient), in group B 46 (i.e. 1.92 mini-implants per patient).

RESULTS: Survival rates of the mini-implants were 91.18 per cent in group A and 95.65 per cent in group B. Treatment goals could be achieved in all cases except one in group A. The incidence of anchorage loss, i.e. dental tipping, employing indirect anchorage was 5.26 per cent in group A and 4.17 per cent in group B. Treatment time was 14.77 months in group A and 9.77 months in group B.

CONCLUSION: Multifunctional use of palatally inserted mini-implants appears to be feasible. Anchorage stability even allows simultaneous use of two mechanics. Success rates were sufficiently high in both groups. Treatment time was significantly shorter when simultaneous use was performed.

53 EFFECT OF INFANT ORTHOPAEDICS ON MAXILLARY ARCH CONSTRICTION IN CHILDREN WITH A UNILATERAL CLEFT LIP AND PALATE

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AIM: Evaluation of the effect of infant orthopaedics (IO) on maxillary arch constriction at 9 and 12 years of age.

SUBJECTS AND METHOD: A prospective two-arm randomized controlled trial in three academic cleft palate centres; Amsterdam, Nijmegen, and Rotterdam, Netherlands. Treatment allocation was concealed and performed by means of a computerized balanced allocation method. Forty-nine infants with complete unilateral cleft lip and palate (UCLP) and no other malformations were used. One group (IO+) wore passive maxillary plates during the first year of life; the other group (IO-) did not. All other interventions were the same. Main outcome measure: The modified Huddart/Bodenham score was used to assess the maxillary arch constriction score at 9 and 12 years of age

RESULTS: No significant differences were found between the IO+ and IO- group. Differences between the centres increased from 9 to 12 years of age. At 12 years of age the differences were significant.

CONCLUSION: IO has no effect on the maxillary arch constriction at 9 and 12 years age. Therefore there is no need to perform IO on children with a UCLP. The differences between the centres were significant at 12 years of age. This could not be explained by any factor taken into account in this study and may be due to surgical effects. To explain this centre effect, more research is needed on the side effects of surgery in children with a UCLP

54 A TWO-YEAR REVIEW OF USE OF MICRO-VIBRATION THERAPY TO SPEED UP ORTHODONTICS***

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AIM: To investigate the efficacy of concurrent micro-vibration therapy (MVT) in accelerating orthodontic treatment

SUBJECTS AND METHOD: Concurrent MVT, 20 minutes per day, with AcceleDent (OrthoAccel Technologies) was offered in November 2009 to appropriate patients. Sixty-five chose concurrent MVT (including 11 orthognathic patients). Eighteen have completed treatment (including 6 orthognathic). The following was assessed: age of patients and their appliance type (n = 65); preferred place of use (n = 22), respondents n = 17; reduction in treatment time (n = 14) compared with predicted treatment times in all completed fixed appliance cases with MVT. Accuracy of predicted treatment time was verified by comparing actual against predicted treatment time in a matched control group of consecutively treated patients. Both groups had 14 patients (11 buccal, 3 lingual) with predicted treatment times of between 18 and 24 months; each included six orthognathic patients. Statistical significance was assessed with the Student's *t*-test

RESULTS: Age (n = 65): 75 per cent >17 years (range 9-62 years); appliance type (n = 65): ceramic 46 per cent, aligner 20 per cent, metal fixed 19 per cent, lingual 12 per cent, removable 3 per cent. Place of use, most popular: watching television = 47 per cent. Reduction of treatment time: MVT predicted X = 20.04, actual X = 12.39 months (P < 0.0001) i.e. 38 per cent faster. X age = 29 years, sd 10.5. Accuracy of predicted treatment time: control predicted X = 22.29, actual X = 20.71 months (P = 0.24) i.e. 7.0 per cent faster. X age = 30 years, sd 12.74. Adjusted predicted MVT treatment time X = 18.62, actual X = 12.39 months (P < 0.0001).

CONCLUSION: The predicted treatment time in the control group was accurate to within an average of 7.0 per cent (1.57 months). Reduction in treatment time with MVT was highly statistically significant (P < 0.0001). After adjusting for prediction error, the MVT group was faster than predicted by 33.5 per cent (P < 0.0001) saving on average 6.23 months treatment time.

55 THE EFFICACY OF TWO DIFFERENT SELF-LIGATING BRACKETS WITH A CONVENTIONAL BRACKET SYSTEM DURING INITIAL ALIGNMENT

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AIM: To investigate the duration of mandibular incisor crowding alleviation, chairtime and bacterial plaque accumulation of two different self-ligating brackets compared with a conventional system.

SUBJECTS AND METHOD: Sixty-nine subjects with the following criteria: age range between 13-18 years; non-extraction treatment protocol in the mandibular arch; eruption of all mandibular teeth (except third molars); and irregularity index between 5-9 mm in the mandibular arch. The patients were randomly assigned to three groups: one group received treatment with a passive self-ligating bracket, one with an active self-ligating bracket and the other with a conventional system, all with 0.022 inch slots. The irregularity index of the mandibular arch was resolved by using nickel titanium arches in an established sequential order, and the duration for alignment was calculated in days. While changing the archwires, chairtime was recorded. At every session plaque accumulation was assessed utilizing plaque disclosing tablets.

RESULTS: There was no difference in the time required to correct mandibular crowding with either self-ligating or conventional brackets (P > 0.05). The plaque index scores revealed no difference between the two self-ligating systems; whereas the measurements were significantly higher than for conventional brackets (P < 0.05).

The shortest chairtime for ligation was recorded for the active self-ligation system followed by the passive and conventional ones, respectively.

CONCLUSION: During alleviation of mandibular anterior crowding, no significant duration advantage was noted between the two types of self-ligating and conventional bracket systems. Even though the self-ligating systems save chairtime, less plaque accumulation gives the conventional brackets an important advantage during fixed appliance therapy.

56 DIMENSIONAL CHANGES OF MAXILLARY SINUSES AND PHARYNGEAL AIRWAY IN CLASS III PATIENTS UNDERGOING BIMAXILLARY SURGERY

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AIM: To evaluate pharyngeal airway and maxillary sinus volume changes after bimaxillary surgical treatment of Class III skeletal deformities.

SUBJECTS AND METHOD: Seventeen Class III skeletal patients (11 females, 6 males) who required bimaxillary orthognathic surgery as a part of their orthodontic treatment. Volumetric measurements were performed using cone beam computed tomography (CBCT) scans, pre- and 3.9 ± 0.87 months post-operatively. All CBCTs scans were assessed and analyzed using Mimics 14.0 software. The pre- and post-operative volumes of the pharyngeal airway and maxillary sinuses, and the relationship between the amounts of surgical movement of the jaws and the above volumes were statistically evaluated. Among the whole sample, eight patients who underwent mandibular setback combined with maxillary impaction and advancement, were also evaluated separately.

RESULTS: There was a significant decrease only for lower and total pharyngeal airway volume in males (4196.27 \pm 2061.11 mm³ and 3375.53 \pm 3624.67 mm³, respectively), a significant decrease in the volume of the maxillary sinus of 3448.09 \pm 3315.56 mm³, and no correlation between skeletal movements and volumetric changes of the pharyngeal airway and the maxillary sinus in the whole group. In the impaction subgroup a significant decrease of 4417.67 \pm 3440.31 mm³ was observed in maxillary sinus volume.

CONCLUSION: There is no significant change in the volume of the pharyngeal airway after bimaxillary surgery for correction of a Class III skeletal relationship, except for lower and total pharyngeal airway volumes in males. However, there was a significant decrease in the total volume of the maxillary sinuses.

57 RISK FACTORS FOR ORTHODONTIC MINISCREW IMPLANT FAILURE: A META-ANALYSIS

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AIM: Risk factors concerning orthodontic miniscrew implants (MIs) have not been adequately assessed. This meta-analysis summarizes the existing knowledge from published clinical trials regarding the failure rates of MIs used for orthodontic anchorage purposes and identifies the factors possibly affecting them.

MATERIALS AND METHOD: Nineteen electronic databases and reference lists of included studies were searched to February 2011, with no restrictions. Only randomized controlled trials, prospective controlled trials and prospective cohort studies were included. Study selection and data extraction were performed twice. Failure event rates, relative risks and the corresponding 95 per cent confidence

intervals (CIs) were calculated. The random-effects model was used to assess each factor's impact. Subgroup and meta-regression analyses were also implemented.

RESULTS: Fifty-two studies were included for the overall MIs' failure rate, and 30 studies for the investigation of risk factors. From the 4987 MIs used in 2281 patients, the overall failure rate was 13.5 per cent (95% CI 11.5-15.8%). Failures of MIs were not associated with patient gender, age or insertion side, while they were significantly associated with jaw of insertion, insertion torque, cortical bone thickness and root contact. In the maxilla, more MI failures were observed in the posterior than in the anterior region, while in the mandible, more MI failures were observed lingually than buccally.

CONCLUSION: Orthodontic MIs present a modest small mean failure rate, indicating their usefulness in clinical practice. Although, many factors affect their failure rates, some of them still need additional evidence to support any possible associations.

58 VIBRATORY LOADING INCREASES THE RATE OF TOOTH MOVEMENT

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AIM: To analyze the effect of cyclic loading (vibrations) on tooth movement in human subjects undergoing orthodontic treatment.

SUBJECTS AND METHOD: Forty-five patients requiring bilateral extraction of the first premolars were randomly assigned to either a control group (orthodontic treatment with fixed appliances, n = 22), or a treatment group (fixed appliances and vibration, n = 23). Cyclic force (25 g at 30 Hz) was applied by the AcceleDent device (OrthoAccel Technologies, Inc.) for 20 minutes daily. The rate of initial alignment was determined by the change in arch perimeter. Subsequently, the maxillary canines were retracted by sliding mechanics along a 0.018 inch steel wire with a force of 180 g applied by a nickel titanium coil spring attached distally to an osseous mini-implant (TAD). At each 4 week visit canine movement was determined by measuring the distance between the TAD and canine bracket using a digital calliper. Measurements were stopped when less than 1 mm of extraction space remained to be closed. To assess root resorption, root lengths were measured on panoramic films taken before, during and after treatment. Changes in the rate of tooth movement were analyzed using ANOVA and a two-sided *t*-test.

RESULTS: During initial alignment the rate of tooth movement was 2.71 and 1.32 length units/week in the vibration and control groups, respectively (P = 0.05). The rate of tooth movement during space closure was 0.32 mm/week in the control group and 0.23 mm/week in vibration group, thus 39 per cent faster in the vibration group (P = 0.04). There was no difference in root resorption between the groups.

CONCLUSION: Daily application of vibratory loading in conjunction with conventional orthodontic treatment can significantly and safely increase the rate of tooth movement without adverse side effects.

59 EVALUATION OF ENAMEL CRACKS AFTER USING DIFFERENT BRACKET TYPES AND DEBONDING TECHNIQUES

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AIM: To investigate tooth enamel for new crack generation after debonding of metal and ceramic brackets using two different debonding methods for ceramic brackets.

MATERIALS AND METHOD: Forty-five premolars were randomly divided into three groups. In group A the premolars were bonded with metal brackets (Sarl, M.B.I., France) and debonded by pliers, according to the manufacturers' recommendations. In groups B and C the same ceramic brackets were used (Clarity, 3M Unitek, Monrovia, USA). In group B debonding was carried out with pliers, according to the manufacturers' recommendations, whereas in group C, an Er-Yag laser was used in the centre of the bracket slot for 9 seconds, at 1 W, 520 mJ and 2 Hz, from a distance of 1 cm. All premolars were examined stereomicroscopically three times, before bonding (T1), after debonding (T2) and after adhesive removal and polishing (T3). At T1 and T3, the tooth enamel was examined, evaluating the number, size and localization of cracks according to Zachrisson's method, and at T2 the adhesive remnant index (ARI) was used for each tooth.

RESULTS: According to ARI scores, most brackets failed at the bracket-adhesive interface. Both in groups A and B, eight out of 15 teeth (53.3%) showed an increase in enamel cracks at T3, whereas in group C only one tooth (6.6%) presented with new cracks. According to Fisher exact test, there was no significant difference between groups A and B in the increase of enamel cracks. However, there was a significant difference between groups B and C, (P < 0.05).

CONCLUSION: The risk of an increase in enamel cracks after debonding metal or ceramic brackets with pliers is the same, in contrast to the Er-Yag laser, which is a safer debonding method for ceramic brackets, as far as enamel damage is concerned.

60 THE EFFECTIVENESS OF RAPID MAXILLARY EXPANSION AS AN INTERCEPTIVE TREATMENT FOR IMPACTED MAXILLARY INCISORS C Pavoni¹, M Mucedero¹, V Giuntini², T Baccetti², Departments of Orthodontics, ¹Universita degli Studi di Roma Tor Vergata, and ²Università degli Studi di Firenze, Italy

AIM: The present prospective clinical trial aimed to assess the effectiveness of rapid maxillary expansion (RME) in the presence of impacted maxillary permanent incisors when compared with simply monitoring the eruption of the teeth after surgical removal of the obstacles to eruption.

SUBJECTS AND METHOD: Sixty-two subjects with delayed eruption of the permanent maxillary incisors due to supernumeraries or odontomas. The transverse width of the maxillary arch was normal or mildly constricted. The obstacle to incisor eruption was surgically removed at the initial observation (T1) in all 62 subjects. Following surgery, 34 subjects (15 males, 19 females, mean age 8 years 11 months \pm 11 months) underwent RME, while 28 subjects (15 males, 13 females, mean age 9 years 1 month \pm 1 year) were monitored after surgery without further treatment (monitoring group). At T2 (one year after T1) the prevalence rate of the erupted incisors was recorded, and compared statistically in the two groups (chi-square test). Also, the time of eruption of the incisors and the amount of space loss in the anterior maxillary region in the two groups were compared (*t*-tests). The power of the study exceeded 0.95.

RESULTS: At T2, eruption of impacted incisors occurred in 73.5 per cent of the cases in the RME group. Only six patients in this group required further surgical intervention and orthodontic traction following T2. Eruption of the impacted incisors in the monitoring group occurred in 39.3 per cent (chi square = 8.45, P < 0.001). The eruption time was significantly faster in the RME group, and space loss significantly less.

CONCLUSION: RME following surgical removal of the obstacles to the eruption of maxillary incisors appears to be an efficient interceptive approach leading to eruption of the incisors in 3 out of 4 cases within 7 months.
61 EARLY SECONDARY ALVEOLAR BONE-GRAFTING ON DENTAL ARCH RELATIONSHIP IN PRE-SCHOOL CHILDREN WITH CLEFT LIP AND PALATE

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AIM: To evaluate dental arch relationship in pre-school children with a unilateral cleft lip and palate after early alveolar bone-grafting (ABG).

SUBJECTS AND METHOD: Three raters blindly assessed the dental arch relationship with the GOSLON Yardstick (1 – very good outcome, 2 - good outcome, 3 - average outcome, 4 - poor outcome, and 5 – very poor outcome) in the early-grafted group (27 boys, 15 girls; mean age = 5.2 years, SD = 0.5 years) and non-grafted group (17 boys, 12 girls; mean age = 5.8 years, SD = 0.8 years). The groups differed regarding the age when ABG was performed: between 2 and 4 years (mean = 2.4, SD = 0.6) in the early-grafted group and after 9 years in the non-grafted group. The strength of agreement of rating was evaluated with kappa (κ) statistics.

RESULTS: Intra- and interrater agreement was high ($\kappa > 0.800$). The mean GOSLON score in the early-grafted group was 2.72 and in the non-grafted group 2.64. The distribution of the GOSLON grades in the early-grafted group was: 54.8 per cent had a score 1 or 2, 23.8 per cent 3, and 21.4 per cent 4 or 5; in the non-grafted group, 38.0 per cent of subjects scored 1 or 2, 41.4 per cent 3, and 20.6 per cent 4 or 5 (P = 0.023)

CONCLUSION: Early alveolar bone grafting seems not to have a negative influence on dental arch relationship assessed at 5 years of age

62 ASSOCIATION AND MUTATION ANALYSES OF THE IRF6 GENE IN FAMILIES WITH NON-SYNDROMIC AND SYNDROMIC CLEFT LIP AND/OR CLEFT PALATE.

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AIM: 1) To detect IRF6 mutations in newly recruited Van der Woude syndrome (VWS) and poplietal pterygium syndrome (PPS) families. 2) To test for association in non-syndromic cleft lip and/or cleft palate (NSCL/P) and in VWS/PPS families, the single nucleotide polymorphism (SNP) rs642961, from the interferon regulatory factor 6 gene (IRF6) enhancer AP- 2α ; region, alone or as haplotype with the IRF6 coding SNP rs2235371 (Val274IIe).

SUBJECTS AND METHOD: IRF6 mutation screening was performed by direct sequencing and genotyping of rs642961 and rs2235371 by TaqMan technology. Seventy-one Swedish NSCL/P families, 24 Finnish cleft palate only (CP) and 24 VWS/PPS families (seven newly recruited) were studied.

RESULTS: Allelic and genotypic frequencies in each phenotype were compared with the controls and no significant difference could be observed. IRF6 gene mutation was detected in six out of seven VWS/PPS families. Association analysis of the entire VWS/PPS sample set revealed the 'A' allele from rs642961 to be a risk allele in all but the Finnish families and was in large majority (>80%) transmitted on the same chromosome as the IRF6 mutation. A significant association was detected in the Swedish CP subset of the NSCL/P collection where the A-C and G-C haplotypes for rs642961-rs2235371 were protective (P = 0.02) and at risk (P = 0.013), respectively.

CONCLUSION: The results do not support the previously reported association between the A allele of rs642961 and the NSCL phenotype. Instead, the G-C haplotype for rs642961-rs2235371 is a risk haplotype in Swedish NSCP cases.

63 CORRECTION OF REVERSE-SEQUENCING CHEWING CYCLES AFTER UNILATERAL POSTERIOR CROSSBITE THERAPY

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AIM: Reverse sequencing chewing cycles are dyskinetic chewing patterns occurring with a high frequency in patients with a unilateral posterior crossbite (UPC) during chewing on the affected side. A UPC is an asymmetric, worsening, malocclusion characterized by severe asymmetry of the masticatory function. The aim of this work was to evaluate the chewing pattern of children with a UPC before and after correction with the function generating bite (FGB) appliance.

SUBJECTS AND METHOD: Thirty-five children, aged from 7 to 11 years (average 8.6 ± 1.3 years), with a UPC. Chewing patterns were evaluated during chewing soft and hard boluses, on the crossbite and non-crossbite sides, before and after therapy, using a kinesiograph (K7-I; Myotronics, Tukwila, Washington, USA) interfaced with a computer for data storage and subsequent analysis.

RESULTS: There was a significant difference in the chewing cycle parameters and in the prevalence of reverse sequencing chewing cycles, when chewing on the crossbite side, before and after therapy, with soft (P = 0.0003) and hard (P = 0.0001) boluses. A significant difference was also demonstrated during chewing on the crossbite side with respect to the non-crossbite side (soft bolus P = 0.0003, hard bolus P = 0.0003), before therapy.

CONCLUSION: Children with a UPC exhibit a high prevalence of reverse and anomalous chewing cycles during chewing on the affected side, significantly decreasing after FGB therapy. FGB is the only appliance able to significantly rebalance mastication after therapy. As neuromuscular control of mastication is deeply involved, the characteristics of the appliance are important to obtain both dental and functional improvement.

64 INVESTIGATION OF THE BONE IN THE ANTERIOR MANDIBLE WITH REGARD TO MINIPLATES AS ORTHODONTIC ANCHORAGE

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AIM: The clinical success of orthodontic anchorage plates depends on the stability of the fixating miniscrews. A critical factor is the amount and quality of bone in the area of application. The purpose of this study was to investigate the supply of bone in the anterior mandible in relation to orthodontic anchorage plates.

MATERIALS AND METHOD: Fifty-one dental computed tomographs (CTs) of fully dentate adult patients (average age 24.0 ± 8.1 years, 27 males, 24 females) could be assessed. In all CTs the width of the mandible and the thickness of the labial cortical layer of the anterior mandible were investigated.

RESULTS: The average thickness of the labial cortical layer was least at the level of the root tips and increased in the basal and distal direction. Similarly, the width of the mandible was lowest at the level of the root tips and increased in a basal direction and towards the lateral teeth.

CONCLUSION: As a consequence of the greater cortical strength it can be expected that orthodontic anchorage plates that are placed at a certain distance from the tips of the dental roots will show greater stability.

65 ASSESSMENT OF FACIAL ASYMMETRY IN GROWING SUBJECTS WITH A THREE-DIMENSIONAL LASER SCANNING SYSTEM

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AIM: To evaluate facial asymmetry in growing subjects with no malocclusion on three-dimensional (3D) laser facial scans.

SUBJECTS AND METHOD: Twenty-seven healthy Caucasian children (15 males, 12 females; aged 5.4 ± 0.3 years) in the primary dentition without malocclusion were randomly selected from a local kindergarten in Slovenia. Surface facial images were obtained using a 3D laser scanning system at baseline and at 18, 30, 42 and 54 months follow-up. Facial asymmetry was assessed quantitatively by measuring the facial shell to mirrored shell average distance. Further, the percentage of asymmetry was calculated as the percentage of shell to the mirrored shell not coinciding within 0.5 mm. Qualitative assessment was performed on colour deviation maps by recording the predominant side of the face for the upper, middle and lower parts of the face separately. Non-parametric tests were used for data analysis.

RESULTS: No face was perfectly symmetric. The average distance between the mirrored shells for the whole face ranged from 0.22-0.85 mm and the percentage of asymmetry 7.8-66.9. There were no significant gender differences (P > 0.05) and no significant change was found over the observed period. The upper part of the face was the least asymmetric, while the lower part was the most asymmetric (P = 0.03).

CONCLUSION: Facial asymmetry is present at an early developmental stage and does not show any tendency to increase or decrease with growth in the pre-pubertal period.

66 TREATMENT EFFECTS OF A FATIGUE RESISTANT DEVICE IN GROWING CLASS II DIVISION 1 INDIVIDUALS

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AIM: To evaluate the skeletal, dental and soft-tissue effects of the Forsus[™] fatigue resistant device (FRD) in growing Class II division 1 individuals.

SUBJECTS AND METHOD: Forty-five growing patients (26 males, 19 females) with a Class II division 1 malocclusion. Twenty-five patients (16 males, 9 females) with a mean age of 11.83 years were treated with the FRD. The remaining 20 patients (10 males, 10 females) with a mean age of 11.3 years formed the control group. From the treatment group, lateral cephalograms and hand-wrist radiographs were taken before and after removal of the appliance. The same records were taken at the beginning and end of the 6 month observation period for the control group. Paired *t*-tests were used to determine the differences in each group and independent *t*-tests to evaluate group differences.

RESULTS: Backward relocation of point A (-0.76 mm; P < 0.05) was the only significant skeletal effect of the FRD. The upper incisors extruded 1.44 mm (P < 0.05) and retruded -1.56 mm (P < 0.001), the lower incisors proclined 3.68 mm (P < 0.001) and intruded -1.68 mm (P < 0.001). The upper molar tipped distally (-1.06 mm; P < 0.05) and intruded (-1.6 mm; P < 0.001), while the lower molars tipped mesially 3.72 mm (P < 0.001) and extruded 2.58 mm (P < 0.001). The occlusal plane

displayed a clockwise rotation (4.64; P < 0.001) and the overjet and overbite reduced. Significant retrusion of the upper lip (-0.76 mm; P < 0.001) and protrusion of soft tissue pogonion (1.8 mm; P < 0.05) were observed.

CONCLUSION: The Forsus[™] FRD is effective in treating Class II division 1 malocclusions mostly through dentoalveolar changes. Class II division 2 subjects with dentoalveolar retrusion are ideal candidates for this treatment protocol.

67 COMPARISON OF TWO IMPLANT-SUPPORTED MOLAR DISTALIZATION SYSTEMS

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AIM: To evaluate and compare the skeletal, dentoalveolar and soft tissue effects of a bone anchored pendulum appliance (BAPA) and miniscrew implant supported distalization system (MISDS) used for molar distalization.

SUBJECTS AND METHOD: Patients with a Class II dental relationship with a Class I or II skeletal relationship were divided into two groups each consisting of 14 individuals. Two titanium intermaxillary fixation screws (length 8 mm, diameter 2 mm) were placed in the anterior paramedian region in each group. In the first group, with an average age of 14.6 years, a MISDS appliance was placed on the screws in the anterior paramedian region and the bilateral coil springs were activated to apply a distalization force of 200 g at a distance of 4-5 mm gingival to the upper molar crown. In the screws in the anterior paramedian region and the anterior paramedian region and the titanium springs were activated to apply a distalization force of 230 g with 70 degree bends.

RESULTS: The Class II molar relationship was corrected to Class I in all patients. Molar distalization was obtained in an average period of 10.2 months in the MISDS group and 8.1 months in the BAPA group. The mandible showed posterior rotation and the anterior face heights increased in both groups, but more in the BAPA group. The maxillary molars were significantly distalized in both groups, but showed significantly more distal tipping in the BAPA group. The maxillary first molars extruded and maxillary premolars distalized spontaneously in both groups.

CONCLUSION: Significant maxillary molar distalization was obtained in both groups with more distalization and distal tipping in the BAPA group. Therefore, both appliances can be used as non-compliant methods in the treatment of Angle Class II malocclusions, considering their different effects and choosing the appropriate cases.

68 ASSESSMENT OF ROOT RESORPTION CAUSED BY CONTINUOUS VERSUS INTERRUPTED ORTHODONTIC FORCES IN PREMOLARS

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AIM: Root resorption is an unavoidable and undesirable sequelae of orthodontic treatment. The aim of the study was to compare the extent of root resorption caused by continuous versus interrupted orthodontic force in a clinical setting.

MATERIALS AND METHOD: Thirty first premolars scheduled for extraction for orthodontic reasons in a group of 12 teenagers. For 4 weeks before extraction 12 teeth were subjected either continuous (group 1) or interrupted (group 2) force application. The morphometric analyses of root resorption were performed by microcomputed tomography (SkyScan 1072, Aartselaar, Belgium). The morphology of all root surfaces was assessed using TView software (SkyScan), which allowed observation of all microscans and identification of root resorption craters. The computer tomography analyzer software (CTAn; SkyScan) was used for determination of crater volume. The extent of tooth movements was measured on stone casts.

RESULTS: The number of the resorption craters was significantly higher and the average volume of the root craters per tooth was almost twice as large in group 1 than in group 2. In both treatment groups the average volume of resorption craters was larger in the cervical root, with the highest value on the buccal surface. However, the distance of tooth displacement was similar in both groups.

CONCLUSION: Use of interrupted orthodontic force leads to the smaller destruction of root structure as opposed to continuous orthodontic force and therefore should be considered in the preparation of optimal orthodontic treatment plan.

69 ENGINEERED SKELETAL MUSCLE AS AN AID FOR THE MANAGEMENT OF CRANIOFACIAL DEFORMITIES

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AIM: The surgical transfer of tissue is the current gold standard to manage craniofacial soft tissue defects. Limitations can include poor restoration of function and aesthetics, donor site morbidity and paucity of available tissue. Tissue engineering techniques have the potential to overcome these limitations. The aim of this study was to engineer a skeletal muscle substitute *in vitro* with the potential to aid surgical management of craniofacial soft tissue defects.

MATERIALS AND METHOD: Human masseter muscle biopsies were obtained from healthy, consenting adults. Cells were extracted and expanded utilising standard cell culture procedures. Degradable reinforced collagen scaffolds were seeded with the cells and incubated for a period of 21 days at 37°C. Modulation contrast and immunofluorescent microscopy was used to assess cell architecture within the scaffolds. The alamarBlue® metabolic assay and real-time polymerase chain reaction (RT-PCR) assessed cell viability and cell differentiation and maturation, respectively.

RESULTS: The scaffolds contracted in a unidirectional manner and provided constructs 30 mm in length. Microscopic assessment confirmed cell alignment similar to normal skeletal muscle. There was good cell viability throughout the experimental period. RT-PCR demonstrated upregulation of genes associated with muscle fibre formation. There was also expression of fast, slow and developmental myosin heavy chain genes, all of which are upregulated within native adult human masseter muscle in varying proportions and are related to the speed of muscle fibre contraction.

CONCLUSION: Tissue engineering techniques employing degradable collagen scaffolds have the potential to produce viable human craniofacial skeletal muscle tissue *in vitro* that has the architecture of native muscle. Genes associated with skeletal muscle differentiation and maturation were upregulated, suggesting analogy to adult human masseter muscle. Future work will aim to refine this system.

70 IS THE USE OF CERVICAL VERTEBRAE MATURATION TO DETERMINE SKELETAL AGE APPROPRIATE?

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AIM: To assess the effective dose of a lateral cephalogram in the craniofacial area, with and without a neck shield, and to compare the difference to the radiation dose of a hand-wrist radiograph.

MATERIALS AND METHOD: Thermoluminescent dosemeters were placed at 19 different sites in the head and neck of a tissue equivalent human skull (Rando phantom). Analogue lateral cephalograms, with and without a neck shield (67 kV, 250 mA, 10 mAs) and hand-wrist radiographs (40 kV, 250 mA, 10 mAs) (Comet AG, Switzerland) were obtained. The effective doses in microsieverts (μ S) were calculated using the recommendations of the 2007 International Commission on Radiological Protection.

RESULTS: The effective dose for conventional lateral cephalograms was 5.03 μ S. By applying a thyroid shield to the Rando phantom, a dose reduction could be achieved in the lateral cephalogram (1.73 μ S) that corresponded to approximately 34 per cent. The effective dose for a conventional hand-wrist radiograph was calculated to be between 0.07 and 0.16 μ s, which corresponded to approximately an 11 to 25-fold reduction in radiation exposure when not using the neck shield.

CONCLUSION: The thyroid is an organ that is sensitive to radiation exposure. Without a neck shield the effective dose of a lateral cephalogram is significantly increased and results in a 1.5-fold higher radiation exposure when compared with thyroid gland protection. An additional hand-wrist radiograph, however, results in only a very little increase in the effective dose. Based on the overriding ALARA-principle, skeletal maturation evaluation using the cervical vertebrae method in lateral cephalometric radiographs must be regarded as obsolete and if needed, a hand-wrist radiogram involving no high sensitive tissues should rather be taken in addition.

71 TENSILE BOND STRENGTH OF METAL PAD CUSTOMIZED BRACKETS BONDED USING SIX DIFFERENT BONDING PROCEDURES. O A Sorel, P Salah, A Marinetti, P Curiel, Department of Orthodontics, Université de Rennes, France

AIM: To investigate the effects of different bonding protocols on the tensile bond strength (TBS) of samples cast in the same metal used in the casting of the pads of digitally customized lingual brackets.

MATERIALS AND METHOD: The samples were constructed with two components: a square pad with a surface measuring 9 mm² and, perpendicular to this surface, a tail. The tail was designed to fit the Lloyd testing device. Two samples were then bonded together, face to face. Six adhesives were tested with a minimum of 30 tests for each (G1: Optibond, G2: Nexus, G3: A&B Reliance, G4: R-Concise, G5: Geristore and G6: Quick Cure). The metal surface was pre-treated with Rocatek. Tensile bond testing was performed with a universal testing device (Lloyd LF Plus; Lloyd Instruments Ltd., Fareham, Hants, UK) at a crosshead speed of 1 mm/minute. Bond strengths were calculated in megapascals (MPa). One-way analysis of variance (ANOVA) was performed to determine significant differences in bond strength between bonding procedures. The means for bond strength values were compared using *post hoc* Tukey's multiple comparison test (P < 0.05).

RESULTS: There was a significant difference between the groups. Group 3 had the highest mean TBS (39.6 MPa), followed by group 2 (36.3 MPa); the lowest was group 1 (5.0 MPa).

CONCLUSION: High TBS values were observed for metal-to-metal bonding. Some of these values may be excessive for enamel safety. The study also highlights the importance of choosing the right protocol in bonding, where there is the possibility of high adhesive strength, as well as ensuring safety during debonding. 72 EFFECTS OF CRYOPRESERVATION ON PERIODONTAL REGENERATION OF SUBCUTANEOUSLY TRANSPLANTED RAT MOLARS S Staels¹, P De Coster², A Vral³, L Temmerman¹, G De Pauw¹, Departments of ¹Orthodontics, ²Oral Biology and ³Anatomy, Embryology, Histology and Medical Physics, Ghent University, Belgium

AIM: To analyse the effects of cryopreservation on periodontal regeneration of autotransplanted rat molars.

MATERIALS AND METHOD: First and second maxillary molars (n = 92) of 24 four-week-old Wistar rats were extracted and immediately autotransplanted into the abdominal tissue (control group n = 44) or after cryopreservation in liquid nitrogen for 7 days (test group n = 48). At 1, 2, 4 and 10 weeks after transplantation, the molars were excised and regeneration of the periodontal tissues was analysed on histological sections stained with routine haematoxylin and eosin and the Goldner method. The following tissue responses were scored on a tooth basis: inflammation, regeneration of the periodontal ligament (PDL), resorption/apposition of cementum, and alveolar bone formation.

RESULTS: Sixty-two teeth were available for histologic evaluation, including 30 experimental and 32 control samples. One week after transplantation, both control and test teeth were surrounded by granulation tissue and some areas of root resorption could be seen. After two weeks, signs of regeneration of the PDL, cementum apposition, and new bone formation roughly coincided in both groups, however markedly retarded in the test group. After four weeks, regeneration progressed equally in both groups, presenting fewer areas of cementum apposition in the experimental samples. Finally, 10 weeks after baseline transplantation, no significant differences between either group could be observed.

CONCLUSION: Cryopreservation followed by autotransplantation of extracted teeth in rats appears to have minimal detrimental effects on regeneration of periodontal tissues after integration periods of 1 to 10 weeks. However, the present findings indicate that the regeneration process in general is retarded for cryopreserved teeth, as compared with their immediately transplanted homologues.

73 OXYTALAN FIBRES: THEIR POSSIBLE ROLE IN ORTHODONTIC RELAPSE

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AIM: Oxytalan fibres may play a role in relapse. To clarify their role, the oxytalan network in the rat periodontium was studied. An *in vitro* model was developed to study the effects of loading on periodontal ligament (PDL) fibroblasts in a three-dimensional (3D) matrix, and on oxytalan fibres.

MATERIALS AND METHOD: Sections of molars from adult rats were stained for oxytalan by Gomori's aldehyde fuchsin following oxidation. Human PDL fibroblasts were seeded in 3D collagen gels in a Flexcell® system (2,106 cells/ml). Attached gels were loaded at 100 µstrain (1 cycle/minute) for 2, 7, and 14 days, and stained for collagen (Azan) and oxytalan. Loaded gels were compared with unloaded gels and free-floating controls. The mRNA expression of matrix metalloproteinases (MMPs), collagen, and oxytalan components was analyzed by QPCR. MMP proteins were analyzed by gelatine zymography.

RESULTS: Thick oxytalan fibres were cervico-apically orientated in the PDL. They insert into the cementum and run to the PDL blood vessels. Thin fibres interconnected the thick fibres in a complex network. In the supra-alveolar regions, thin oxytalan fibres followed the supra-alveolar collagen fibres. *In vitro*, in the free-

floating gels, fibroblasts were randomly orientated, and the collagen was degraded. MMP expression was high, while collagen expression was low. No oxytalan fibres were present. In the loaded and unloaded gels, the fibroblasts orientated longitudinally, proliferated, and expressed less MMPs and more collagen. Oxytalan components were upregulated, and thin fibres were occasionally found.

CONCLUSION: The oxytalan fibre network is mainly cervico-apically orientated. Human PDL fibroblasts can be cultured in 3D collagen gels to study the effects of loading on remodelling of the extracellular matrix (ECM), including oxytalan. Loading stimulates ECM synthesis, while MMP expression is reduced. Oxytalan components are upregulated by loading. This model is suitable for further studies on the effects of orthodontic forces on PDL fibroblasts and the formation of oxytalan fibres.

74 ALTERED SERUM LEVELS OF THE OSTEOCLAST-SPECIFIC TRACP 5B ISOFORM IN CHINESE CHILDREN UNDERGOING ORTHODONTIC TREATMENT

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AIM: Orthodontic tooth movement is dependent upon the ability of mechanical forces to induce remodelling activity within the tooth-supporting alveolar bone. In view of the importance of bone resorption in mediating such tooth movement, the aim of this study was to establish whether changes in the osteoclast-specific bone marker tartrate resistant acid phosphatase 5b (TRACP 5b) could be detected in the sera of orthodontic patients.

SUBJECTS AND METHOD: Fourteen subjects (10 girls, 4 boys) aged 10.5 to 16.5 years (mean 12.6 years) being treated with fixed appliances and a distalizing headgear. Venous blood samples (3 mL) were collected from the cubital vein pre-treatment (T0), and 2, 4 and 6 months into treatment (T1–T3). Serum TRACP 5b levels were quantified using a solid-phase immunofixed enzyme activity assay.

RESULTS: When the data was pooled and treated cross-sectionally, a significant increase in immunoreactive TRACP 5b was detected at T1 indicating increased bone resorptive activity. When non-extraction and extraction patients were compared, the non-extraction group was found to have a significantly higher level of the enzyme at T1. Boys were also found to have consistently higher levels of TRACP 5b in their serum at all time points. However, when the serum profiles of individual patients were recorded longitudinally a very different pattern emerged.

CONCLUSION: Although preliminary, this study is the first to show that the osteoclast-specific TRACP 5b isoform can be detected in the sera of patients undergoing orthodontic treatment and has potential as a clinical marker of bone resorption.

75 A RANDOMIZED CLINICAL TRIAL TO EVALUATE MANDIBULAR TRANSVERSE DENTOALVEOLAR CHANGES FOLLOWING TREATMENT WITH SELF-LIGATING BRACKETS

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AIM: To perform a three-dimensional (3D) assessment of transverse expansion of the mandibular dentoalveolar complex following orthodontic treatment with active and passive self-ligating brackets (SLBs).

SUBJECTS AND METHOD: Sixty-four patients with Class I, Class II, and mild Class III malocclusions, were randomly assigned to treatment with passive (Damon 3 MX) or active (In-Ovation R) SLBs. Impressions and cone beam computed tomography scans were taken before and after treatment. 3D models were generated from the scans via a semi-automated segmentation process. Post-treatment models were registered with respect to the pre-treatment models and subsequently superimposed on regional mandibular stable structures. Changes in basal alveolar bone and dental arch form were assessed using a 3D colour-coded mapping algorithm. Overall movement of the first and second premolars was measured.

RESULTS: Forty-four patients completed treatment according to the prescribed protocol. Transverse expansion mainly occurred as a result of tipping. No transverse augmentation of basal bone could be detected. High variation and strong patient-related patterns of transverse and sagittal expansion were observed.

CONCLUSION: The anticipated true expansion and buccal bone modelling using SLBs could not be confirmed in the majority of the cases. Due to the large interindividual variation, a 3D patient-specific analysis seems to be mandatory to identify individual factors influencing the final treatment outcome.

76 SOFT TISSUE MORPHOLOGY OF THE NASO-MAXILLARY COMPLEX FOLLOWING SURGICAL CORRECTION OF MAXILLARY HYPOPLASIA T Ubaya-Narayanage, Department of Orthodontics, Glasgow Dental Hospital, Scotland

AIM: To evaluate three-dimensional (3D) naso-maxillary complex soft tissue morphology following Le Fort I maxillary advancement and to compare the findings against a local reference group.

SUBJECTS AND METHOD: Following ethical approval and statistical advice, 120 subjects were randomly recruited from within the local population and imaged using stereophotogrammetry. Using a visual analogue scale, eight lay people scored the images, ranking them from most to least attractive. The data was divided into tertiles; most attractive, attractive and least attractive. To be selected for the reference group, the same subject had to be placed in the most attractive and attractive categories by at least six lay panel members. Forty images (16 males, 24 females) were chosen as the reference group. Linear and angular measurements of this group were compared with those of 35 (19 females, 16 males) surgically managed cases which had Le Fort I advancement for correction of maxillary hypoplasia in the anteroposterior direction and who had been previously imaged. The data was checked for normality and a Student's *t*-test carried out. Clinical significance was set at 3 mm.

RESULTS: The facial morphology post-surgery was similar to the reference group, except for nasal base width, which was wider by 2.3 mm for males [95% confidence interval (CI) 0.3, 4.4] and 2.6 mm (95% CI 1.3, 3.0) for females. In the orthognathic group the females had a smaller nasolabial angle by 9.7 degrees than the reference group.

CONCLUSION: Following Le Fort I the facial morphology of both the female and male post-surgical orthognathic groups was similar to a reference group; except both orthognathic groups had wider nasal bases, which may be clinically significant; the female group also had a smaller nasolabial angle. The 3D facial characteristics of the local reference group could be used as an objective parameter to measure and quantify surgical outcomes.

77 DEHISCENCE AND FENESTRATION IN PATIENTS WITH DIFFERENT VERTICAL GROWTH PATTERNS ASSESSED WITH CONE-BEAM COMPUTED TOMOGRAPHY

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AIM: To test the null hypothesis that the presence of alveolar defects (dehiscence and fenestration) is not different among patients with different vertical growth patterns.

MATERIALS AND METHOD: A total of 1872 teeth in 26 hyperdivergent (mean age: 24.4 ± 4.8 years), 27 hypodivergent (mean-age: 25.1 ± 4.5 years) and 25 normodivergent (mean-age: 23.6 ± 4.1 years) patients with no previous orthodontic treatment were evaluated using cone-beam computed tomography. Axial and cross-sectional views were evaluated as to whether dehiscence and/or fenestration on the buccal and lingual surfaces existed or not. For statistical analysis, a Pearson chi-square test was used at the P < 0.05 significance level.

RESULTS: The hypodivergent group (6.56%) had a lower dehiscence prevalence than the hyperdivergent (8.35%) and normodivergent (8.18%) groups (P = 0.004). A higher prevalence of dehiscence and fenestration were found on the buccal than on the lingual sides, in all vertical growth patterns. While fenestration was a common finding for the maxillary alveolar region, dehiscence was a common finding in the mandible, in all groups.

CONCLUSION: The null hypothesis was rejected. Significant differences in the prevalence of dehiscence were found in patients with different vertical growth patterns. However, no significant differences in prevalence of fenestrations were determined.

78 EVALUATION OF THE BONE-SCREW AND BONE-PLATE INTERFACE OF ORTHODONTIC MINIPLATES IN PATIENTS.

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AIM: To describe the histological components of the bone-screw and bone-plate interface of orthodontic miniplates in humans.

MATERIALS AND METHOD: Forty-seven samples, consisting of tissue fragments attached or not, to miniplates or their fixation screws, were collected from 24 patients at the end of their orthodontic treatment with miniplates. The samples were embedded in methylmethacrylate, cut into undecalcified sections and submitted to microradiographic analysis. The sections were stained and examined under ordinary light.

RESULTS: Three types of reactions were observed. 1. The majority of the stable miniplates (38/47) were easy to remove and showed segments of interface consisting of alternated mature and new lamellar bone and vascularized connective tissue. 2. The screws of two stable miniplates were highly osseointegrated (requiring the surgeon to trephine) with an extended bone-screw contact, and with bone contact expanding to the miniplate. The histological features were similar to the previous group, although the bone-screw contact was higher. 3. In seven unstable samples removed during treatment, mainly woven bone trabeculae, without any sign of inflammation was observed.

CONCLUSION: The healing reactions observed around human stable miniplates consist mainly in limited repair and remodelling processes of lamellar bone, without inflammation.

79 PROGNOSTIC FACTORS FOR THE OUTCOME OF THE TUNNEL TECHNIQUE IN THE SURGICAL-ORTHODONTIC APPROACH TO IMPACTED CANINES

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AIM: To evaluate the influence of pre-treatment radiographic features (alpha-angle, d-distance, and s-sector) on the duration of active orthodontic traction and the post-treatment periodontal status [pocket depth (PD]) and keratinized tissue (KT) width] of impacted maxillary canines treated by a combined surgical (flap approach) and orthodontic (direct traction to the centre of the ridge) treatment.

SUBJECTS AND METHOD: One hundred and sixty eight patients with 168 palatally impacted canines. All patients were treated consecutively within a prospective clinical trial with a specific surgical approach consisting of the tunnel technique with direct traction to the centre of the alveolar ridge (closed flap surgery). Multiple regression analysis was used.

RESULTS: Pre-treatment radiographic variables were significantly associated with the duration of orthodontic traction and with the success of therapy. Age, gender, and site of impaction did not significantly affect the duration of traction. No significant differences in PD and KT width were present at the end of surgical-orthodontic treatment with respect to any of the variables considered. The analysis of PD and KT width variables after orthodontic treatment revealed a healthy periodontium.

CONCLUSION: Alpha-angle, d-distance, and s-sector are valid indicators for the duration of orthodontic traction. They are not prognostic indicators of final periodontal status of orthodontically repositioned canines.

80 ANCHORAGE LOSS DURING HERBST TREATMENT – PREVENTABLE THROUGH MINIPINS?

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AIM: To assess if the often undesired side effect of mandibular incisor proclination and protrusion during treatment with the Herbst/multibracket appliance can be prevented through simple minipin anchorage.

SUBJECTS AND METHOD: In a group of 12 Herbst patients, minipins were placed bilaterally between the lower canine and first premolar and were ligated to the Herbst/multibracket appliance to reinforce anchorage. The control group, matched for gender and skeletal maturity, was treated with an identical treatment protocol, but without minipin anchorage. Pre- and post-treatment cephalograms were analyzed for mandibular incisor proclination (IL/ML) and protrusion (Ii-MLp) by a single blinded examiner.

RESULTS: Although the minipin group generally showed less lower incisor proclination (4.8 mm) than the group without skeletal anchorage (6.5 mm), a large interindividual variation was observed, ranging from -3 to 12.5 mm in the minipin group and -6 to 23 mm in the group without pin anchorage. A similar picture was found for protrusion. Whereas the mean protrusion was slightly lower in the minipin group (1.1 versus 1.7 mm, respectively), the interindividual variation was very high, ranging from -1 to 3.5 mm in the minipin group and from -2 to 6 mm in the group without skeletal anchorage.

CONCLUSION: Simple minipin anchorage might reduce, but cannot prevent, anchorage loss during Herbst treatment. For the individual patient the amount of incisor proclination and protrusion remains unpredictable.

81 DIFFERENTIATION OF STEM CELLS FROM MASSETER AND LIMB MUSCLES *IN VITRO*

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AIM: Surgical repair of muscles in the soft palate of cleft lip and/or palate patients is often accompanied by fibrosis, which leads to speech and feeding problems. Treatment strategies to improve muscle regeneration have until now only been tested in limb muscles. Therefore, the myogenic potential of stem cells isolated from craniofacial (masseter) and limb muscles was compared.

MATERIALS AND METHOD: Stem cells were isolated from masseter and limb muscles of rats, and cultured. Proliferation was analysed by DNA quantification and differentiation capacity by quantifying the numbers of fused cells, and by measuring the mRNA levels of differentiation markers. Cultured stem cells were stained to quantify Pax7, MyoD, and Myogenin expression. Differences between the muscles were tested using two-way ANOVA and a suitable *post-hoc* test.

RESULTS: Proliferation was similar in the masseter and limb stem cells. Differentiating masseter and limb stem cells showed a comparable number of fused cells and mRNA expression levels of Myh-1, Myh-3, and Myh-4. During proliferation and differentiation, the number of Pax7+, MyoD+, and Myogenin+ cells in the masseter and limb stem cell populations was similar.

CONCLUSION: Masseter and limb muscle stem cells show similar myogenic capacities *in vitro*. Therefore, *in vivo* differences in regeneration capacity between these muscles might rely on the local microenvironment, the niche. Thus, regenerative strategies for limb muscles might also be suitable for craniofacial muscles. This might offer new possibilities to improve the outcome of cleft palate surgery.

82 UPPER MOLAR DISTALIZATION WITH MINI-IMPLANTS: FAILURE RATES AND EFFICIENCY***

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AIM: To eliminate anchorage loss of the anterior dentition, skeletal anchorage devices have been integrated into distalization appliances. However, failure rates of mini-implants in the alveolar process seem to be unsatisfactory. The aim of this study was to evaluate the failure rate of mini-implants inserted in the anterior palate.

SUBJECTS AND METHOD: Upper molar distalization was performed in 164 patients (aged 7 to 46 years) with mini-implants in the anterior palate. Eighteen of the 164 patients had a Class II division 2 malocclusion. Sliding mechanics were applied and attached to the first molars. Cephalometric analysis was performed before and after distalization.

RESULTS: The overall failure rate was 3.9 per cent, while the failure rate in the Class II division 2 group was 5.8 per cent. Cephalometric evaluation revealed mean molar distalization of $4.1 \text{ mm} (\pm 1.3 \text{ mm})$.

CONCLUSION: Compared with the alveolar process, the anterior palate proved to be the superior insertion site with a much lower failure rate of mini-implants. Using sliding mechanics, bodily molar distalization could be achieved.

83 VALIDITY, RELIABILITY AND REPRODUCIBILITY OF LINEAR MEASUREMENTS ON DIGITAL MODELS

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AIM: Digital three-dimensional (3D) models are nowadays widely used for orthodontic diagnosis. The aim of the present study was to assess the validity, reliability and reproducibility of digital models obtained from the intraoral Lava chairside scanner and from cone beam computed tomographic (CBCT) scanning of alginate impressions (DigiModel) for tooth width measurements and Bolton analysis.

MATERIALS AND METHOD: A DigiModel, an intraoral scan and a plaster model were made of 22 subjects. Tooth width measurements on the DigiModels and intraoral scans were compared with those on the corresponding plaster models (gold standard). Intraclass correlation coefficients were calculated to determine interexaminer reliability of the measurements of each method. Anterior and overall Bolton ratios were calculated for each participant and for each method. The paired *t*-test was used to determine validity. The scanning time, using the intraoral scanner, was registered and analyzed.

RESULTS: Tooth width measurements of the individual teeth on the DigiModels and intraoral scans did not differ significantly from those on the plaster models (P > 0.05). Overall and anterior Bolton ratios from the two types of digital models differed significantly from the gold standard (P < 0.05). However the differences never exceeded 1.5 mm, which could be regarded as clinically insignificant. Scanning time using the intraoral scanner decreased significantly with the number of scans performed.

CONCLUSION: Both intraoral and CBCT scanning of alginate impressions are valid, reliable and reproducible methods to obtain dental measurements for diagnostic purposes.

84 HISTOLOGICAL EVALUATION OF THE EFFECTS OF SYSTEMIC FLUORIDE INTAKE ON ORTHODONTIC TOOTH MOVEMENT

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AIM: Movement of the teeth in the alveolar process requires bone turnover. Fluoride influences bone growth by acting as a mitogenic agent for osteoblasts and might also act as an inhibitory stimulus to osteoclasts. The aim of this study was to determine the effects of systemic fluoride intake on orthodontic tooth movement.

MATERIALS AND METHOD: Sixteen Wistar albino female rats were housed for fertilization and divided into two groups. The first group received 150 ppm fluoridated water and the second group bottled water during gestation. From each group 12 male pups were chosen for this experiment. The fluoridated group received 150 ppm NaF from birth to 8 weeks. A split mouth design was used. Under general anaesthesia, impressions were taken of the maxilla and then a closed coil spring appliance was ligated between the maxillary left central incisors and first molar. The orthodontic force applied was approximately 75 g and the duration of the experimental period was 18 days. At the end of the experiment, impressions were performed again and then the upper first molars were used for histological examination. Statistical analysis was performed with the Statistical Package for Social Sciences, version 18.0 (SPSS Inc., Chicago, Illinois, USA). Repeated measurement ANOVA was used to compare the groups.

RESULTS: Dental measurements showed a statistically non-significant, decrease in tooth movement in the fluoridated group. Histomorphometric evaluation revealed

increased osteoblastic activity at the distal side and increased osteoclastic activity at the mesial side in both experimental groups. Within the experimental groups, the non-fluoridated group showed significantly increased osteoclastic activity. As a consequence of orthodontic force application, both groups exhibited wider periodontal space at the distal than at the mesial side. Histopathology revealed no root resorption in the fluoridated group.

CONCLUSION: Systemic fluoride intake affects orthodontic tooth movement.

85 A NEW ORTHOPAEDIC TREATMENT APPROACH USING CORTICOTOMY, SKELETAL ANCHORAGE AND CLASS III ELASTICS H N Yilmaz¹, N Kucukkeles¹, H Garip², T Satilmis², Departments of ¹Orthodontics and ²Oral Surgery, Faculty of Dentistry, Marmara University, Istanbul, Turkey

AIM: Class III malocclusions are difficult to treat effectively and efficiently. Maxillary deficiency is present in 60 per cent of skeletal Class III cases. Facemask treatment has been proposed and is the most frequently used treatment protocol for this anomaly. However unwanted dentoalveolar effects and insufficient advancement increase the popularity of skeletal anchorage for orthopaedic protraction. The aim of this study was to evaluate the effectiveness of a new treatment approach that combines skeletal anchorage and corticotomy assistance in maxillary retrognathism.

SUBJECTS AND METHOD: Nineteen patients (mean age: 13.57 years) with Class III malocclusions. After a 5 month follow-up with cephalometric radiographs in order to create a control group, acrylic cap splints with hooks at the level of the molars were bonded to the upper dental arch. Miniplates were then placed on the anterior wall of symphysis and an incomplete Le Fort I osteotomy was performed under general anaesthesia. Four days after surgery, the patients were instructed to wear Class III elastics (300 g per side) between the maxillary hooks and miniplates. At the end of day 10, the force value was increased (600 g per side). After sufficient achievement of a Class II molar and canine relationship, the acrylic cap splints were debonded and fixed orthodontic treatment commenced. Changes were evaluated with cephalometric radiographs.

RESULTS: Point A moved significantly 3.5 mm (2.32-6.34 mm) forward on average in 3.85 ± 1.12 months during treatment whereas no significant change was seen in growth in the control period. The occlusal plane rotated in a counterclockwise direction due to extrusion of the upper molars and proclination and intrusion of the upper incisors. The upper lip moved forward and the profile improved significantly.

CONCLUSION: This protocol was found to be fast and effective especially in subjects with a deep overbite and low angle growing patients when compared with conventional facemask therapy.

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Scientific posters

86 LEARNING PREFERENCES OF FIFTH YEAR DENTAL STUDENTS: TEACHING ROUTINE ORTHODONTIC

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AIM: To compare three different teaching methods for final year Bachelor of Dental Surgery (BDS) students in the orthodontic undergraduate curricula

SUBJECTS AND METHOD: Thirty final year BDS students from a United Kingdom dental school, were instructed to undertake two standard orthodontic procedures exposing them to three different teaching methods: 1. PowerPoint® presentation, 2. Video-based presentation (VBT) and 3. 'Hands on' practical session. Learning preferences were investigated by questionnaire and focus group discussion. The student's acquired knowledge was determined using a multiple short answer test. The preferred method of delivery was assessed by allowing one or any combination of the above three methods. Inferences were made from the information obtained

RESULTS: The combination of all three teaching methods was the most popular choice preferred by 57.2 per cent of the participants. Forty per cent preferred VBT in combination with the hands on practical session. Although there was a positive response towards the usefulness of VBT, it was the least preferred method when used in singularity. Only 2.8 per cent of fifth year dental students chose VBT as the preferred sole method of teaching; when combined with hands on chair side teaching, this increased to 14.3 per cent. VBT was considered to be useful only for delivering teaching of an orthodontic module when used as an adjunct to either a lecture or a hands on teaching session. Undergraduate students preferred VBT not to replace teaching methods such as a practical session, a Power Point presentation or a combination of the latter two.

CONCLUSION: The results from this study can have local and international ramifications as most higher education institutions are developing modern e-learning techniques that might not be favoured by students.

87 HOW ACCURATE IS MAXILLARY SURGERY? A RETROSPECTIVE AUDIT OF LE FORT 1 OSTEOTOMY

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AIM: To investigate the accuracy of maxillary surgery in the East of England, United Kingdom (UK) using cephalometric superimposition to compare the pre-surgical planned movements with the achieved outcomes. The standard used in this study was that published by Semaan *et al.* (2005) for cases treated in a hospital environment as follows: 50 per cent of cases within 2 mm of the predicted outcome position; and 22 per cent within 1 mm of the predicted outcome position.

SUBJECTS AND METHOD: Five hospitals in the eastern region of the United Kingdom submitted 40 consecutively treated Le Fort 1 and bimaxillary cases. The planned anteroposterior and vertical movements of the molars and incisors were digitised onto a pre-surgical cephalometric tracing and this was then superimposed onto the post-surgical cephalometric tracing. Differences in the positions of the molars and incisors in the horizontal (x) and vertical (y) axes were measured in millimetres. Repeat tracing and superimposition of 10 cases gave a linear error of 1.5 mm.

RESULTS: Fifty two per cent of cases were within 2 mm of the planned position; and 16 per cent were within 1 mm. This compared favourably with international standards.

CONCLUSION: This audit established a standard in the Eastern Region of the UK for the accuracy of maxillary Le Fort 1 surgery, which closely agrees with international standards. The five hospital departments involved were compliant with the established orthodontic and surgical protocols. Good practice has been identified and a further audit is planned with larger numbers in 2012. Units should target outcomes to be close to the best performing units.

88 SOFT TISSUE CHANGES AFTER BIMAXILLARY ORTHOGNATHIC SURGERY TO CORRECT A CLASS III MALOCCLUSION

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AIM: To retrospectively compare the soft tissue response between bilateral sagittal split osteotomy (BSSO) and extra-oral vertical ramus osteotomy (VRO) after correction of Class III malocclusions by means of bimaxillary orthognathic surgery, and to compare the influence of the amount of maxillary horizontal and vertical movement and differences in soft tissue response on cephalograms.

SUBJECTS AND METHOD: Fifty-one consecutively treated patients (38 females, 13 males, with a mean age of 19.1 years). All had a one-piece Le Fort I osteotomy with maxillary advancement and mandibular setback. VRO was performed in 30 cases, and BSSO in 21 cases. Lateral cephalograms were obtained before surgery, within one week of surgery and one year after surgery.

RESULTS: The BSSO and VRO groups did not show any significant differences in soft tissue response. The mean soft to hard tissue ratios in the upper jaw region were lower in the group with greater maxillary advancement and *vice versa* in the lower jaw region. The maxillary impaction group showed a little greater soft to hard tissue ratio than the group without maxillary vertical changes.

CONCLUSION: Soft tissue post-surgical changes in mandibular region are highly predictable those in the maxillary region are less predictable and prone to higher individual variation. Vertical movements of the maxilla during surgery influence soft tissue behaviour.

89 THE IMPACT OF MESIODISTAL BRACKET WIDTH ON THE RESISTANCE TO SLIDING OF DIFFERENT BRACKET SYSTEMS P Aceto, M I Castaldo, A Longobardi, D Esercizio, G Matarese, Department of Orthodontics, Second University of Naples, Italy

AIM: To evaluate *in vitro* the frictional forces and the resistance to sliding during dental alignment and levelling generated by three different types of brackets using an experimental model with three non-levelled brackets.

MATERIALS AND METHOD: Three types of orthodontic brackets were tested: Time 3 self-ligating brackets, Alexander brackets and conventional twin stainless steel brackets. A 0.016 Therma Ti-Lite was tested with a preformed stainless steel ligature wire (0.010) for conventional and Alexander brackets. Each of the three bracketarchwire combinations was tested 10 times. Kinetic frictional forces were measured on a specially designed testing machine. The wires tested were pulled through a set of three non-levelled brackets at a speed of 4 mm per minute over a distance of 5 mm. All data were statistically analyzed, using analysis of variance (P < 0.05) and *post hoc* tests.

RESULTS: No difference was found between the three bracket systems (P > 0.05). However, the conventional bracket system exerted the lowest forces and showed the highest resistance to sliding. Self-ligating and Alexander bracket systems showed minor resistance to sliding and similar load-deflection curves.

CONCLUSION: Self-ligating and Alexander brackets reduce the resistance to sliding for different reasons: self-ligating brackets decrease ligation forces while Alexander brackets lower binding forces.

90 ALIGNMENT EFFICIENCY AND DENTOALVEOLAR EFFECTS OF SELF-LIGATING AND CONVENTIONAL BRACKET SYSTEMS IN SUBJECTS WITH MANDIBULAR CROWDING P Aceto¹, R Nucera², V Grassia¹, M L Cristallo¹, G Cordasco², Departments of Orthodontics, ¹Second University of Naples and ²University of Messina, Italy

AIM: To compare two different orthodontic bracket systems [self-ligating brackets (SLB) and conventional Alexander brackets] for time requirements to complete the alignment of crowded mandibular teeth, the width changes in the lower arch and the proclination of the lower incisors.

MATERIALS AND METHOD: A randomized clinical trial was conducted in two orthodontic clinics. Fifty subjects were selected from a pool of patients with the following inclusion criteria: non-extraction treatment in the mandibular arch; no spaces in the mandibular arch; irregularity index was between 4 and 8 mm in the mandibular arch; no previous orthodontic treatment. The patients were randomly assigned to two groups: the former received treatment with SLB (Time 3, AO) and the latter with Alexander brackets (AO), both with 0.018 inch slots. The time required to completely alleviate the mandibular crowding was estimated in days. Measurements of intercanine and intermolar widths were made on dental casts to determine width changes associated with correction. Lateral cephalometric radiographs were used to assess mandibular incisor proclination before and after alignment.

RESULTS: No significant difference was noted (P > 0.05) in the initial rate of alignment with either bracket systems.

CONCLUSION: The use of Alexander or Time 3 brackets does not seem to affect treatment duration to correct initial crowding.

91 DO SEGMENTED MECHANICS PERFORM DIFFERENTLY THAN CONTINUOUS ARCH MECHANICS IN PATIENTS WITH CLASS II SUBDIVISION?

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AIM: To evaluate the treatment outcome of Class II subdivision malocclusions treated with either segmented (SA) or continuous arch (CA) mechanics expressed as a change in canine (CRel) and molar (MRel) relationship, molar rotation, canine position, and midline concordance.

MATERIALS AND METHOD: Pre- and post-treatment digital models of 83 patients, treated with either a SA (n = 65) or CA (n = 18) were analyzed. CRel and MRel were determined. Molar rotation, canine position and midline deviation were also registered. For each treatment approach it was noted whether treatment had been performed with or without extractions.

RESULTS: Following treatment without extractions, MRel was fully corrected in 80 per cent of SA cases and in 63.6 per cent of CA patients. When extractions were part of the treatment, 75 per cent in the SA group and 57.2 per cent in the CA group obtained the planned MRel. Following treatment, the CRel was neutral in 71.1 per cent of the SA non-extraction cases and in 70 per cent in the extraction group. The corresponding figures in the CA extraction group were 57.1 per cent neutral CRel and 63.6 per cent in the non-extraction group.

CONCLUSION: Correction of asymmetry in patients exhibiting subdivision malocclusions was more efficient with SA than with CA. SA non-extraction was found to give the most satisfactory treatment outcome regarding canine position in the sagittal and transverse planes of space compared with the CA groups. The same applied to MRel and midline. The segmented approach could be considered superior to sliding mechanics when treating Class II subdivision malocclusions.

92 CRANIOFACIAL CHARACTERISTICS OF PATIENTS WITH ANKYLOSING SPONDYLITIS

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AIM: Ankylosing spondylitis (AS) is a disease that causes inflammatory changes. The initial clinical signs of this disease are pain and discomfort; synovial changes progressively involve all axial joints, including the temporomandibular joint (TMJ). Eventually, bony alterations develop (condylar erosions, flattening, sclerosis) that affect the position of the condyle, the superior joint space, and the range of movements. The aim of this pilot study was to evaluate the craniofacial characteristics of adolescents with AS and to compare the morphological data with that of healthy age- and gender-matched controls.

SUBJECTS AND METHOD: Twelve patients with a previous diagnosis of AS (32.8 \pm 8.8 years; 6 females, 6 males) and 12 age- and gender-matched controls (31.5 \pm 6.8 years; 6 females, 6 males). The inclusion criteria were; no previous orthodontic treatment, and no history of diseases affecting the TMJ and masticatory system. Juvenile AS patients were excluded from the study. Intraoral examination was performed by one clinician. Lateral cephalograms and panoramic radiographs were taken. Statistical comparison of the two groups was performed with an independent samples *t*-test and expressed as the means and standard deviations.

RESULTS: There were statistically significant differences between the groups only for the measurement of facial angle (Gl'-Sn'-Pg' P = 0.046). The other maxillomandibular and dental measurements showed no significant differences.

CONCLUSION: AS has no effect on craniofacial morphology. Studies with larger samples are needed to investigate the difference in craniofacial morphology between AS and healthy individuals.

93 PROFILE AESTHETIC IMPROVEMENT AS A BEST OUTCOME OF FUNCTIONAL THERAPY

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AIM: Apart from skeletal or dental changes, the soft tissue paradigm has raised questions as to whether aesthetic improvement might be achieved followed by functional therapy. The purpose of this study was to evaluate the post-treatment effects of functional therapy on the soft tissue profile of skeletal Class II patients

SUBJECTS AND METHOD: Twenty-five skeletal Class II patients with mandibular deficiency treated using modified Twin Block appliances. Pre- and post-treatment profile photographs were taken in the natural head position and 19 soft tissue measurements were analyzed before and after treatment. Data analysis was done using SPSS 16 software and a paired *t*-test was used to compare the pre- and post-treatment findings. P < 0.05 was considered significant.

RESULTS: The estimated values showed statistically significant post-treatment positive mean changes as follows: 2 degree reduction in facial convexity, 8 degree reduction in Z-Merrifield angle, 3.18 mm protrusion in soft tissue pogonion and 10 degree increase in mentolabial angle (P = 0.001). There was also a noticeable reduction in lip incompetence due to an increase in lower lip height and a reduction of the inter-labial gap (P = 0.001). The undesired effects included a backward change in the midface, protrusion of the upper lip and reduction of the naso-labial angle (P = 0.001)

CONCLUSION: Functional therapy could have clinically positive effects on the profile aesthetics of Class II patients during the growth period. Reduction of facial convexity and correction of lip incompetence could be among the invaluable outcomes of functional therapy

94 HARD TISSUE CHANGES AFTER TWIN-BLOCK THERAPY

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AIM: The question as to whether growth modification in Class II malocclusions is dental or skeletal has not yet been answered. The aim of this retrospective study was to evaluate post-treatment dental and skeletal changes after functional therapy.

MATERIALS AND METHOD: Pre- and post-treatment lateral cephalograms of 30 Class II mandibular deficient patients. All patients were treated using a specially modified Twin Block appliance. The cephalograms were traced and 18 dental and skeletal variables were measured. SPSS 17 software and paired *t*-tests were used to compare the averages before and after treatment. P < 0.05 values were considered significant.

RESULTS: Horizontally, SNA and SNB angles did not show significant posttreatment changes, however the cumulative value, as represented by ANB, showed a significant reduction of this measurement by 1.67 degrees (P = 0.0001). There was also a statistically significant reduction of convexity angle by 3.56 degrees (P = 0.0001) and reduction of the overjet by 4.18 mm (P = 0.049). Vertically, except for LAFH/TAFH that showed a statistically significant increase (P = 0.002), other variables such as basal angle, FMA, Y-axis, gonial angle and inclination angle remained unchanged (P > 0.05). Dentally, upper (U1-NA) and lower (IMPA, L1-NB) incisor inclinations were not significantly changed.

CONCLUSION: Skeletal and dental changes are separate parts of functional therapy in Class II patients. With correctly designed components of functional appliances the chance to achieve more skeletal than dental changes is enhanced.

95 CHANGES IN PHARYNGEAL AIRWAY DIMENSIONS AFTER MAXILLARY POSTERIOR SEGMENT INTRUSION WITH ZYGOMATIC ANCHORAGE

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AIM: To evaluate if maxillary posterior segment intrusion with zygomatic bone anchorage has any effect on the sagittal pharyngeal airway area in anterior open bite (AOB) patients.

SUBJECTS AND METHOD: Nineteen subjects, mean age 17.7 years. An intraoral appliance and zygomatic bone anchorage with an intrusive force of 400 g was used for 6.84 ± 1.64 months. Cephalometric analysis and area measurements were evaluated on the cephalometric radiographs taken before and after intrusion. Pharyngeal airway passage was divided into naso- and oropharyngeal areas and measurements were performed using ImageJ 1.43u for Windows, a Java image processing software. Wilcoxon's test was used for evaluation of craniofacial measurements and a paired *t*-test for airway area measurements.

RESULTS: Maxillary molar intrusion of 3.37 ± 1.21 mm was obtained, as a result of which the mandible showed a counter-clockwise rotation revealed by an increase in SNB angle and a decrease in all measurements showed the facial growth direction. When pre- and post-intrusion pharyngeal area measurements were compared, no

statistically significant changes were found in the oro- and nasopharyngeal airway areas (P > 0.05).

CONCLUSION: Maxillary molar intrusion with zygomatic anchorage did not have any effect on pharyngeal airway dimensions in the short-term.

96 A PROSPECTIVE, *IN VIVO* STUDY OF COLOUR CHANGES AFTER APPLICATION OF LINGUAL RETAINER

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AIM: Bonded orthodontic retainers constructed from composite and flexible and spiral orthodontic wire provides an aesthetic and efficient system for maintaining retention. As lingual retainers must be worn for a long-time, they must have an aesthetic appearance and should not affect the colour of the teeth. The aim of this study was to prospectively assess *in vivo* colour alterations of natural teeth associated with fixed lingual retainer.

MATERIALS AND METHOD: A 3M Unitek Transbond LR capsule kit was used for application of the lingual retainer. An Elipar FreeLight 2 (3M Espe) was used for polymerisation and colour measurements were carried out with a spectrophotometer. The study group consisted of 23 patients. The selection criteria were: in the last stage of treatment, no plaque accumulation and no dental caries or prosthetic restorations. The spectrophotometric data of a standardized labial circular area of the teeth that had a lingual retainer were recorded, before (T0), immediately after (T1) and 1 (T2) and 3 (T3) months after insertion of the lingual retainer. The colour parameters of the Commission Internationale de l'Eclairage—L*, a*, and b* were measured for colour differences (ΔE) for time intervals. All ΔE values were calculated using the formula: $\Delta E = [(L1-L2)2 + (a1-a2)2 + (b1-b2)2]1/2.$

RESULTS: No significant differences were recorded for L* values. For a* and b* values significant differences were observed for all time periods (except for T2-T3). For ΔE values ($\Delta 1 = 3.63$, $\Delta 2 = 3.28$, $\Delta 3 = 3.4$), clinically visible and acceptable differences were observed for all time values.

CONCLUSION: Lingual retainers cause colour changes of the teeth on insertion and following long-term use.

97 EFFECTS OF FIRST PREMOLAR EXTRACTIONS ON UPPER AIRWAY DIMENSIONS IN BIMAXILLARY PROCLINATION PATIENTS

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AIM: To retrospectively investigate the effects of orthodontic treatment, with first premolar teeth extractions, and its associated arch dimensional changes in bimaxillary proclination cases on the upper airways dimensions.

MATERIALS AND METHOD: Pre- and post-treatment cephalograms, and dental cast of 40 bimaxillary proclination patients (age range: 18 and 23 years). All patients were treated with four first premolar extractions. Cephalometric radiographs were used to measure the airways dimensions, and dental casts to measure the changes in arch dimensions. A paired *t*-test was used to detect differences at P < 0.05.

RESULTS: There were statistically significant reductions in tongue length (P < 0.05), posterior adenoid thickness (AD2-H; P < 0.05), upper and lower incisor inclination, and lower incisor to A-Pog line (P < 0.001). Considering the dental cast results, statistically significant reductions in upper and lower arch lengths, and lower intermolar widths were found (P < 0.001). The only statistically significant increase was recorded for upper intercanine width (P < 0.001).

CONCLUSION: First premolar extractions for treatment of bimaxillary proclination do not affect the upper airways dimensions despite the significant reduction in tongue length and arch dimensions.

98 THE EFFECT OF DIFFERENT BRACKET BASE CLEANING METHODS ON SHEAR BOND STRENGTH OF REBONDED BRACKETS

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AIM: To assess the effect of different bracket base cleaning methods on the shear bond strength (SBS) of rebonded brackets.

MATERIALS AND METHOD: Eighty brackets were bonded to freshly extracted premolar teeth using light cured composite adhesive. SBS was measured for 20 random samples. After debonding, 60 debonded brackets were randomly allocated into three groups of different bracket base cleaning. G1: treated with a slow speed round carbide bur, G2: treated with an ultrasonic scaler, G3: treated with sandblasting. After that, brackets were rebonded in the same manner as the first bonding and SBS was measured. The modified adhesive remnant index (ARI) was recorded for all groups. The time needed to clean the bracket bases was measured for group 1 and 2.

RESULTS: SBS for new brackets was 11.95 MPa followed by 11.65 MPa for the carbide bur, 11.56 MPa for sandblasting and 11.04 MPa for the ultrasonic scaler. There was no statistically significant difference between any group (P = 0.946). The mean time needed to clean the bracket base with the round carbide bur was 32 seconds whereas that for the ultrasonic scaler was 97 seconds (P < 0.001). In all groups, failure mode showed that the majority of adhesive composite remained on the bracket base with an ARI score of 4.

CONCLUSION: Clinically available methods such as the slow speed carbide bur and ultrasonic scaler are effective, quick and cheap methods for bracket base cleaning for rebonding. However, the round carbide bur was quicker.

99 AN ALGORITHM APPROACH FOR ORTHODONTIC PATIENTS WITH NASAL BREATHING AND PREDISPOSITION TO OBSTRUCTIVE SLEEP APNOEA

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AIM: To study patients with obstructive sleep apnoea (OSA) to provide an algorithm to identify nasal breathing and hereditary predisposition to the disease based on the medical history of relatives.

MATERIALS AND METHOD: Determination of the degree of treatment motivation was undertaken using a questionnaire that provided information concerning the social and moral development of the individual (Erikson's theory of social development and Colbertt's three stages of moral development of personality). Full face and profile photographs of the patients were computer-processed and negative characteristics, such as an extended lower third of the face and adenoid facies were noted. The anticipated future changes without orthodontic treatment were processed by a suitable program. Photographs and comments about the necessity of treatment are explained in the presence of parents. An orthodontic device is determined in accordance with the teeth and maxillary deformities (transverse widening or fast expansion, fixed appliances). Instructions for the breathing manners and training in nasal breathing, exercises and myo gymnastics for muscle groups are shown.

RESULTS: The analysis provides guidelines for monitoring the performance of the tasks set by the expert – multifunctional exercises and a selection of a suitable orthodontic appliance. Once the child correctly performs the exercises, the parent is

provided with a sheet with a description of the exercises. There is then a discussion with the parent and the child about the ways in which they should be performed - when, how many times a day and how long.

CONCLUSION: Orthodontic treatment, training in nasal breathing and the response to nasal disease is complex and prolonged, and largely dependent on individual patient characteristics and willingness to cooperate.

100 SOFT TISSUE PROFILE CHANGES AFTER MAXILLARY SEGMENTAL OSTEOTOMY ACCESSED USING A THREE-SIDED FLAP TECHNIQUE

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AIM: The anterior maxilla can be approached through a variety of different surgical techniques including those of Wassmund (1927), Wunderer (1963) and Cupar (1954), each of which has its own advantages and indications. The aim of this study was to prospectively assess the viability and upper lip and nose profile changes after maxillary segmental osteotomy accessed using a three-sided mucoperiosteal flap approach.

SUBJECTS AND METHOD: Fifteen patients with anterior maxillary excess underwent orthognathic surgery with a pre-planned premaxillary osteotomy. The incision for access to the maxilla was a three-sided mucoperiosteal flap in which a transcrevicular incision was made along the gingival papillae from the premolar region of one side to the contralateral region, then a vertical incision from each side extended to the sulcus. Cephalometric radiographs were taken before, immediately following and 6 months after surgery, and superimposed to identify the soft tissue changes associated with the underlying bone movement.

RESULTS: There was an increase in upper lip length and thickness with a concomitant flattening. There was a high correlation between labrale superious and incisal superious. The soft tissue points of the nose changed vertically and horizontally to a significant level especially in some of the profile angles, depending on the type of surgical movement.

CONCLUSION: This phase 1 trial revealed that the new modified flap has adequate and favourable access to expose the premaxilla and shows some advantages over the other approaches.

101 THE DILEMMA OF HAWLEY VERSUS VACUUM RETAINERS: A MICROBIOLOGY STUDY

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AIM: To determine the surface characteristics of acrylic and thermoplastic retainer materials and to assess whether this affects the proportions of microorganisms harboured on them. Several studies have investigated the advantages and disadvantages of Hawley versus vacuum retainers. The selection of the type of retainer remains controversial, however, vacuum retainers are increasingly prescribed by orthodontists on the basis of their clinical and aesthetic benefits without consideration of their respective microbiological aspects.

MATERIALS AND METHOD: The study consisted of two parts. Firstly, the surface properties, including surface roughness and surface free energy were evaluated. An *in vitro* evaluation of biofilm accumulation on cold cure acrylic and vacuum materials was then carried out using a laboratory model. The second part

involved a cohort observational study to determine the prevalence and proportions of microorganisms attached to these retainers. To this end different areas of the mouth were sampled within a group of retainer wearers, and mucosal carriage was compared to a group of non-retainer wearers.

RESULTS: Both materials showed a tendency to harbour microorganisms and revealed no difference in biofilm formation. However, non-oral species such as *Staphylococcus* and *Candida* (prevalence of 50% and 66%, respectively) were recovered from the oral cavity of the retainer wearer group. Neither genus was isolated from non-retainer wearers. The vacuum retainer group harboured more than double the bacterial count than the Hawley group.

CONCLUSION: The dilemma of which retainer to use may be resolved by understanding the microbiology associated with the two types. Certainly, the results show that orthodontic retainers could be a reservoir for opportunistic pathogens and act as a source of cross-, self- and re-infection.

102 EFFECTS OF ONE- AND TWO-STEP SELF-ETCHING PRIMERS ON SHEAR BOND STRENGTH OF ORTHODONTIC BRACKETS

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AIM: To compare the effects of one- and two-step etching primer (SEP) systems on the shear bond strength (SBS) of orthodontic brackets.

MATERIALS AND METHOD: Seventy-two premolars, extracted for orthodontic reasons, were randomly divided into six equal groups. In the first three groups, onestep SEP (Transbond Plus SEP, Bond Force and Clearfil S³) were used and in the next three groups, two-step SEPs (Clearfil SE, Clearfil Protect Bond and Clearfil Liner Bond 2V). Transbond XT adhesive paste was used for all samples. All brackets (Ormco) were cured with a light emitting diode (Ivoclar Vivadent Bluephase) for 20 seconds, thermocycled (500 cycles, 5C-55°C) and tested with a universal testing machine. SBS and adhesive remnant index (ARI) values were obtained for all samples.

RESULTS: The mean SBS of the Transbond Plus SEP group was the highest (16.80 \pm 1.78 MPa) while that of the Clearfil Liner Bond 2V group was the lowest (13.51 \pm 1.42 MPa; *P* < .05). There was no significant difference between the SBS of the other groups. There were also no significant differences between the ARI scores of any group (*P* > 0.05).

CONCLUSION: One- and two-step self-etching systems can be safely used to bond orthodontic brackets.

103 EVALUATION OF MICROLEAKAGE UNDER ORTHODONTIC BRACKETS BONDED WITH SELF-ADHESIVE RESIN CEMENTS

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AIM: To assess microleakage under orthodontic brackets with self-adhesive resin cements.

MATERIALS AND METHOD: Thirty-six human premolars, extracted for orthodontic reasons, were randomly divided into three equal groups. Three different self-adhesive resin cements (Maxcem Unicem, Relyx U 100, Clearfil SA) were used to bond metal brackets (Ormco). The brackets were cured with a light emitting diode (Ivoclar Vivadent Bluephase) for 20 seconds. The specimens were sealed with nail varnish, stained with 0.5 per cent basic fuchsine for 24 hours, sectioned and examined under a stereomicroscope, and scored for microleakage at the enamel-adhesive and

adhesive-bracket interfaces from the occlusal and gingival margins. Statistical analysis was performed by Kruskal-Wallis and Wilcoxon signed tests.

RESULTS: All samples demonstrated microleakage between the enamel-adhesive and adhesive-bracket interfaces but there were no statistically significant differences between groups (P > 0.05). All groups showed statistically higher microleakage at the enamel-adhesive interface compared with adhesive-bracket interface (P < 0.05).

CONCLUSION: Self-adhesive resin cements cause microleakage between both enamel-adhesive and adhesive-bracket interfaces, which may lead to lower shear bond strengths and white-spot lesions.

104 CONDYLE POSITION IN SKELETAL CLASS II SUBJECTS AND ANTERIOR DISK DISPLACEMENT OF THE TEMPOROMANDIBULAR JOINT O C Almasan¹, M Baciut², M Hedesiu³, S Bran², G Baciut⁴, Departments of ¹Prosthodontics and Occlusion, ²Maxillofacial Surgery and Implantology, ³Oral Radiology and ⁴Cranio-Maxillofacial Surgery, University of Medicine and Pharmacy Iuliu Hatieganu, Cluj Napoca, Romania

AIM: To assess the sagittal and coronal mandibular condyle position in skeletal Class II subjects with anterior disk displacement of the temporomandibular joint (TMJ).

MATERIALS AND METHOD: The coronal and sagittal positions of 30 condyles from 15 skeletal Class II subjects (ANB >40°) were evaluated, according to the method of Pullinger and Hollender. Disk position of the TMJ was evaluated using magnetic resonance imaging. Joint space was measured on axial sections through the condyle obtained from cone beam computed tomography (CBCT) sections. Sagittal and coronal condyle position was evaluated on CBCT images using a protractor overlay method centred to the midpoint of the condyle. Joint space was measured at 30, 60, 90, 120 and 150 degrees. Posterior and anterior joint space was used to determine condyle position. Statistical analysis was performed using the Statistical Package for Social Sciences, version 13.0 (SPSS Inc., Chicago, Illinois, USA). An experimental group of 16 joints with anterior disk displacement and a control group of 14 joints with normal disk position were evaluated.

RESULTS: Sagittal mean joint space was reduced in the experimental group when compared with the control group. In the experimental group space was diminished (300°, 1.76 mm; 600°, 2.04 mm; 900°, 2.47 mm; 1200°, 2.21 mm) compared with the control group (300°, 2.3 mm; 600°, 2.8 mm; 900°, 2.96 mm; 1200°, 2.56 mm; P = 0.01). Coronal mean joint space was diminished in the experimental group (300°, 2.39 mm; 600°, 2.72 mm; 900°, 2.66 mm; 1200°, 2.38 mm) when compared with the control group (300°, 3.51 mm; 600°, 3.58 mm; 900°, 3.6 mm; 1200°, 2.69 mm, P = 0.001).

CONCLUSION: In skeletal Class II subjects with anterior disk displacement of the TMJ, the condyle may have an anterior and superior position when compared with Class II subjects with a normal disk position.

105 TREATMENT OF CLASS III MALOCCLUSIONS USING TEMPORARY ANCHORAGE DEVICES

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AIM: To evaluate the effectiveness of using temporary anchorage devices (TADs) and Class III elastics in growing Skeletal III patients with retrognathic maxillae whose maxillae were disarticulated using the alternate rapid maxillary expansion and constriction (Alt-RAMEC) protocol.

SUBJECTS AND METHOD: Fourteen subjects (7 males, 7 females) with an average age of 12.42 years (range 11.2–14.4 years) who exhibited Class III malocclusions with retrognathic maxillae with a cervical maturation stage of CS2 to CS3. Four TADs were inserted, two either side of the midpalatal suture and two in the mandible between the canines and lateral incisors. The palatal TADs were connected to a palatal expander and the lower TADs to a lingual arch. The maxilla was then expanded at 1 mm/day for seven days followed by constriction of 1 mm/day for 7 days. This protocol was repeated for nine weeks. Class III elastics were then worn for 24 hours/day delivering a force of 400 g. Protraction ceased when a 2 mm overjet was achieved. Cone beam computed tomographic scans were taken after TAD placement and at the end of active treatment. Rendered lateral cephalograms were then produced and cephalometric measurements were taken and compared using paired *t*-tests.

RESULTS: The aim of the study was achieved in all 14 subjects in 9 weeks of Alt-RAMEC followed by 8.57 weeks of protraction (range 8–9 weeks). The mean horizontal movement of point A was 3.28 ± 1.54 mm (P < 0.001). There was a mean increase in ANB of 3.95 ± 0.57 degrees (P < 0.001). Protraction led to a backward and downward rotation of the mandible. Dental effects included a proclination of the upper incisors coupled with retroclination of the lower incisors. A mean increase in overjet of 5.62 ± 1.36 mm (P < 0.001) was also observed.

CONCLUSION: The Alt-RAMEC protocol in conjunction with maxillary and mandibular TADs and Class III elastics is an efficient method of treatment of maxillary deficient Class III patients eliminating the need for the protraction headgear appliance; however the long-term stability of these changes need to be evaluated.

106 STIMULATION OF NEW BONE FORMATION IN ORTHOPAEDIC EXPANDED SUTURES – A SYSTEMATIC REVIEW

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AIM: An orthopaedically expanded suture leads to a biological chain of events that induces new bone formation. Enhancing new bone formation in these areas may improve the stability of expansion. The aim of this study was to review the literature on stimulation of new bone formation in orthopaedically expanded sutures.

MATERIALS AND METHOD: A literature search of PubMed was conducted for the period 1970 to 2011 using subject heading terms 'expansion', 'bone formation', 'sutures' and 'osteogenesis', which were also crossed with various combination.

RESULTS: Eighteen studies satisfied the inclusion criteria. Orthopaedic expansion was successfully performed in 14 studies on rats, two on rabbits and two on mice with various expansion rates. Expansion was performed in the mid-palatal suture in 11 studies, the sagittal suture in four studies, and the inter pre-maxillary suture in three studies. To improve bone formation 16 different therapies or materials were used. The results showed that these materials were applied locally in 13 animal studies, systemically in four studies, and systemically and locally one study. All studies reported a significant improvement in bone formation compared with the control groups.

CONCLUSION: Stimulation of bone formation in orthopaedically expanded sutures could shorten the retention period and the relapse potential may be reduced. Further research is required to clarify the dose-effect relationship and mode of application before routine clinical use.

107 PATIENTS WITH SLEEP APNOEA TREATED WITH MANDIBULAR ADVANCEMENT APPLIANCES

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AIM: To evaluate the efficiency of treatment with a mandibular advancement appliance (MAA) at the normalization of respiratory variables in symptoms related to sleep apnoea/hypopnoea (SAH) and in the improvement of Health-Related Quality of Life (HRQoL), as well as to evaluate the level of fulfilment and side effects.

SUBJECTS AND METHOD: Forty-five patients diagnosed with SAH. Night records were obtained with respiratory polygraphy. The HRQoL was assessed prior to and 6 to 12 months after MAA appliance use. Basic Nordic Sleep, Epworth Sleepiness Scale, the Stanford Sleepiness Scale, the generic 36-item short-form health survey (SF-36) and the functional outcomes of sleep questionnaires were used for assessment.

RESULTS: Successful treatment was achieved in 80 per cent of the patients. The minimum basal oxymetry increased significantly after treatment while the number of apnoeas, hypopnoeas and apnoea/hypopnoea index decreased. In the SF-36 questionnaire the scoring of the physical health summary component improved significantly. When compared with a reference population, an improvement was also noticed in the scales: physical functioning, role physical, bodily pain and emotional role. The adverse effects of the appliance were mild or moderate, except for mouth dryness and excessive salivation, which was present up to 6 months later.

CONCLUSION: MAA treatment normalizes respiratory variables, improves symptoms and contributes to improving HRQoL, with a high degree of performance. Its secondary effects are irrelevant.

108 ONE-STAGE SURGICAL PROCEDURE FOR CORRECTION OF ADULT MAXILLARY HYPOPLASIA: A STUDY OF THIRTEEN CASES***

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AIM: To retrospectively assess the transverse stability of an original one-step surgical approach – a Le Fort I and maxillary expansion in 13 patients with moderate transverse maxillary deficiency associated with a sagittal and/or vertical skeletal anomaly.

SUBJECTS AND METHOD: During the one-stage surgical procedure, bi- or threedimensional anomalies were corrected by Le Fort I osteotomy and the maxillary expansion was guided with a transpalatal bone-anchored device (TPD). Expansion was measured on study models obtained 1-2 months pre-surgery (T1), 6 months after surgery (T2) and at least 12 months post-surgery (T3). A Le Fort I–TPD was used in 13 out of 120 adult patients with transverse maxillary deficiency. The other 107 patients underwent first line palatal distraction.

RESULTS: The transverse occlusion was corrected in all cases. At T3 the gingival landmarks revealed an average expansion of 1.58 mm for the canines, 2.99 mm for the premolars and 3.39 mm for the molars. For the occlusal landmarks, the average expansion was 1.43 mm for the canines, 2.96 mm for the premolars and 3.30 mm for the molars. Canine expansion was significantly less than that of the premolars and molars. This more posterior expansion was achieved through the surgical procedure.

CONCLUSION: The transverse stability obtained with the bone-anchored TPD was satisfying. This study supports the principle of this one-step surgical procedure that combines a Le Fort I osteotomy with controlled maxillary expansion.

109 EFFECT OF A SELF-ETCHING ADHESIVE CONTAINING AN ANTIBACTERIAL MONOMER

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AIM: To evaluate the activity of an antibacterial monomer-containing self-etching adhesive (AMCA) on microbiological composition in the subgingival area *in vivo*, and to compare it with a conventional adhesive system.

SUBJECTS AND METHOD: A split-mouth design was chosen with 15 patients and the brackets in the contralateral quadrants were bonded with either a conventional adhesive system (group 1) or AMCA (group 2). At the beginning (T0) and at the first (T1), third (T2) and sixth (T3) months of the study, periodontal indices (plaque index, gingival index, probing depths and bleeding on probing) were recorded; subgingival plaque samples were collected. In plaque samples six microbial species (*Porphyromonas gingivalis, Tannerella forsythensis, Prevotella intermedia, Aggregatibacter actinomycetemcomitans, Fusobacterium nucleatum, Campylobacter rectus*) were studied with real-time polymerase chain reaction. Wilcoxon, Kruskal-Wallis rank and Mann Whitney-U tests were used for statistical comparison. The significance level was set at P < 0.05.

RESULTS: Except for probing depths, periodontal parameters were increased significantly from T0 to T3 in both groups. However, no significant difference could be detected in periodontal indices between groups. Changes in bacterial load from T0 to T3 were not different between the groups. The majority of bacterium was *F*. *nucleatum* at T0 and T3 in both groups. In both groups the amounts of *T. forsythensis* (P < 0.05) and *F. nucleatum* (P < 0.05) were increased during treatment period.

CONCLUSION: The microbiological composition in subgingival areas near brackets bonded with AMCA was not different from brackets bonded with the conventional system. The antibacterial effect of AMCA was limited in reducing periodontopathogenic bacteria around the brackets.

110 CEPHALOMETRIC FACIAL SOFT TISSUE NORMS IN AN IRANIAN POPULATION

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AIM: To perform a lateral cephalometric evaluation of an Iranian population with close to ideal occlusion to establish cephalometric norms of clinically relevant soft tissue measurements for adult Iranian orthodontic patients, and to make a clinical comparison between these norms and those of the common analysis systems.

SUBJECTS AND METHOD: Fifty subjects (25 males, 25 females) with an age range of 20 to 25 years characterized by normal occlusion, crowding of 2 to 4 mm, straight profile, no history of surgery for aesthetic, orthodontic treatment or a cleft lip and palate. A lateral cephalogram was taken of all subjects in the natural head position. Linear and angular soft tissue parameters were recorded and measured. The findings were analyzed and compared with the results of the other published studies. An independent samples *t*-test was used to analyse the data.

RESULTS: The average subject in the sample showed significant differences between soft tissue parameters compared with the norms of the common analysis

systems in mentocervical angle, nasomental angle, upper lip curvature, upper/lower lip to E-line and upper/lower lip to S-line.

CONCLUSION: There is a significant difference between the facial soft tissue contours of the Iranian population and other ethnic groups.

111 PREVALENCE OF THE CUSP OF CARABELLI IN GHANAIAN SCHOOL CHILDREN

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AIM: To evaluate the presence of the cusp of Carabelli in Ghanaian school children. Clinically the cusp of Carabelli can interfere with molar band placement

SUBJECTS AND METHOD: Three hundred school children of Ghanaian origin ranging from 6-12 years of age who were caries free on the teeth to be examined. Each subject was examined for the cusp on both the maxillary second primary molar (55.65) and the maxillary first permanent molars (16 and 26). The cusp was scored either as present or absent. All data were subjected to either chi-square analysis or Student's *t*-test evaluation when indicated.

RESULTS: Intraexaminer reproducibility assessment gave Kappa statistical values of 0.50 and 0.57 for the two examiners and a value of 0.48 for interexaminer assessment. The prevalence of the cusp was 57.3 per cent in the population studied with almost similar prevalence in both males and females. There was no significant difference in the cusp distinctiveness in either of the genders. The cusp was more marked in males compared with females

CONCLUSION: The findings suggest a lower prevalence of the cusp of Carabelli in Ghanaian populations as compared with Caucasian populations.

112 TREATMENT ALTERNATIVES FOR SINGLE OR MULTIPLE MISSING TEETH***

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AIM: Congenitally missing teeth, single or multiple, change the occlusion and affect aesthetics to different extents. Frequently patients seek orthodontic treatment not in terms of function, but for aesthetic considerations. The current study aimed to define the different types of tooth aplasia and the level of aesthetic disturbance for the patient to determine clinical management.

SUBJECTS AND METHOD: Ten clinical subjects with congenitally missing laterals and two with multiple missing teeth. Since hypodontia is a malocclusion that requires an interdisciplinary approach, treatment planning was considered by at least two specialists.

RESULTS: The clinical dilemma of these cases was: levelling and alignment of the dental arches with the present teeth or regaining space to facilitate prosthetic rehabilitation. The factors, which were considered in treatment planning, were complex and included: the number of missing teeth; groups of missing teeth; location of the missing teeth and type of occlusion.

CONCLUSION: The current research suggests treatment alternatives of different cases with optimal aesthetic restoration.

113 BITE FORCE AND ITS ASSOCIATION WITH STABILITY FOLLOWING CLASS II DIVISION 1 FUNCTIONAL APPLIANCE TREATMENT

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AIM: To investigate the value of pre-treatment maximal molar bite force as a predictive variable in determining post-treatment changes and stability following functional appliance treatment in Class II malocclusion children.

SUBJECTS AND METHOD: Thirty-one Class II malocclusion children having undergone functional appliance treatment were followed for at least one year posttreatment. Maximal molar bite force measurements, lateral cephalograms, and study models were taken before treatment, after treatment, and after post-treatment followup. Relationships between pre-treatment maximal molar bite force and dental or cephalometric changes post-treatment were examined. The patients were divided into stable and unstable group, based on dental sagittal changes (overjet and molar relationship), and differences between the two groups of patients were determined.

RESULTS: Post-treatment changes varied widely. Fifteen children showed dental sagittal relapse, namely a shift in the molars towards a Class II relationship and an increase in overjet, while 16 did not. The unstable group demonstrated a lower pre-treatment maximal molar bite force, as well as a more obtuse gonial angle, than the stable group.

CONCLUSION: Children with a lower pre-treatment maximal molar bite force are more prone to dentoalveolar sagittal relapse following functional appliance treatment.

114 IMPACT OF ORTHODONTIC TREATMENT ON ORAL HEALTH-RELATED QUALITY OF LIFE IN STANDARD, SURGERY AND CLEFT PATIENTS

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AIM: To compare the effects of orthodontic treatment on oral health-related quality of life (OHRQoL) between standard, orthognathic surgery and cleft lip and/or palate patients.

SUBJECTS AND METHOD: Sixty-eight consecutive patients (31 females, 37 males) with a mean age of 15.1 years (\pm 4.1 years), commencing orthodontic treatment. Participants were classified as standard, surgery or cleft. All subjects were treated with a fixed edgewise appliance. Participants completed the self-report Oral Health Impact Profile (OHIP-14) within a 6-week window before and after orthodontic treatment. Data were analyzed by means of bivariate tests, and a generalized linear model using change in OHIP-14 scores (difference between pre-and post-treatment scores) as the main outcome variable.

RESULTS: The mean improvement in OHIP-14 score of the overall study sample was 69.6 per cent (P < 0.001). The surgery group had the greatest mean improvement in OHIP-14 score (87.2%; P < 0.001), followed by the standard group (60.4%; P = 0.001). There was no significant difference between pre- and post-treatment OHIP-14 scores in the cleft group, with a mean improvement of 38.5 per cent (P = 0.091). The patient group was a significant predictor of change in OHIP-14 score, even after adjusting for age and gender (P = 0.023).

CONCLUSION: The short-term effects of orthodontic treatment on OHRQoL appear to be influenced by patient group and the magnitude of change in facial aesthetics. The greatest improvement in OHRQoL occurs in those undergoing orthognathic surgery, while the least occurs in cleft lip and/or palate patients. 115 EFFECT OF TWO- AND THREE-WEEKLY REACTIVATIONS OF CONTINUOUS AND INTERMITTENT FORCES ON PAIN PERCEPTION B Aras¹, T Turk², S Elekdag Turk², F Guldogus³, M A Darendeliler⁴, ¹Department of Orthodontics, Sydney Dental Hospital and SWSLHD, Australia, Departments of ²Orthodontics and ³Algology, University of Ondokuz Mayis, Samsun, Turkey and ⁴Department of Orthodontics, University of Sydney, Australia

AIM: Comparison of pain response under continuous and intermittent forces with two- and three-weekly reactivation periods.

SUBJECTS AND METHOD: Thirty-two patients (mean age: 14.4 years) randomly divided into two groups of two- and three-weekly reactivations. In both groups, a buccal tipping force of 150 g was applied to the upper first premolars. The location of the intermittent and continuous force was assigned randomly. Removal of the cantilever spring for the last three days of each period was the defining characteristic of the intermittent force design in this study. Wires were calibrated to the initial force level on each reactivation visit for three months. Pain thresholds were recorded with an electrocutaneous stimulation instrument (Painmatcher, Cefar Medical AB, Sweden). Visual analogue scales and pain diary entries were used and repeated after each reactivation appointment. Spontaneous pain response, related to upper premolars, was evaluated.

RESULTS: In both groups pain response decreased over time but a significant difference was observed for the three-weekly reactivations of the continuous force (P < 0.05). Continuous and intermittent forces did not show any significant difference for any of the four reactivations (P > 0.05). Furthermore, the comparison of two- and three-weekly intermittent forces did not present any difference for any of the four reactivations (P > 0.05). The groups were found comparable in terms of pain threshold distribution (P > 0.05)

CONCLUSION: Reactivation periods may have an effect on pain perception when continuous forces are used. Continuous forces with longer reactivation durations lead to a significant decrease in pain response over time.

116 EFFECTS OF CONTINUOUS AND INTERMITTENT ORTHODONTIC FORCES ON CANINE DISTALIZATION

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AIM: To measure the amount of canine distalization with continuous and intermittent orthodontic forces with superelastic nickel-titanium (NiTi) closing coils over a defined time (12 weeks).

SUBJECTS AND METHOD: Sixteen patients who required maxillary canine distalization into first premolar extraction sites as part of their orthodontic treatment. A split-mouth set-up was used for intermittent and continuous force comparisons. NiTi closing coil springs delivering a force of 150 g were used for canine distalization after an alignment and stabilization period. Eleven days after the first force application, the coil springs were removed, and the teeth rested without a force for 3 days on the intermittent sides only. The continuous force was applied for the whole experimental period without any pause; i.e., the springs were not removed on the continuous sides. On day 14, the cycle was restarted with the insertion of springs on the intermittent sides. This procedure was carried out until the end of the experimental period. Intra-oral and cast measurements were made at the beginning of canine distalization and every 42 days for 84 days to assess total space closure, canine distalization, molar anchorage loss and canine rotation.

RESULTS: The amount of total space closure was higher with continuous force on the model and intra-oral measurements (P = 0.041 and P = 0.006, respectively) when compared with intermittent force. However, the amount of canine distalization did not show a significant difference between intermittent and continuous forces (P = 0.587). The anchorage loss was greater with continuous force than with intermittent force (P = 0.041).

CONCLUSION: Intermittent force is effective for canine distalization providing less anchorage loss and more rotational control when compared with continuous force.

117 MATERNAL PSYCHOLOGICAL CONDITIONS AND STRUCTURES IN MOTHERS WITH CLEFT LIP AND PALATE CHILDREN

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AIM: To examine the decision making process after first phase orthodontic treatment for children with cleft lip and palate (CLP), to better understand treatment of children and maternal feelings from a family therapy viewpoint by qualitative research.

SUBJECTS AND METHOD: Six mothers, whose children had a CLP and had who had undergone the first phase of orthodontic treatment. Semi-structured interviews were conducted with the state-trait anxiety inventory to indicate the level of maternal anxiety at the interview stage. The results were recorded verbatim.

RESULTS: Some of the mothers showed low levels of anxiety during the interview stage and were not removed from the study. Seven themes were extracted that included: 'shock and embarrassment', 'help and information', 'expectations and possibilities of therapy', 'a sense of maternal guilt', 'hopes and fears of long-term treatment', 'parent-offspring conflict and persuasion of treatment', and 'trust in the doctors'. Treatment decisions: 'expectations and possibilities of therapy', 'parent-offspring conflict and persuasion of treatment', continually circulated. While maternal feelings to a sense of maternal guilt, and trust in doctors indicated these structures coexist.

CONCLUSION: Mothers experience maternal feelings of guilt with regard to the pain and suffering of children during the treatment process. Therefore mothers should be consulted in the decision-making process for emotional reasons, to support the mother and child relationship during long-term treatment and encourage trust in the doctors with greater maternal involvement in the decision making processes. It was thought that maternal feelings were structured in layers but in fact they are referenced in themes with each other.

118 THREE-DIMENSIONAL MODELS. ARE THEY AFFORDABLE?

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AIM: To evaluate if it is cost-effective to obtained a three-dimensional (3D) intraoral scan in an orthodontic practice based on recent literature

MATERIALS AND METHOD: A review of publications in PubMed since 2006 to the present. The key words were used were: 3D scans, cone beam computed tomography, orthodontics, cost effectiveness.

RESULTS: It is cost effective to have a 3D intraoral scan for orthodontic study models when more than 166 patients have been scanned (both articulator and standard study models) or 333 patients have been scanned (study models only). The number of patients may change depending on the different prices of the scanner and casts. 3D

models have a number of advantages such as: 1. The reduction in time in not having to cast models; 2. Neither a laboratory nor storage room are required for the dental casts; 3. Management with 3D cephalometrics or a combination of both (models and 3D radiograph); 4. There is no interphase between impression and plaster so 3D impressions are more accurate; 5. No allergies with impression materials; 6. Ability to customise brackets; 7. Marketing with patients results in a new dimension. There are however some drawbacks including: 1. The operator can scan only one patient at a time; 2. Operator skills are required to handle the scanner; 3. Investment at the beginning is high

CONCLUSION: 3D dental casts are as accurate as traditional dental casts (especially if impressions are not cast straight away). A minimum of 250 patients are needed to make it cost-effective. Less storage need and marketing are also benefits of the use of this technology.

119 DISPLACEMENT AND STRESS DISTRIBUTION AROUND THE MAXILLARY CANINE ROOT DURING SECTIONAL RETRACTION IN DIFFERENT T-LOOP POSITIONS

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AIM: Distal canine retraction following extraction of first premolars is a routine orthodontic treatment, especially in the maxilla. The present study assessed displacement and stress distribution in root surrounding areas of the maxillary canines during retraction by a sectional T-loop archwire using the finite element method.

MATERIALS AND METHOD: A geometric model of maxillary canine, its periodontal ligament (PDL), maxillary bone and also T-loop were designed by SolidWorks software using a patient's computed tomographic scan. The values of force (Fl), moment (M), M/F ratio, displacement and stress pattern of the canines were calculated in α , β and μ positions of the loop by means of Abaqu S6.6.3 analytical software following 2 mm activation of the loops

RESULTS: A simple distalizing force on the crown without counterbalancing moments induced uncontrolled tipping of the canine (distal crown and mesial root movement), with distribution of low compressive stresses on the distal side and low tensile stresses on the mesial side of the PDL. In three positions, the T-loop produced similar patterns of stress distribution for the same load, with stress concentrated at the cervical and apical thirds of the PDL, and this force produced an area of zero stress in the PDL near the middle of the root. The magnitude of stress was varied in different loop positions. The highest magnitude was at the cervical margin in α position, and the lowest in μ position.

CONCLUSION: The more distally sited a T-loop during canine retraction, the less its efficiency.

120 RELATIONSHIP BETWEEN CONCERN AND DEMAND FOR ORTHODONTIC TREATMENT IN PATIENTS AND THEIR PARENTS C Aydogan, M S Kayasan, F Kazanci, Department of Orthodontics, Yuzuncu Yil University, Van, Turkey

AIM: All potential orthodontic patients and their parents have concerns about orthodontic treatment. Individual concerns represent a decisive factor in the demand for orthodontic treatment. On the other hand, demand for orthodontic treatment is influenced by parental attitudes and values. The aim of this study was to investigate

the relationship between concern and demand of patients and their parents about orthodontic treatment.

SUBJECTS AND METHOD: One hundred and eighty nine patients (74 boys, 115 girls; mean age 13.35 ± 2.27 years) and their parents referred for orthodontic consultation. All participants were asked about their concerns for orthodontic treatment and their answers were recorded. A visual analogue scale was used to determine patients' and parents' demand for orthodontic treatment. The significance of the dependency of gender on demand was checked using the chi-square test. Kappa statistics was used to evaluate the consistency of both patients' and parents' demand.

RESULTS: Twenty-one patients (11% of the patients) and four parents (2% of the parents) rejected orthodontic treatment. Fifty-nine patients and 51 parents stated at least one concern for orthodontic treatment. There were no statistically significant differences between the demand for orthodontic treatment of boys and girls when gender distribution was considered. Similarly, no significant differences were found between parents of boys and girls. Kappa values indicated low agreement between patients and parents demand for orthodontic treatment.

CONCLUSION: Although patients and their parents seek orthodontic consultation, they may have several concerns about orthodontic treatment. When a patient (and/or parent) rejects orthodontic treatment, the possible concerns of the individual must be taken into account.

121 EFFECTS OF COMMONLY USED DRUGS ON TOOTH MOVEMENT

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AIM: To describe the effects of commonly used drugs in orthodontic movement.

MATERIALS AND METHOD: Thirty-four articles written in the last 10 years were reviewed using PubMed and Scopus databases. Key words were: drugs, antiinflammatory, non-steroid anti-inflammatory drugs (NSAID), corticosteroids, acetaminophen, fluoride, tooth movement, orthodontics, bisphosphonates.

RESULTS: Bisphosphonates, vitamin D, fluoride and NSAIDs can cause a decrease in the rate of orthodontic movement. On the contrary, corticosteroids could be related to a higher rate of tooth movement, resulting in less stable results. Paracetamol and celecoxib seem to be the painkillers that have less impact on movement rate, so they could be the most suitable analgesics during orthodontic treatment.

CONCLUSION: Certain currently used drugs have an impact on the rate of tooth movement and the use of these should be taken into account when making a diagnosis and in treatment planning.

122 COMPARING A NEW DISTALIZATION METHOD WITH CONVENTIONAL MECHANICS

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AIM: To introduce a new distalization mechanic, the 'butterfly' and to compare its moment-force (M/F) systems with laceback and sectional arch mechanics using finite element (FE) analysis.

MATERIALS AND METHOD: Segments of maxillae containing the teeth were obtained from patients and scanned with microcomputed tomography in order to generate a FE model. In a series of FE analysis simulating three different methods of canine distalization, various orthodontic movements and Von Mises stress distribution, the influences of the M/F ratio and the force magnitude were examined. The clinical part of the study consisted of 60 patients who underwent four first premolar extractions and fixed orthodontic appliance therapy. The mean age at the start of treatment was 12.88 ± 1.15 years. The patients were grouped into butterfly, laceback ligatures and sectional arch groups based on the distalization mechanics. The mean treatment durations were 15.95, 25.3 and 26 months, respectively. A Kruskal Wallis test was performed to determine group differences.

RESULTS: FE analysis showed that Von Mises stress distribution in the butterfly and sectional models was at the distal surface of the canine root homogenously, however with laceback ligatures the stress distribution was apical and at the alveolar crest at two points. There was a significant difference due to treatment duration between the butterfly and other groups (P < 0.05).

CONCLUSION: Butterfly mechanics shorten treatment duration and increases the M/F ratio, which results in more parallel movement of the canine. This technique provides a simple answer to most questions related to canine distalization.

123 EXPRESSION OF GINGIVAL CREVICULAR FLUIDS, MMP-1, MMP-2, MMP-8, WITH ORTHODONTIC TREATMENT: A SYSTEMATIC REVIEW S Bahmani¹, S Foroughi Moghaddam¹, A Sohrabi¹, H Sadr Haghighi¹, V Zand², Departments of ¹Orthodontics and ²Endodontics School of Dentistry Tabriz

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AIM: During orthodontic treatment, the early response of periodontal tissues to mechanical stress involves several metabolic changes that allow tooth movement; the collagenous extracellular matrix (ECM) of the periodontal ligament (PDL) and alveolar bone is remodelled. Metalloproteinases (MMPs) are enzymes that play a central role in PDL remodelling. Collagenase-1 (MMP-1) and collagenase-2 (MMP-8), because they share a unique ability to cleave native triple-helical interstitial collagens, can initiate this tissue remodelling. Gelatinases (MMP-2) are also involved in the breakdown of ECM.

MATERIALS AND METHOD: A literature reviews in Medline, Google Scholar and PubMed with the objective to research gingival crevicular fluids MMP-1, -2 and -8 expressions during orthodontic treatment.

RESULTS: In several studies force induced significantly increased levels of MMP-1 protein after force application but in another study no significant increase in MMP-1 was found. MMP-2 protein was induced by compression and increased significantly in a time-dependent fashion, reaching a peak after 8 hours of force application. On the tension side, MMP-2 was significantly increased after 1 hour but gradually returned to base levels within 8 hours. GCF and MMP-8 levels for orthodontically treated teeth were significantly higher at 4 to 8 hours after force application.

CONCLUSION: Orthodontic forces affect MMP-1, -2, and -8 protein levels on the compression and tension sides, although to different extents, whereas MMP-1, -2, and MMP-8 protein levels change in a time-dependent manner.

124 EVALUATION OF POSSIBLE CORRELATION BETWEEN OCCLUSION AND POSTURE – A FORCE PLATFORM EXAMINATION***

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AIM: A force platform is used in clinical practice and in research to evaluate posture and relationship between posture and dental occlusion. The aim of the study was to evaluate, in a group of selected subjects (healthy volunteers), the possible correlation with a force platform.

SUBJECTS AND METHOD: Forty-four subjects (30 males, 14 females aged 17-35 years, mean 23.75 ± 4.10 years). The single blind experimental protocol was created by using a 'Correkta' (DL Medica, Italy). In order to evaluate the effective influence of each factor on the response from a statistical point of view, in the light of the multifactorial nature of the matter, ANOVA was used.

RESULTS: Ocular afference significantly alters posture (P < 0.001). Mandibular position seems to influence postural structure only in the sway area, with low statistical evidence (P = 0.065).

CONCLUSION: Only ocular afference can influence posture with a high level of statistical evidence.

125 MAGNETIC RESONANCE IMAGING AND CLINICAL DIAGNOSIS OF THE TEMPOROMANDIBULAR JOINT IN JUVENILE IDIOPATHIC ARTHRITIS PATIENTS

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AIM: Juvenile idiopathic arthritis (JIA) is the most frequent autoimmune disease in children and adolescents. In 87 per cent of these patients the temporomandibular joint (TMJ) is affected, but nearly 50 per cent proceed asymptomatically. The aim of this study was to enlarge a previous investigation and to add the clinical parameters, deviation and deflection on mouth opening, and to determine prevalence of anterior disc displacement (ADD) in patients with JIA.

MATERIALS AND METHOD: Data of 100 randomized patients (mean age 12 years, 63 females and 37 males) affected by JIA were examined retrospectively. The results of the TMJ clinical examination were compared with the MRI results.

RESULTS: The MRI showed condylar alteration in 58 per cent and an acute inflammation in 32.5 per cent. Twenty-three patients presented with deviation and 27 with deflection. Fifty-three per cent of patients with condylar alteration showed deviation or deflection during mouth opening, but no significant correlation between the deviation side or the deflection side and condylar alteration could be determined. Sixty-nine patients showed chin deviation. In 18 per cent the severity of condylar alteration correlated with chin deviation to the left and in 9 per cent to the right side. ADD was diagnosed in 59 TMJs but only six patients had clicking sounds during clinical examination.

CONCLUSION: The outcomes confirm previous results: the female gender and left condyles are more affected by TMJ arthritis. Clinical examinations without MRI are not conclusive in diagnosis of condylar alteration and ADD. Further investigations are required to resolve the risk of ADD in patients with JIA and in those with unimpaired TMJ, and the consequences for treatment procedures.

126 ANALYSIS OF WILSON'S MAXILLARY CURVE IN NORMOCCLUSION AND MALOCCLUSION SUBJECTS WITH AND WITHOUT BILATERAL POSTERIOR CROSSBITE

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AIM: To determine, by angular references, the curve of Wilson of the first and second maxillary molars and elucidate a possible relationship of the dentoalveolar compensation curve between a normocclusion pattern and a malocclusion pattern with and without a bilateral posterior crossbite, according to the cone beam (CB) method.

SUBJECTS AND METHOD: Ten malocclusion subjects, with or without a bilateral posterior crossbite (regardless of sagittal Angle and vertical malocclusions), and 10 patients with normocclusion (patients who underwent a CB study for reasons other than orthodontics). The subjects were aged between 19 and 55 years and had not previously received orthodontic treatment. CB frontal sections of the first and second molars were obtained, and angular measurements between the left and right axis of the first and second molars were made with respect to a perpendicular to the frontal palatal midpoint. To assess the results, ANOVA, Bonferroni analysis and Levene's statistics were carried out.

RESULTS: The average value of the total maxillary curve of Wilson for the first molars (sum of left and right angle) was 8.1 for the normocclusion group, 0.4 for the bilateral posterior crossbite group and 16.9 for the group without this alteration. The mean differences were statistically significant (P < 0.042) between the groups with and without a crossbite.

CONCLUSION: The curve of Wilson of the maxillary first molars in patients with a bilateral posterior crossbite is less than or more concave than in subjects without transverse alterations, suggesting less pronounced dentoalveolar compensations.

127 DIGITAL MODELS AND ACCURACY OF OCCLUSION – AN *IN VITRO* PILOT STUDY

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AIM: Three digitization technologies are available: impression, model, and intraoral scanners. The null hypothesis was: there is no difference between the occlusion of the original model and the corresponding digital model.

MATERIALS AND METHOD: Standard working models were mounted in an articulator and were digitised using impression scanners (A) DigimodelTM and (B) O3DM®, model scanner (C) 3shape and intraoral scanner (D) iTero®, whilst following precisely the manufacturers' protocols. Overjet and molar relationship were recorded in the sagittal dimension, overbite in the vertical dimension and dental midline shift in the transverse dimension. Occlusograms were evaluated using histocytometry image analyzer software: the surface with the closest contacts was measured. Descriptive statistics were performed calculating the mean, median, standard deviation and standard error of the mean. Boxplots were drawn to display differences.

RESULTS: Digital models revealed deviations in the sagittal parameters of overjet and molar relationship from -0.5 mm (SD $\pm 0.7 \text{ mm}$) to +2.0 mm (SD $\pm 0.4 \text{ mm}$). The overbite deviated from -0.7 mm (SD $\pm 0.3 \text{ mm}$) to +0.7 mm (SD $\pm 0.7 \text{ mm}$). Midline discrepancies were not found. The digital model derived from intraoral scans revealed the smallest deviations: sagittal +0.1 mm (SD $\pm 0.2 \text{ mm}$) and vertical -0.7 mm (SD $\pm 0.3 \text{ mm}$). The Δa of the closest tooth contacts in the occlusograms was: A $+32.9 \text{ mm}^2$, B -22.8 mm^2 , C $+31 \text{ mm}^2$ and D $+11.6 \text{ mm}^2$.

CONCLUSION: The null hypothesis was rejected: the occlusion of digital models deviated by up to 2 mm sagittally and up to 0.7 mm vertically. The occlusion from scanned plaster casts and intraoral scans was more accurate than from scanned impressions. Occlusograms of digital models mostly overestimate the contacts in maximum intercuspation and therefore should be interpreted with caution. Further evidence based studies are needed to investigate the accuracy of digital model occlusion *in vivo*.
128 IMPACT OF FIXED ORTHODONTIC TREATMENT ON APPROXIMAL CARIES: A RETROSPECTIVE STUDY ON BITEWING RADIOGRAPHS

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AIM: There appears to be no study on the impact of fixed multibracket treatment on approximal caries using bitewing radiographs. The aim of this retrospective study was to investigate if there is an association between fixed multibracket therapy and approximal carious lesions.

MATERIALS AND METHOD: Bitewing radiographs of 104 orthodontically treated patients with fixed multibracket appliances were compared with 111 untreated subjects. Individuals of both groups were between 15 and 16.25 years of age when the radiographs were taken. The bitewings of the test group were selected consecutively from archived individual records at the University of Zürich. The untreated control group was randomly selected from 16 communities of the Canton of Zürich. The approximal surfaces of all present upper and lower permanent molars and premolars were assessed by two calibrated investigators.

RESULTS: The average number of enamel lesions in the test group after fixed orthodontic treatment was lower than in the control group (0.57 versus 1.85, P < 0.001). The same was found for dentine lesions (0.06 versus 0.49, P < 0.001). Of the treated patients, 73.1 per cent had no enamel lesions and 95.2 per cent had no dentine lesions. In the control group, 55 per cent of the individuals had no enamel lesions and 77.5 per cent no dentine lesions. The distribution of carious lesions was comparable within both groups.

CONCLUSION: When compared with the control group, the study failed to show an association between fixed multibracket therapy and approximal carious lesions.

129 EVALUATION OF FRICTION OF DIFFERENT LIGATION METHODS R Bayri¹, H N Yilmaz², E Koc², N Kucukkeles², ¹Private Orthodontic Practice and ²Department of Orthodontics, Faculty of Dentistry, Marmara University, Istanbul, Turkey

AIM: To evaluate *in vitro* the frictional values of three different ligation methods in accordance with and without bracket brands at crowded configuration.

MATERIALS AND METHOD: Three aesthetic conventional [Inspire Ice (Ormco), Signature III (RMO), Leone Logic Line (Leone)] and one metal bracket [Mini Taurus (RMO)] were evaluated in terms of friction. All brands were tested in a crowded configuration of bracket alignment with 0.014 inch NiTi archwire. All brackets were ligated with metal ligatures, elastomeric ligatures and non-conventional elastomeric ligatures (Leone Slide Ligatures) and 120 tests were performed. For accurate and repeatable placement on metal plates a special jig was designed. The pulling speed was set to 10 mm/minutes for 30 seconds for each sample.

RESULTS: Free from bracket brand, out of three of ligation methods, Leone Slide ligature produced the lowest friction. In accordance with bracket type, from the brackets ligated with elastomeric modules, Leone Logic Line showed the lowest friction and Inspire Ice the highest friction. Significant differences were also found between brackets when ligated with metal ligatures; maximum friction with Inspire Ice followed by Signature III, Mini Taurus and Leone Logic Line. When Leone Slide ligatures were used, Leone Logic Line brackets showed the least friction followed by Mini Taurus, Signature III and Inspire Ice.

CONCLUSION: Leone Slide ligatures can be recommended for clinical use for combining aesthetics of modules and low friction values and decreased chair time to

place and remove. Leone Logic Line brackets combined with Leone Slide ligatures had the least friction.

130 ALVEOLAR BONE THICKNESS AND LOWER INCISOR POSITION IN SKELETAL CLASS I AND II MALOCCLUSIONS***

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AIM: To evaluate possible differences in lower incisor position and bony support between Class II average and high angle patients compared with subjects with Class I malocclusions.

MATERIALS AND METHOD: Cone beam computed tomography (CBCT) archived records of 79 patients were selected. For overall comparison, the two groups were generated according to the sagittal jaw relationships [Class I (0° <ANB<4°) and Class II (ANB < 4°)]. The groups were then divided into average (26° <SN-MP< 38°) and high (SN-MP >38°) angle subgroups. On CBCT records, six angular and six linear measurements were undertaken, and two ratios were calculated. Overall comparison was performed with an independent samples *t*-test and subgroup comparisons with a Kruskal Wallis test. When a significant difference was found, a Mann Whitney-*U* test was performed. Statistical significance was tested at $\alpha = 0.05$.

RESULTS: The only statistically significant difference between Class I and Class II patients was for labial cortical bone thickness (P = 0.003). Greater differences were recorded for subgroup comparisons. In Class II average angle patients, protrusion and proclination of the lower incisors were concomitant with the increase in lingual alveolar bone angle. The measurements related to the thickness of cancellous bone were greater for average compared with high angle Class II subgroups patients. The root apex was closer to the buccal alveolar bone in high angle subgroups compared with average subgroups.

CONCLUSION: Labial cortical bone thickness was found to be greater in Class I patients. Lower anterior bony support and lower incisor position show distinct differences between average and high angle Class II patients. These differences were not recorded to the same extent in the Class I average and high angle sample.

131 BILATERALLY PALATALLY DISPLACED MAXILLARY CANINES: A PROSPECTIVE RANDOMIZED CONTROLLED STUDY

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AIM: To prospectively evaluate the effect of extraction of primary canines on palatally displaced canines (PDC).

SUBJECTS AND METHOD: Twenty-one patients, mean age at diagnosis 11.7 ± 1.3 years, with bilateral PDCs. After randomization, one primary canine was assigned for extraction and the contralateral side served as the control. The patients were then followed for 12 months with panoramic and intraoral occlusal radiographs. The two PDCs in every patient were compared for the angle of the canines (α) to the midline, the distance of the cusp tip (d) to the occlusal line, and the medial crown position in sectors 1–5, according to Ericson and Kurol (1988). A paired *t*-test was performed for comparison of α and d within patients, and differences between the extracted and contralateral side at 12 months were calculated with and without adjustment for differences between sides at baseline.

RESULTS: The improvement of α -angle on the extraction side compared with the control side was statistically significant at 12 months, mean 8.6 degrees [95% confidence interval (CI) 2.7 to 14.5] P = 0.006 and with adjustment for baseline 7.8 degrees (95% CI 2.1 to 13.5) P = 0.010. The mean improvement of d was 2.6 mm (95% CI 0.6 to 4.6) P = 0.014 and 2.6 mm (95% CI 0.9 to 4.3) P = 0.005 with adjustment for baseline. When stratified for age, the data indicated that younger patients (10-11 years) had an even better response to interceptive extraction than older patients (12-14 years). A tendency could also be detected for a better response for PDCs in sectors 2 and 3 than those in sectors 4 and 5.

CONCLUSION: The preliminary results indicate that extraction of the primary canines induces significant improvement in the position of PDCs. Younger patients seem to show a better treatment effect.

132 TRANSVERSE DEVELOPMENT OF THE DENTAL ARCH WITH COPPER NICKEL TITANIUM ARCHWIRES DURING ALIGNMENT AND LEVELLING

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AIM: To evaluate, in a randomized clinical trial, the resolution of dental crowding and dentoalveolar transverse development with copper nickel titanium (NiTi) archwires (Ormco, California, Glendora, USA) in self-ligation and conventional brackets systems during alignment stage.

SUBJECTS AND METHOD: Patients were randomly divided into three groups. Group 1 wore MBT brackets with a copper-NiTi archwire, group 2 Damon brackets with a copper-NiTi archwire and group 3 (control group) MBT brackets with superelastic NiTi archwires. The archwire diameter used in all groups was 0.014 inches. All patients were evaluated after two months of treatment. Two blinded observers measured the plaster models using an accurate gauge and repeated them after two weeks to evaluate inter- and intraobserver quality. After data collection, the following were: 1) Global expansion: In this case millimetres were calculated subtracting the total expansion achieved to the initial width. 2) Crowding resolution: The percentage resolution according to the initial state. 3) Expansion according to the dental arch: The expansion percentage achieved according to the archwire: the percentage expansion achieved according to the width of the archwire (taken as 100% of the width at the level of canines, first premolars, second premolars and first molars to determine the amount of expression of the archwire).

RESULTS: Statistical analysis was performed with SPSS 20.0 (IBM, New York, USA). To calculate the inter- and intraobserver correlation, Kappa and Pearson indices were used respectively. Samples were compared with ANOVA parametric test.

133 BINDING-DETERMINED GEOMETRY OF A THREE-BRACKET-RELATIONSHIP

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AIM: Classical friction, binding and notching are the three components of resistance in the bracket-wire-interface. Elastic and plastic deformation of the wire creates horizontal forces, which influence the geometry of tooth movement. Under this premise, the clinical situation of a three-bracket relationship between premolar, high canine and lateral incisor was transferred to a two-dimensional measuring apparatus in order to analyze forces and moments.

MATERIALS AND METHOD: At a constant hypotenuse of 8.6 mm in a triangle of the catheti 'canine position' and 'interbracket distance', the positions of the lateral brackets were adjusted dynamically to the declining canine position. Forces and moments were measured for a 0.022 inch passive self-ligating and a 0.022 inch conventional wire-ligated bracket system in combination with a 0.014 inch NiTi wire. RESULTS: Initial horizontal forces were measured at 79.4 \pm 6.3 cN and 71.9 \pm 3.0 cN (premolar) and 82.7 \pm 5.2 cN and 61.7 \pm 4.3 cN (lateral incisor). These forces showed similar characteristics for both bracket systems and reduced markedly at a canine position of 2 mm. At 1 mm they were no longer measurable. At this point, the end of binding and start of classical friction may be assumed.

CONCLUSION: This *in vitro* model is able to explain the clinical observation of space opening in the initial phases of levelling. Binding creates horizontal forces that determine the geometry of a three-bracket-relationship, regardless of ligature system.

134 EVALUATION OF BOND STRENGTH OF DIFFERENT RESIN SYSTEMS FOR ORTHODONTIC BONDING

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AIM: To evaluate the bond strengths of three different adhesive systems.

MATERIALS AND METHOD: One hundred and eighty bovine lower incisors divided into three groups of 60 teeth, were cut and embedded in acrylic resin matrices, in which orthodontic brackets were bonded with Transbond XT, Transbond XT self etching primer or Tyrian. For each composite, bond strength tests were executed immediately (n = 30) and 24 hours (n = 30) after bonding.

RESULTS: The average bond strength values were 7.43, 7.09 and 3.41 MPa immediately after bonding and 7.42, 8.81 and 5.35 MPa 24 hours after bonding. The differences were statistically significant at the 5 per cent level between the Tyrian and Transbond groups at both observation times.

CONCLUSION: Tyrian showed a significantly lower bond strength when compared with the findings for the Transbond groups, which were similar.

135 RAPID MAXILLARY EXPANSION IN THE TREATMENT OF RESPIRATORY PROBLEMS IN PATIENTS IN THE PRIMARY AND MIXED DENTITIONS

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AIM: To evaluate the effect of rapid maxillary expansion (RME) in the reduction of nasal airway resistance.

SUBJECTS AND METHOD: Sixty-six children of both genders ranging in age from 5 to 9 years in the primary or mixed dentition with different degrees of maxillary constriction. Each subject was treated with a RME appliance cemented by the same clinician using glass ionomer cement and submitted to rhinomanometry and orthodontic documentation before and 10 days after expansion. The Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, USA) was used to analyze the data.

RESULTS: There was a statistically significant difference regarding a reduction in nasal air resistance after analysing the values of the pre- and post-expansion rhinological examinations.

CONCLUSION: In agreement with the literature, the findings confirm the effectiveness of RME in improving respiratory problems in paediatric patients.

136 COULD CHANGES IN MAXILLARY INCISOR INCLINATION AFFECT THE POSITION OF POINT A?

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AIM: To test the hypothesis that a change in maxillary incisor inclination influences the position of point A sagittally.

MATERIALS AND METHOD: Lateral cephalometric films were obtained from 25 Class II division 2 subjects (15 girls, 10 boys), and 25 Class I (14 girls, 11 boys) patients with normal incisor inclinations to form a study and control group, respectively. The changes in incisor inclination and point A in both groups were assessed on radiographs before and after active fixed appliance treatment using linear and angular measurements (U1-SN, U1-FH, NV-tip of incisor, NV-apex of incisor, SNA, NV-point A). Any possible correlation between incisor inclination and point A position was statistically analysed.

RESULTS: Significant proclination was observed in maxillary incisor position in the study group (+11.70 +3.5 mm; P < 0.05) while the incisors remained almost unchanged in the controls (+3.70 +0.7 mm; P > 0.05). The change in the position of point A was not statistically significant in either the study (0.30 and -1 mm; P>0.05) or control (-0.20 and -0.5 mm; P > 0.05) group. The difference between the groups was also not significant. Spearman correlation showed that there was no correlation between upper incisor inclination and point A position in either group.

CONCLUSION: The hypothesis was rejected. The results suggest that the change in incisor inclination due to orthodontic treatment does not affect the sagittal position of point A.

137 MAXILLARY FORWARD MOVEMENT IN PATIENTS TREATED WITH REVERSE HEADGEAR AND RAPID MAXILLARY EXPANSION.

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AIM: To test the hypothesis that the buttressing effect due to rapid maxillary expansion (RME) is substantially responsible for anterior movement of point A in patients treated with RME and reverse headgear (RHG) therapy.

SUBJECTS AND METHOD: Two groups were formed: 24 patients (14 girls, 10 boys) treated with fixed appliances subsequent to RME/RHG, and 24 patients (15 girls, 9 boys) treated with fixed appliances subsequent to RME therapy. Lateral cephalograms were obtained at the beginning and end of active treatment. The cephalometric films were traced digitally and analyzed using a computer program (Dolphin Imaging, 10.5.02.68). The mean pre-treatment skeletal maturation stages of the subjects in the two groups were assessed using the cervical vertebral method.

RESULTS: There was no difference in pre-treatment maturation stages between the two groups. Anterior movement of point A, which represents forward movement of the maxilla, was 2.50 and 2.31 mm in the RME/RHG group and 1.26 and 1.05 mm in the RME group. The difference between the treatments was significant (P < 0.05).

CONCLUSION: The hypothesis is rejected. The results show that RME and RME/RHG therapy have an almost equal effect on anterior movement of the maxilla.

138 CLASS II DIVISION 2 TREATMENT – DOES SKELETAL MATURITY INFLUENCE SUCCESS AND STABILITY?

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AIM: To retrospectively analyse the influence of skeletal maturity on dentoskeletal changes during and after Herbst-multibracket (MB) treatment (tx) of Class II division 2 malocclusion subjects.

SUBJECTS AND METHOD: Thirty-seven Class II division 2 patients fulfilled the inclusion criteria (fully erupted premolars and canines, Class II molar relationship of at least 0.5 cusp width bilaterally or 1 cusp width unilaterally, retention period of at least 24 months). The mean tx duration was 21 months and the average retention period 34 months. According to pre-tx skeletal maturity (assessment by hand-wrist radiographs) the subjects were assigned to one of the following groups: pre-peak/peak (PRE: n = 9), post-peak (POST: n = 14) and end of growth (END: n = 14). Lateral cephalograms (T1: before tx, T2: after Herbst-MB tx, T3: after retention) were analysed using the SO-analysis described by Pancherz, and standard cephalometrics.

RESULTS: During tx (T1-T2), significant improvement of the sagittal molar relationship occurred in all groups (PRE +3.6 mm/POST +3.7 mm/END +3.3 mm). However, concerning skeletal effects, there was a clear group difference (PRE 19%/POST 62%/END 31%). Improvement (P < 0.01) was also seen for ANB (PRE -1.8 /POST -1.8 /END -0.8) and skeletal profile convexity (NAPg angle: PRE +3.1 /POST +4.1 /END +1.6). Furthermore, overbite decreased (P < 0.001) in all groups (PRE -3.3 mm/POST -4.5 mm/END -4.3 mm). During retention (T3-T2), minimal changes (P > 0.05) of molar relationship (<0.2 mm) and skeletal relationship (ANB: PRE +0.5 /POST -0.1 /END +0.1; NAPg angle: PRE +0.1 /POST +0.3 /END +0.1) were seen in all groups. Furthermore, overbite increased (PRE +0.5 mm, P > 0.05/POST +0.9 mm, P < 0.01/END +1.1 mm, P < 0.01).

CONCLUSION: Irrespective of skeletal maturity, Herbst-MB tx of Class II division 2 malocclusions was shown to be successful and stable. However, the post-peak group showed the highest number of skeletal effects for the correction of molar relationship.

139 EFFECTIVENESS AND EFFICIENCY OF ANTERIOR FORCED CROSSBITE CORRECTION

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AIM: To retrospectively analyse the success rate and efficiency of anterior forced crossbite correction.

SUBJECTS AND METHOD: Sixty-five patients fulfilled the inclusion criteria: anterior forced crossbite, early or late mixed dentition, treatment using an upper removable acrylic plate. Study models from before and after treatment were evaluated concerning treatment success (overjet and overbite of at least 1 mm). For the assessment of efficiency, the patients' treatment charts were checked regarding treatment duration and the number of appointments until the crossbite was corrected or treatment was discontinued. Furthermore, possible predicting factors for treatment success were assessed: ANB angle, individualised ANB angle (Panagiotidis and Witt, 1977), Wits appraisal, mandibular plane angle, Angle Class, number of teeth in crossbite, dental maturity, cooperation (assessed as negative comments in the treatment chart).

RESULTS: A successful crossbite correction was achieved in 48 patients (74%) in an average of 6.0 months and 3.2 appointments. After a further 10 months and 6.4 appointments was completed. In 17 patients (26%) the treatment goal was not achieved even after an average of 23.4 months and 13.8 appointments. Concerning possible predicting factors for treatment success, only Angle Class (I = 83% success / III = 63% success), the number of teeth in crossbite (1-2 teeth = 81% success / 3-4 teeth = 42% success), dental maturity (early mixed = 84% success / late mixed = 52% success) and cooperation (number of negative comments success group = 1.5 / failure group = 3.1) seemed to influence treatment outcome. None of the cephalometric parameters were of prognostic value.

CONCLUSION: Removable acrylic plates show a moderate success rate and efficiency for the correction of an anterior forced bite. The chance for treatment success seems to be highest in early mixed dentition Angle Class I patients with one or two teeth in crossbite.

140 OPEN BITE TREATMENT IN ADULT PATIENTS WITH TEMPORARY ANCHORAGE DEVICES

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AIM: To illustrate the use of temporary anchorage devices (TADs) in adult patients with a severe open bite.

SUBJECTS AND METHOD: Ten adults patients aged 25 to 35 years with a Class I malocclusion, a Class I molar relationship, crowding in the lower and upper arches, a hyperdivergent skeletal pattern and a severe open bite. Panoramic and lateral radiographs were taken for all patients at the beginning and end of treatment. The orthodontic treatment plan was carried out using traditional fixed appliances with extraction of the four second premolars to reduce crowding and a transpalatal bar (vertical holding appliance) to control the vertical dimension. Two TADs (Spider Screw SL 1.5×8 mm) were inserted in the upper arch between the first and second molars in the attached gingiva. Intrusion of posterior sectors was achieved by means of elastic modules connected from the TAD directly to the 0.018 ×0.022 stainless steel archwire.

RESULTS: The mean treatment time was 24 months. At the end of orthodontic treatment all patients finished with a Class I canine and molar relationship, upper and lower crowding was corrected, as well as the severe open bite.

CONCLUSION: The use of TADs combined with a vertical holding appliance could represent an effective treatment option in cases of severe open bite in adult patients with a hyperdivergent skeletal pattern because the vectorial forces expressed by the system permits bodily intrusion of the upper molars.

141 CRANIAL BASE PARAMETERS IN RELATION TO SKELETAL MALOCCLUSION TYPE

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AIM: To assess the possible relationship between cranial base morphology and the aetiology of the three Classes of skeletal malocclusion.

SUBJECTS AND METHOD: Forty patients in the mixed dentition stage of development, from which a control sample and three malocclusion Classes were formed. Lateral cephalograms of all patients were traced and the following cranial

base dimensions were measured: anterior cranial base length (N-S), posterior cranial base length (S-Ba), total length (N-Ba) and cranial base angle (N-S-Ba).

RESULTS: N-Ba differed more or less significantly for every malocclusion group. For this variation in N-Ba, N-S and S-Ba were responsible, but mostly N-S-Ba. In skeletal Class III malocclusions there was a marked increase in the flexure of the cranial base, which appeared to be related to forward displacement of the mandible.

CONCLUSION: Even though the cranial base is considered to be a major factor in determining the anteroposterior relationships of the jaws and the dental arches, it is not the only factor involved in malocclusion; other factors may influence static jaw position and the degree of prognathism in individual cases.

142 OSSEOINTEGRATED PALATAL IMPLANT SUPPORTED VERSUS CONVENTIONAL DENTAL ANCHORAGE IN ADOLESCENTS***

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AIM: Clinical comparison of osseointegrated palatal implant (PI) supported anchorage with conventional dental anchorage (DA) for two-phase retraction, in extraction cases requiring 'maximum anchorage', in growing patients after the postpubertal growth spurt.

SUBJECTS AND METHOD: Thirty patients with homogeneous facial skeletal characteristics (mean age: 14.22 ± 1.37 years) were randomly allocated to two groups. In the PI group (n = 15, mean age 14.15 ± 1.2 years) Orthosystem® implants were placed into the palate for absolute anchorage and in each case a 1.2×1.2 mm thick rigid transpalatal arch (TPA) was fixed to the implant and to the molar bands by laser welding. In the DA group (n = 15, mean age 14.3 ± 1.57 years) maximum anchorage was provided by a TPA and a 0.017×0.025 inch stainless steel (SS) utility arch. A superelastic closed-coil spring was used for canine retraction. Sequential activation of the 'teardrop' closing loop of the SS contraction arch was used for incisor *en masse* retraction. The main outcome measures were duration of the orthodontic treatment phases and cephalometric analysis of maxillary first molar movement.

RESULTS: An insignificant difference (P = 0.47) was observed between the groups regarding the duration of canine retraction; however in the PI group the duration of the anterior retraction was shorter (P < 0.05). The total treatment time was shorter by five months in the PI group. In molar mesial movement no significant difference was found during canine retraction but the anchorage loss during anterior retraction in the PI group was less (P < 0.05). No significant difference was found in net molar anchorage loss between the groups.

CONCLUSION: Conventional maximum dental anchorage stability was equivalent to a PI during canine retraction and sufficiently stable during the whole of treatment to achieve the typical treatment goals. Indications for maximum anchorage should be redefined corresponding to the new anchorage tools.

143 ASSESSMENT OF THE RELATIONSHIP BETWEEN SOFT TISSUE AND SKELETAL FACIAL PROFILE

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AIM: Facial aesthetic and soft tissue morphology play an important role in contemporary orthodontic treatment planning. The aim of this study was to examine

the relationships between soft tissue profile and underlying skeletal structures and show the possibility to assess a sagittal jaw relationship through soft tissue contour analysis.

MATERIALS AND METHOD: Lateral cephalometric head films of 137 children, aged 7 to 12 years, who had not undergone orthodontic treatment. From the total sample only children with a skeletal Class I as determined by ANB angle, Wits appraisal and NAPg angle were further examined. The stratum of ANB Class I contained 51 children, i.e. 37 per cent of the total sample, whereas the stratums of Wits and NAPg Class I had 57 and 53 individuals, 41.6 and 38.7 per cent of the total sample, respectively. The relationship between the soft and hard tissue profile was examined through the correlation between ANB, Wits appraisal and NAPg, which represent a sagittal jaw relationship, and appropriate soft tissue parameters: A'N'B' and NSnPg' angles.

RESULTS: Statistical analysis revealed significant correlations between skeletal sagittal parameters and their soft tissue analogs: A'N'B' and N'SnPg' (P < 0.001). However, the correlation between NAPg and soft tissue analogs was the highest (r = 0.667). This finding confirms Holdaway's statement that the angle of facial convexity directly influences the position of the lips and soft tissue chin.

CONCLUSION: There is strong correspondence between the soft tissue facial profile and its underlying skeleton. Therefore, the soft tissue angle A'N'B' and N'SnPg' angle could be a preliminary method for assessment of sagittal jaw relationship.

144 A RETROSPECTIVE STUDY OF AETIOLOGICAL FACTORS LEADING TO A MANDIBULAR FUNCTIONAL SHIFT.

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AIM: Lateral mandibular deviation (LMD) represents an important part of transverse anomalies. Clinically, there is a deviation from the centre point of the chin and the lower inter-incisor point compared with the median sagittal plan at the end of closing of the oral path. This pathology affects muscle balance and condylar position. If left untreated, LMD can lead to mandibular joint disorders and asymmetry of the skeletal bases, leading to an anatomical mandibular shift. LMD is often associated with dental crossbites. The aim of this study was to investigate potential aetiological factors of LMD and crossbites by assessing statistical correlations between this pathology and various parafunctions in a sample of young patients undergoing orthodontic treatment. SUBJECTS AND METHOD: The records of 779 children between 7 and 12 years. Based on their analysis, several parameters were identified such as LMD, dental crossbite, breathing pattern, digit sucking habit, short lingual fraenulum and nail biting.

RESULTS: Significant correlations were found between LMD and three parameters: dental crossbite (P < 0.001), mouth breathing (P < 0.05), and a short lingual fraenulum (P < 0.01). However, no significant relationship could be found between LMD and thumb sucking or nail biting.

CONCLUSION: The results are similar to those in the literature, except for the relationship between LMD and thumb sucking. The occurrence of LMD is strongly correlated with ear-nose and throat (EN) dysfunctions such as mouth breathing and oro-maxillofacial disorders such as a short lingual fraenulum and dental crossbites. These results emphasize the importance of a multidisciplinary management, involving orthodontists, ENT specialists, speech therapists and stomatologist.

145 COMPARISON OF MAXILLARY OCCLUSAL PLANE INCLINATION TRANSFERRED USING THREE DIFFERENT FACEBOW SYSTEMS

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AIM: To compare occlusal plane steepness on semi-adjustable articulators, transferred using three different facebow systems, with the cant of the maxillary occlusal plane in the sagittal and frontal planes measured on cephalometric radiographs taken in the natural head position (NHP).

MATERIALS AND METHOD: The facebow records of 30 patients who had undergone orthodontic treatment were taken with A SAM® facebow, AN Artex® facebow and a newly developed maxillary bubble level stand. These records were compared with lateral and frontal cephalometric radiographs taken in the NHP in the sagittal and transverse planes. The slope of the maxillary occlusal plane was used for comparison. To assess the reliability of the maxillary bubble level stand method, the records were repeated after one hour and the measurements were compared with oneway ANOVA.

RESULTS: The maxillary bubble level stand was reliable. Statistically significant differences were found between the cephalometric sagittal measurements and those of the different facebow records (P < 0.001). No significant difference was observed between the bubble level stand measurements or the lateral cephalometric records (P > 0.05); whereas the values of the SAM® and Artex® facebow groups were statistically different from those of the lateral cephalometric measurements (P < 0.01 and P < 0.05, respectively). No statistically significant difference was detected between the groups in the transverse measurements (P > 0.05).

CONCLUSION: Transfer with a bubble level stand using the true horizontal plane in NHP, is a reliable and reproducible transfer method. The sagittal maxillary occlusal plane inclination in the maxillary bubble level stand transfer system was closer to the maxillary occlusal plane inclination in NHP than those with the other facebow systems using different intracranial planes. Frankfort horizontal and the Camper plane may not always be parallel to the true horizontal plane and may lead to errors in facebow transfer.

146 COMPARISON OF THE BOND STRENGTH OF FIVE ORTHODONTIC ADHESIVE MATERIALS

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AIM: To compare the bond strength of five orthodontic adhesive materials by means of a tensile test.

MATERIALS AND METHOD: Composite resins: Transbond XT (3M Unitek, Monrovia, California, USA), Light Bond (Reliance Orthodontic Products, Itasca, Illinois, USA), No-mix (American Orthodontics, Sheboygan, Wisconsin, USA) and resin modified glass ionomer cements (RMGIC) Fuji Ortho LC (GC Corporation, Tokyo, Japan) and Fuji Ortho (GC Corporation). Metal brackets (OmniArch, Dentsply GAC International Bohemia, New York, USA) were bonded with the adhesives to the buccal surface of 125 (5 groups of 25) extracted human premolars. The enamel was etched for 20 seconds with 37 per cent orthophosphoric acid for composite adhesives and the RMGICs 10 seconds with 10 per cent polyacrylic acid. The teeth were stored in distilled water at room temperature. Bond strength was

measured by means of a tensile test on a Zwick Z020 testing machine. The tensile reader was set for 2.5 kN, speed 2 mm/minute.

RESULTS: Composites had statistically higher mean bond strengths than RMGIC (parametric analysis of variance ANOVA P < 0.0001). The mean bond strengths were: group A, light cured composite Transbond XT, 16.21 MPa, group B, light cured composite Light Bond, 16.76 MPa, group C, chemically cured composite No-mix 13.77 MPa, group D, light cured GIC Fuji Ortho LC, 11.32 MPa and group E, chemically cured GIC Fuji Ortho, 10.47 MPa.

CONCLUSION: The bond strength of all adhesives was over 8 MPa, which is the strength recommended by Reynolds for effective practical use. Composites had higher bond strengths. However, both composites and RMGICs showed sufficient bond strength for clinical practice. Therefore material selection is also affected by other factors, e.g. cariostatic effect, environment of adhesion, length of procedure, method of bracket removal, amount of adhesive residue on the enamel surface, costs, etc.

147 EFFECTS OF RAPID AND SLOW MAXILLARY EXPANSION ON THE RADICULAR MORPHOLOGY OF THE FIRST PERMANENT UPPER MOLARS R Bucci, G Franzese, P Manzo, I Cioffi, R Martina, Department of Oral Sciences, Section of Orthodontics and Temporomandibular disorders University of Naples Federico II, Italy

AIM: To evaluate the *in vivo* effects of rapid (RME) and slow (SME) maxillary expansion on root morphology of the first permanent upper molars, in order to verify which of the two methodologies is less harmful to root tissues.

MATERIALS AND METHOD: Low dose computed tomography (CT) examinations of 20 patients, treated with a two banded palatal expander, performed before treatment (T0), and 5 months after the first activation of the expander (T1). Twelve subjects (6 males, 6 females, mean age \pm SD = 9.4 \pm 2.3 years) were treated by RME and eight subjects (4 males, 4 females, mean age \pm SD=9.4 \pm 1.6) by SME. Activation of the screw was three turns/day (0.75 mm/day) in the RME group and two turns/week in the SME group (0.50 mm/week). Dedicated software was used to segment the roots of the first permanent maxillary molars to create a three-dimensional model of the segmented tissues, and to measure the root volumes and densities of root tissues. Analysis of variance was used to detect T1-T0 differences.

RESULTS: No significant statistical differences between RME and SME were found with respect to root volume or density. Root resorption was well below the voxel size, and amounted to less than 1 per cent of the mean root volume in both expansion treatment modalities.

CONCLUSION: Both expansion techniques have similar effects on radicular morphology and tissue densities.

148 EFFECTS OF A POSTERIOR CROSSBITE ON ROOT DEVELOPMENT OF POSTERIOR TEETH

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AIM: A persistent crossbite is capable of causing asymmetrical and non-uniform force exertion on posterior dentition which in turn may affect bone as well as root development. The aim of this study was to retrospectively investigate the root development by metric analysis of computerized tomography (CT) scans based on examination of the posterior teeth of adolescents with posterior crossbites.

SUBJECTS AND METHOD: Nine unilateral posterior crossbite subjects and 24 noncrossbite controls. The CT scans were acquired using New Tom 5G. Threedimensional images were rendered using Simplant[®] Pro software. The root lengths of upper teeth from canine to first molar were measured metrically on CT scans for both sides. The data was evaluated using a Mann-Whitney U test.

RESULTS: There were no statistically significant root length differences between the right and left sides of either study group (P > 0.05). The root lengths of the crossbite and non-crossbite subjects were also not statistically different (P > 0.05) except for the canines that appeared to be significantly longer (17.49 to 15.03 mm) in the non-crossbite group (P < 0.001).

CONCLUSION: A posterior crossbite does not cause significant root length differences on opposite sides of the posterior dentition. However, a posterior crossbite seems to be capable of adversely affecting canine root development causing shorter root formation in crossbite subjects.

149 ROOT RESORPTION OF UPPER AND LOWER FIRST PREMOLARS AFTER FOUR WEEKS OF OCCLUSAL TRAUMA

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AIM: To measure and quantitatively compare the volumes of root resorption following four weeks of occlusal trauma.

SUBJECTS AND METHOD: Forty-eight maxillary and mandibular first premolars of 12 patients (6 girls, 6 boys) who required bilateral extractions as part of their orthodontic treatment. The mean age was 15 years 6 months. One side of the dental arch was used as the control. On the contralateral side, a light-cure glass ionomer cement (Transbond Plus, 3M Unitek) was bonded onto the occlusal surface of the lower first premolar in such a way that the cement was in contact with the upper first premolar. The thickness of the cement was adjusted to 2 mm between the buccal cusp tips of the upper and lower first premolars. After four weeks, the upper and lower first premolars were extracted on both sides. Each sample was imaged using a micro-computed tomographic system (SkyScan 1172, SkyScan, Aartselaar, Belgium), and then analyzed with specially designed software for volumetric measurements of resorption craters. Furthermore, pain was evaluated with the visual analogue scale for seven days.

RESULTS: The total resorption volume of the trauma group was significantly higher than that of the control group (P < 0.001). In the trauma group, there was a significant difference among the root surfaces (P < 0.01); this difference originated from the buccal and distal surfaces (P < 0.083). The apical, middle and cervical thirds did not reveal a significant difference in either group. The degree of pain did not differ significantly. There was no statistically significant difference in pain for the upper and lower teeth.

CONCLUSION: Occlusal trauma caused statistically significant root resorption of the upper and lower premolars when compared with the control group.

150 EVALUATING EFFICIENCY OF DIFFERENT INTERPROXIMAL ENAMEL STRIPPING METHODS

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AIM: To investigate the efficiency of common orthodontic interproximal enamel stripping methods.

MATERIALS AND METHOD: To test the effects of stripping method, time, and material wear on the amount of enamel reduction, 120 extracted male premolar teeth were divided into 12 groups. The teeth were stripped by different methods (Komet stripping discs, Ortho-Strips or metal strips) for different time periods (10 or 20 seconds) with new or previously used stripping materials. Teeth were polished by Sof-Lex discs according to a standard technique. A Plexiglas® set-up was used to strip teeth and to obtain radiographs in a standard position. The teeth were stripped using an electrical micromotor with a digital chronometer at the dental unit. Radiography was performed with a Dentaline RVG device before and after stripping and after polishing to determine the amount of stripped and polished enamel. To evaluate reductions in enamel, a computer program was used to calibrate the images. Statistically significant differences were defined as those having a value of P < 0.01. **RESULTS:** After stripping for 10 seconds, mean enamel reductions of 0.22 and 0.05 mm were obtained with Komet stripping discs and Ortho-Strips, respectively. After stripping for 20 seconds, reductions of 0.34, 0.09, and 0.05 mm were obtained with Komet stripping discs, Ortho-Strips, and diamond-coated metal strips, respectively. Stripping discs were the most effective method, and loss of tooth substance was lowest with the metal strips (both P < 0.01). The stripped enamel amount increased directly with stripping time and decreased indirectly with the wear level of the stripping materials. Loss of tooth substance by polishing (mean: 0.01 mm) was

CONCLUSION: For treatment planning and dental health, it is important to understand the degree to which enamel is reduced by different stripping methods and times. The amount of enamel stripped by polishing was negligible.

151 DENTAL ANOMALIES IN A PORTUGUESE POPULATION

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AIM: To evaluate the prevalence and pattern of agenesis, supernumerary teeth, impacted teeth and transpositions, as well as the relation between them, in a Portuguese sample.

SUBJECTS AND METHOD: The study group comprised 2888 patients, observed between 2005 and 2009. Evaluation of the following parameters was undertaken: agenesis of all teeth, supernumerary teeth, included permanent teeth and tooth transposition. The age range of the subjects varied from 7 and 21 years. In order to study third molar absence, those aged below 14 years were excluded. Statistical analysis was performed using the SPSS®.

RESULTS: Excluding third molars, the prevalence of tooth agenesis, supernumerary, included teeth and transpositions were 6.1, .8, 1.8 and .2 per cent, respectively. There was a significantly higher prevalence of supernumerary teeth in males than in females (P < 0.05). A mesiodens was the most frequent supernumerary tooth, the upper canine was the tooth included most frequently, and the upper canine with the upper lateral were the two teeth more frequently transposed. There was a significantly higher prevalence of missing third molars in the included canine group than in the non-included canine group (P < 0.05).

CONCLUSION: Agenesis is the most frequent dental anomaly. No differences were found between genders, except for supernumerary teeth, which were more frequent in males. A relationship between third molar agenesis and included canines was found.

minimal.

152 *IN VITRO* STUDY TO DETERMINE MARGINAL QUALITY OF METAL BRACKETS. IS THERE A DIFFERENCE BETWEEN BOVINE AND HUMAN TEETH UNDER THERMOCYCLING?

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AIM: In many studies, bovine teeth are used as equivalent substitutes for human teeth. The aim of this research was to compare the marginal quality of orthodontic metal brackets subjected to thermocycling (TC) between bovine and human enamel.

MATERIALS AND METHOD: Twenty healthy teeth per group were extracted and stored in chloramine-B (0.5%). A metal bracket (Discovery®, Dentaurum) was bonded onto each enamel surface with light-curing adhesive (TransbondTM XT, 3M Unitek). After 24 hours dye-penetration with methylene-blue (0.5%), the cervical and incisal bracket surfaces were analyzed. Light-microscopy was used to detect any dye penetration and marginal gaps (interface bracket/composite = iB/C, composite/enamel = iC/E). TC (×5000, 5-55°C) was followed by re-staining and re-evaluation.

RESULTS: Human teeth, compared with bovine teeth, had more than 3 times less marginal gaps before TC (P < 0.001) and a relatively similar gap distribution after TC (P = 0.180). After TC the analyzed interfaces showed most of the gaps at iC/E for human (74%) and bovine (64%) teeth. No dye penetration was observed at any cut surface.

CONCLUSION: Human teeth appear to have fewer marginal gaps than bovine teeth around the bracket base directly after applying metal brackets. However, the marginal gaps around the bracket base seem to be superficial in human and bovine teeth and do not lead to dye penetration into the deeper layers underneath the bracket base.

153 EVOLUTION OF DIFFERENT DIMENSIONAL CHARACTERISTICS IN LOWER DENTAL ARCHES

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AIM: To analyze how time influences the dimensional characteristics of the dental arches considering the variations associated with age and gender.

SUBJECTS AND METHOD: Fifty-four randomly selected Spanish subjects in the permanent dentition, without agenesis or missing teeth. Forty-one lower casts from 20 females and 21 males (average age, 27.14 years) were included. All dimensions (dental mesiodistal diameters, intercanine and intermolar distances, arch lengths and lower dental crowding) were measured twice with a digital calliper. For statistical analysis, regression lines were drawn for each variable versus age and gender.

RESULTS: Mesiodistal diameters in males were greater than in females. Intercanine distance decreased with age in males, while intermolar distance increased. Females were almost equal in both dimensions. Arch length decreased in both genders with an increase in age. There was an increase of anteroinferior dental crowding with age in both genders.

CONCLUSION: A decrease of arch length could affect later anteroinferior dental crowding. Mesial displacement of the teeth to a narrower part of the arch could explain the decrease in intercanine and intermolar widths.

154 EXPANSION IN THE MIXED DENTITION: AN ALTERNATIVE METHOD

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AIM: To investigate changes in the maxillary transverse dimension (dentoalveolar expansion) produced by a low-friction system during the levelling and aligning phases of fixed appliance therapy.

SUBJECTS AND METHOD: Twenty patients in the mixed dentition with a negative transverse discrepancy (mean 4.3 mm) consecutively treated with preadjusted brackets, superelastic nickel titanium round archwires, and low-friction ligatures (Slide). Dental casts of the maxillary arch were obtained before treatment (T1) and at the end of levelling and aligning (T2). The T1-T2 changes were tested statistically with a Wilcoxon signed-rank test.

RESULTS: Statistically significant increases were recorded for all dentoalveolar widths (1.6 to 4.0 mm). The changes in arch depth and arch perimeter were not significant.

CONCLUSION: The low-friction system produced statistically significant increases in the transverse dentoalveolar measurements in the mixed dentition phase.

155 ENAMEL DEFECTS ON THE MAXILLARY PREMOLARS IN CLEFT PATIENTS: A RETROSPECTIVE STUDY

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AIM: To investigate whether surgical closure of the soft palate has any relationship with the appearance of developmental defects of enamel on the maxillary premolars in cleft patients (CP). Such a relationship could be suspected since the formation of the enamel occurs around the same period as soft palate closure.

SUBJECTS AND METHOD: One hundred and twenty three cleft patients followed by the Cleft Team of University Hospitals of Leuven (CT-UHL). All four maxillary premolars were examined on the available clinical photographs by three independent observers according to the Developmental Defects of Enamel Index. Three groups were formed: 1) 89 CP patients from CT-UHL, 2) 18 CP patients who received surgical intervention at private clinics and 3) 16 cleft lip and alveolus patients from CT-UHL and private clinics. Group 1 was subdivided into cleft type: palate cleft, unilateral cheilo-gnatho-palate cleft (CGPC) on the right side, unilateral CGPC on the left side and bilateral CGPC.

RESULTS: Out of the total sample, 43 patients showed developmental defects on one or more of their maxillary premolars. All these developmental defects occurred in the first group of patients. No significant differences could be found between the four subgroups of group 1, i.e. type of palatal cleft.

CONCLUSION: The surgical technique used by the CT-UHL for closure of the soft palate appears to have some influence on the appearance of developmental defects in premolars. This can be due to interference with the blood supply during surgical closure of the soft palate. More research is needed however to confirm these findings.

156 ORTHOGNATHIC OUTCOME IN A TEACHING HOSPITAL AND A DISTRICT GENERAL HOSPITAL ENVIRONMENT

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AIM: To evaluate the orthognathic outcome in a teaching hospital and a district general hospital environment and to compare these outcomes. The main outcome was assessed using the Peer Assessment Rating (PAR) Index and this was correlated with treatment variables that included demographics, malocclusion, treatment length and grade of clinician.

SUBJECTS AND METHOD: One hundred and sixty two and 277 patients were identified from Guy's Hospital (GH) and Kingston Hospital (KH), respectively from joint orthodontic-orthognathic clinics held between 2006-2011. One hundred and sixty and 177 records were available from GH and KH, respectively. Data was gathered from patient notes, radiographs and study models which included demographics, referral source, malocclusion, grade of clinician, treatment length, surgical movements, complications, cephalometric values ANB and start and finish maxillary and mandibular unit lengths. Patients with craniofacial syndromes and orofacial clefting were excluded. Final outcome was assessed using PAR scores.

RESULTS: Ninety patients completed treatment, 56 mid-treatment and 14 dropped out at GH. One hundred and eighty-nine completed treatment, 81 mid-treatment and seven dropped out at KH. Data analysis showed that the treatments provided were effective in terms of skeletal and dental outcomes; the mean PAR scores were 86 per cent (GH) and 84 per cent (KH). There was no statistically significant difference between the two hospitals. Treatment was longer than expected; 32.3 (GH) and 30.5 months (KH) but there was no significant difference. Interestingly the planning to surgical stage was longer at KH as were the overall number of appointments and this was significant. Using ordered logistic regression neither gender nor malocclusion were significant predictors of PAR

CONCLUSION: Combined orthodontic–orthognathic treatment at GH and KH is equally effective but treatment duration is longer than expected. This is useful information to aid the patient consent process. The outcome of treatment was not influenced by treatment variables.

157 MINIMUM DATASET COMPLIANCE FOR ORTHOGNATHIC PATIENTS AT KINGSTON HOSPITAL, ENGLAND

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AIM: To evaluate compliance of orthognathic record keeping for patients treated at Kingston Hospital (orthodontics) and St George's Hospital [Oral and maxillofacial surgery (OMFS)] with the British Orthodontic Society (BOS)/British Association of Oral & Maxillofacial Surgeon (BAOMS) Minimum Dataset. One hundred per cent compliance would be ideal and therefore the standard set for this audit.

SUBJECTS AND METHOD: Patients who commenced an orthognathic treatment plan in the year 2008 were identified from the departmental logbook. Data pertaining to compliance was collected retrospectively from hospital records using the BOS/BAOMS Minimum Dataset Proforma. Patients who failed to complete treatment were excluded from the audit. Data analysis was carried out.

RESULTS: Forty-eight patients were identified. Compliance for the various aspects of record keeping were varied though generally good pre-operatively and poorer post operatively. In particular, the timing and type of post-operative radiographs were inconsistent and documentation of pre- and post-operative sensory disturbance was consistently lacking. The BOS questionnaire was not completed by any of the sample. A common incidental finding was that of haphazardly filed, and often loose, medical record sheets in patient files.

CONCLUSION: Orthognathic record keeping at Kingston Hospital can be improved through conscious application of the minimum dataset as routine practice. Timely completion of filing of this proforma within the patient's file, may improve compliance and encourage good practice.

158 BIOETHICS IN DENTISTRY: A CURRENT PERSPECTIVE

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AIM: From Hippocrates, ethics in medicine/odontology had a traditional continuity until about the middle of the XX century, when its strong traditions began to be replaced owing to social and technological changes. The aim of this research was to update bioethical changes in dentistry century due to socio-technological, orthodontic and orthopaedic development.

MATERIALS AND METHOD: Bibliographic research was conducted from 2005 to 2011 using six keywords: bioethic, patient/dentist relationship, autonomy, medical/patient communication, health coaching and informed consent.

RESULTS: The traditional four ethical codes, which are privacy, fidelity, confidentiality, clinical-researcher relationship, are complemented by 'truthfulness'. Everyone has the right to participate in treatment decision-making because autonomy is accepted among the medical environment. In 2005 the Barcelona Forum of patients claimed the need to establish a relationship of trust and mutual respect for patient involvement in decision-making. Communication with the patient goes beyond establishing diagnosis. It is necessary to understand what the patient wants. The paternalistic relationship evolves into one in which the patient is an active agent. Communication is an art requiring complementary skills, such as non-verbal communication, paralinguistic aspects and an assertive communication style. Health coaching is a personal change in management that helps to pass a current to a desired position. The aim is to prevent a habit and obtain some improvement. It requires health care experience. Informed consent is not just a document, but a continuous relationship process with the patient. The current international point of view is considered as the practice of 'defensive dentistry'.

CONCLUSION: If we wish dental practice to continue to be a profession, this challenge must be met and needs of 21st century society and patient trust responded to.

159 LONG-TERM FOLLOW-UP OF DENTOSKELETAL EFFECTS IN PATIENTS TREATED WITH THE FRÄNKEL-2 APPLIANCE

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AIM: To evaluate the dentoskeletal effects produced by the Fränkel-2 (FR-2) appliance during treatment of patients with Class II malocclusions by mandibular retrusion, and to verify the long-term stability of these changes.

MATERIALS AND METHOD: Pre- and post-treatment and long-term serial cephalograms (at least 10 years after the end of treatment) of patients treated with the FR-2 were compared with data from untreated controls. All patients and controls had a Class II malocclusion caused by a short mandibular body. Lateral cephalograms were analyzed with a specific tracing regimen in both groups. Summary measures for the initial cephalometric values and increments of changes between visits within groups were calculated and tested by paired *t*-test.

RESULTS: Compared with the controls, FR-2 treatment produced a significant decrease in ANB that improved the skeletal intermaxillary and occlusal relationship. At long-term follow-up, the FR-2 group showed further improvements of skeletal intermaxillary and occlusal relationship; therefore the changes observed during treatment showed no compensatory decline or 'rebound'.

CONCLUSION: FR-2 treatment, in conjunction with a period of post-functional fixed appliance therapy designed to perfect the occlusion, can produce a long-lasting improvement of skeletal Class II malocclusions with little skeletal correction and significant incisor compensation.

160 A LABORATORY STUDY OF THE MECHANICAL BEHAVIOUR OF LOOPS

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AIM: The possibility to quantify, as well as to control moment-force (M/F) ratios in brackets are the key for a controlled and predictable dental movement. The aim of the present work was to determine the force systems in the α of T and L shaped loops for the same vertical dimension and interbracket distance with five different preactivation bends and two metallic alloys (stainless steel and TMA) with a section of 0.017×0.025 inches.

MATERIALS AND METHOD: Two hundred loops were submitted to mechanical testing; for each pre-activation 10 loops were used. The moment and horizontal force intensities were quantified using the OrthoMeasure apparatus, a testing table and digital comparator. The values were registered every 0.5 mm of activation, with an initial activation of 1 mm and a final activation of 6 mm. The data was statistically analysed using ANOVA at a significance level of 5 per cent.

RESULTS: There were statistically significant average differences according to the pre-activation in all kinds of loops at strength and ratio M/F levels. L loops registered higher values of force than T loops and the influence from pre-activation localization was confirmed. With regard to M/F ratios, T loops registered higher values. Without pre-activation, the TMA loops presented higher values than steel loops. In the loops without pre-activation, an augmentation of the M/F ratio was demonstrated through an activation augmentation, opposite to that observed in pre-activated loops. In most activations with pre-activated loops, the steel presented M/F ratio values higher than TMA. When the bend distribution was partial or completely gingival, there was an increase in M/F.

CONCLUSION: The loop presenting the best compromise between force and M/F ratio was the T loop in TMA, with a pre-activation of 40 degrees, in the 1 to 4 mm activation interval.

161 INFLUENCE OF INTRUSION FORCES ON APICAL ROOT RESORPTION DURING ORTHODONTIC TREATMENT

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AIM: To investigate the enhanced risk of apical root resorption using utility arches in orthodontic treatment, to examine whether other parameters such as intrusive forces, orthodontic archwire system and treatment time have an influence on apical root resorption, and to determine whether one of the maxillary incisors is mainly affected by root resorption.

SUBJECTS AND METHOD: Forty patients with a deep bite. The experimental group comprised 20 patients treated with a utility arch system and a control group of 20 patients who received full-arch fixed appliances. The amount of root resorption was retrospectively quantified on the panoramic radiographs obtained before and after treatment. Root resorption of all maxillary central und lateral incisors was categorized into three degree of severity (according to Göz and Rakosi). These results were compared with those of the control group. To determine statistical differences a Mann-Whitney *U*-test was performed. The level of significance was set at $\alpha = 0.05$.

RESULTS: The degree of root resorption was not significant (P = 0.68). Single maxillary incisors were affected by apical root resorption. There was no significant difference between the experimental and control groups. Treatment time and archwires were not significantly correlated with root resorption.

CONCLUSION: The presumed risk of root resorption in orthodontic treatment using a utility arch is not related to the amount of root resorption. No significant relationship was found either between root resorption on all incisors or in relation to single maxillary incisors. The archwire system and treatment time were not significantly correlated with root shortening.

162 COMPARISON OF THE VALUES OF TANAKA-JOHNSTON, MULLER AND MOYERS METHODS FOR PROXIMITY TO THE ACTUAL VALUES R M Celik¹, Y E Akgul¹, A Demir¹, Z Sari², Departments of Orthodontics, Faculties of Dentistry, ¹Selcuk University, Konya and ²Akdeniz University, Antalya, Turkey

AIM: To compare the applicability of Tanaka-Johnston, Moyers and Muller methods for a middle Anatolian Turkish population in the mixed dentition.

MATERIALS AND METHOD: Study models of patients in the permanent dentition, excluding two (disto-occlusal-mesio-occlusal) or three (mesio-occlusal distal) face restorations, dental abnormalities, attrition and caries. The mesiodistal crown sizes of the permanent canine and premolars in the maxilla were measured and compared with the predicted values derived from the methods of Tanaka-Johnston, Moyers and Muller's (50% line from Moyers table was considered). One researcher compared 186 different measurements. An independent two sample paired *t*-test was used for statistical evaluation of alignment of actual and estimated values with each other.

RESULTS: All values obtained with the above methods did not statistically represent the actual values. However in numerical comparison of the averages, the values of Muller were closer to the actual values.

CONCLUSION: Although all the methods evaluated did not accurately represent the actual values, Muller's method was observed to be more accurate.

163 DIAGNOSIS OF DENTAL MATURITY FOR IDENTIFICATION OF SKELETAL MATURATION

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AIM: To analyse the diagnostic performance of the circumpubertal dental maturation phases for the identification of individual-specific skeletal maturation phases.

SUBJECTS AND METHOD: Three hundred and fifty four healthy subjects, 208 females and 146 males (mean age, 11.1 ± 2.4 years). Dental maturity was assessed through the calcification stages from panoramic radiographs of the mandibular canine, the first and second premolars, and the second molar. Determination of skeletal maturity was according to the cervical vertebra maturation (CVM) method on lateral cephalograms. Diagnostic performances were evaluated according to the dental

maturation stages for each tooth for the identification of the CVM stages and growth phases (as pre-pubertal, pubertal, and post-pubertal) using positive likelihood ratios (LHRs). A positive LHR threshold of 10 or more was considered for satisfactory reliability of any dental maturation stage for the identification of any of the CVM stages or growth phases.

RESULTS: The positive LHRs were generally less than 2.0, with a few exceptions. These four teeth showed positive LHRs greater than 10 only for identification of the pre-pubertal growth phase, with values from 10.8 for the second molar (stage E) to 39.3 for the first premolar (stage E).

CONCLUSION: Dental maturation assessment is only useful for diagnosis of the pre-pubertal growth phase, and thus, precise information in relation to the timing of the onset of the growth spurt is not provided by these indices

164 MAXILLARY CANINE RETRACTION WITH IMPROVED SUPERELASTIC NICKEL TITANIUM AND STAINLESS STEEL WIRES C-C Chen, Department of Dentistry, Tzu Chi General Hospital Taipei Branch, Taiwan

AIM: Improved superelastic nickel titanium wire (ISW) is now widely used in orthodontic treatment. In premolar extraction cases, canine retraction can proceed on ISW from the initial stage. However, there are few studies concerning comparison of ISW with stainless steel wire during canine retraction. The aim of research was to investigate the efficiency of canine retraction with both materials.

SUBJECTS AND METHOD: Six orthodontic patients aged from 20 to 35 years with severe crowding or maxillary protrusion. Extraction of maxillary premolars was planned. The archwire split from mid-line of right and left central incisors when canine retraction began. On the left side ISW and on right side stainless steel wire were used, then 100 g nickel titanium close coil springs were placed to perform canine retraction. In three cases, miniscrews were inserted in the molar area as absolute anchorage. In the other three cases, the coil spring was placed from the first molars to the canines. The amount of canine movement and anchorage loss were evaluated every 4 weeks.

RESULTS: Even though stiffness and friction of ISW and stainless steel wire were different, there was no significant difference between ISW and stainless steel wire regarding the retraction of maxillary canines and anchorage loss. In both groups similar data was collected.

CONCLUSION: Canine retraction and alignment of the dentition could be performed simultaneously on ISW soon after tooth extraction. Thus, total treatment duration may be shortened. The efficiency of canine retraction on both ISW and stainless steel wire are similar.

165 ORTHOGNATHIC SURGERY: PRINCIPLES IN SUBJECTS WITH A CLASS III MALOCCLUSION.

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AIM: Perfection of combined treatment planning in complex rehabilitation of patients with a gnathic form of Class III malocclusion.

SUBJECTS AND METHOD: Seventy-nine patients aged 18-25 years with a gnathical form of a Class III malocclusion were investigated before and after combined orthodontic-surgical treatment.

RESULTS: Three degrees of expressiveness of the anomaly in a vertical plane were: 1st: <NGoMe – 70-79, <Pn\OccL - 78, Wits - 11; 2nd: <NGoMe – 79-80, <Pn\OccL - 71, Wits - 13; 3rd: <NGoMe – 85-90, <Pn\OccL - 66, Wits - 17. CONCLUSION: 1. The volume of the mouth cavity should not decrease as a result of movement of the jaws. 2. ANB angle should be kept within average norm. 3. It is not recommended to increase the parameters characterizing the position of the maxillary bones in a vertical direction. 4. Sagittal movement of the mandible should be at a minimum level and should not exceed 7 mm, thus the mandible should be rotated no more than 5 degrees. 5. The direction of displacement of the maxilla directly depends on the planned position of the mandible. 6. Vertical displacement of the maxilla should not exceed 5-7 mm a d mesial displacement 7-8 mm.

166 CHANGE OF MANDIBULAR POSITION DURING TWO-PHASE ORTHODONTIC TREATMENT OF SKELETAL CLASS II IN THE CHINESE POPULATION

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AIM: To investigate mandibular sagittal change during two-phase orthodontic treatment of skeletal Class II malocclusions in the Chinese population.

SUBJECTS AND METHOD: Thirty consecutively treated Chinese males who fulfilled the selection criteria. They had received two-phase treatment: (1) Cast-Herbst appliance and (2) pre-adjusted edgewise therapy. The average age at the start of phase I (T0) was 13.4 ± 1.2 years. The average durations of phase I (T0-T1) and phase II (T1-T2) were 1.1 ± 0.2 and 1.9 ± 0.8 years, respectively. Cephalograms taken at T0, immediately after Herbst treatment (T1) and immediately after pre-adjusted edgewise therapy (T2) were analyzed according to Pancherz's method.

RESULTS: The average change in sagittal positioning of the mandible during T0-T1 was 6.8 mm (S.D. 3.44 mm), T1-T2 0.4 mm (S.D. 2.79) and T0-T2 7.2 mm (S.D. 4.67). During the first phase the mandible came forward in 100 per cent of the patients, was unchanged in 0 per cent and went backward in 0 per cent; the corresponding figures during the second phase were 33.3, 33.3 and 33.3 per cent, and for the total treatment (T0-T2) 100, 0 and 0 per cent.

CONCLUSION: The first phase treatment with the functional appliance seemed to have a beneficial change on the mandible in all patients, whereas for the second phase there was no or negative change of the mandibular position in the correction of the Class II malocclusion, in the majority of the patients.

167 A RETROSPECTIVE STUDY OF FACTORS ASSOCIATED WITH THE CLINICAL SUCCESS OF ORTHODONTIC MINISCREWS

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AIM: To study the success rate and investigate factors affecting the clinical success of miniscrews used as orthodontic anchorage.

MATERIALS AND METHOD: Three hundred and thirteen miniscrews in 128 patients were examined by reviewing the treatment notes. The criterion for miniscrew success was anchorage function sustained until intentional removal or for more than 12 months after insertion. Potential confounding variables investigated were: gender, placement site (maxilla or mandible), and type, length and diameter of the miniscrew. The logistic regression model, fitted using generalized estimating equations (GEE), was used to examine the association between factors and the clinical success of the miniscrews. The analyses were performed using Stata version 10 and a value of P < 0.05 was used to determine statistical significance.

RESULTS: The overall success rate was 81.5 per cent. The results of the univariate analysis by the GEE method showed that the odds of achieving clinical success were higher for longer miniscrews (OR: 1.30, 95% CI: 1.03 to 1.64, P = 0.026). The other factors (gender, placement site, type and diameter of miniscrews) showed no statistically significant association with clinical success. When all factors were considered in the multivariate analysis, the length of the miniscrew was identified as a risk factor that affects clinical success (OR: 1.34, 95% CI: 1.01 to 1.78, P = 0.040). CONCLUSION: Even though clinically useful as orthodontic anchorage, miniscrews can unpredictably fail and patients must be routinely warned of the possible need for re-insertion. Whenever possible, longer miniscrews should be used.

168 RELATIONSHIP BETWEEN MALOCCLUSION/ORTHODONTIC TREATMENT NEED AND ORAL HEALTH RELATED QUALITY OF LIFE A Cioffi, R Rongo, V D'Antò, S Martina, R Valletta, Department of Oral and Maxillofacial Sciences University of Naples 'Federico II', Italy

AIM: To assess the current evidence on the relationship between malocclusion/orthodontic treatment need and Oral Health-related Quality of Life (OHRQoL).

MATERIALS AND METHOD: Medline, via PubMed, was searched for articles published, since January 1948 to July 2011 in English, concerning the impact of malocclusion/orthodontic treatment need on OHRQoL. Electronic research was integrated by reference linkage. Eligible articles were reviewed and assessed.

RESULTS: From 37 reviewed articles, 14 were excluded from the list of potentially eligible papers because of their lack of relevance. The majority of the studies (22/23) observed an association between OHRQoL and malocclusion/orthodontic treatment need, especially in psychological and social function. Various OHRQoL measures [such as the Child Perception Questionnaire (CPQ) for children and Oral Impacts of Daily Performance (OIDP) for adults] were used to assess patient's oral health-related impacts. Subjects in most studies were classified according to their orthodontic treatment need by the Index of Orthodontic Treatment Need (IOTN) or the Dental Aesthetic Index (DAI). The strength of correlation between malocclusion/orthodontic treatment need and OHRQoL presented a wide variability. Individuals who required orthodontic treatment had worse OHRQoL indices but OHRQoL was also influenced by psychological well-being. Moreover, females were more aware than males of the appearance of their teeth and adolescents attributed great importance to an attractive dental aspect. Only one study demonstrated that orthodontic treatment does not improve OHRQoL.

CONCLUSION: There is an association (although modest) between malocclusion/orthodontic treatment need and poor OHRQoL. There is a growing interest in this topic but there is a need for further studies about this relationship that employ standardized assessment methods to obtain uniform outcomes amenable to meta-analysis.

169 TEMPORARY ANCHORAGE DEVICES IN THE TREATMENT OF IMPACTED CANINES

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AIM: To test the efficacy of temporary anchorage devices (TADs) in the treatment of impacted canines.

SUBJECTS AND METHOD: Thirteen patients (mean age 16 years) all with a Class I malocclusion, with mild or no crowding. Panoramic radiographs showed monolateral

palatally impacted canines. With the popularity of TADs it was decided to obtain a guide to eruption of impacted canines with the aid of these auxiliary devices. For this reason two miniscrews (Excalibur 1.8×10 mm SIA Orthodontics, Rocca D'Evandro, Italy) were inserted in the palatal area between the roots of first and second molars and between the roots of first molar and second premolar. The first activation was achieved with an elastic module connecting the canine with the miniscrew in order to distally move the canine as far from the laterals as possible. A TMA sectional wire was then modelled and connected to the two TADs by means of metal ligatures and composite, while the cantilever loop was connected to the impacted canine for extrusion.

RESULTS: All patients showed resolution of the canine impaction avoiding the need for other auxiliary anchorage devices or patient compliance, and without detrimental effects on the upper arch.

CONCLUSION: TAD supported mechanics are effective in the treatment of impacted canines preventing undesired tooth movement or reactional anchorage forces directed on the upper arch.

170 ORAL HYGIENE IN ORTHODONTIC THERAPY AND GENDER SPECIFIC DIFFERENCES IN CARIES RISK.

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AIM: White spots lesions, the primary stage of dental decay, are a challenge in orthodontic therapy. Therefore it is important to fix arrangements and strategies for these patients with high caries risk. The identification of gender differences in caries risk should add useful information to the guidelines for preventing enamel decalcification and caries during fixed orthodontics.

SUBJECTS AND METHOD: Thirty subjects (17 girls, 13 boys) aged 9 to 16 years, due to undergo multibracket therapy, were tested in their oral hygiene ability and their salivary parameters, the number of specific oral bacteria (*Lactobacilli* and *Streptococcus mutans*) and their decayed, missed and filled teeth (DMFT) were determined.

RESULTS: For most of the tested parameters, gender differences favouring the girls were found although none of the results reached statistical significance. Boys compared with girls revealed worse accounts especially in variables reflecting individual oral hygiene [plaque index (PI) 74 versus 62%, bleeding on probing 59 versus 40%)]. The DMFT index, which was high in both groups, was higher in boys than in girls (4.23 versus 4.18). Salivary parameters indicated a better initial position in caries risk for girls than for boys: high buffer capacity (76 versus 53%), pH-value above 6.8 (58 versus 46%), low viscosity of saliva (82 versus 53%). More boys than girls showed a higher level of *S. mutans* (23 versus 11%). Due to diet and drinking habits of the surveyed teenagers, an unbalanced nutrition can be hypothesized for the majority of boys (53%) and girls (58%).

CONCLUSION: Gender differences in health awareness and also in oral hygiene and other caries preventive factors should start in the early ages. Gender differences have to be considered in patient management and preventive strategies before and during orthodontic therapy. The results of this pilot study should be tested in a larger group.

171 COMPARISON OF ACCURACY, RELIABILITY, AND REPRODUCIBILITY OF THREE DIGITAL MODEL SOFTWARE PROGRAMS***

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AIM: For orthodontic diagnosis and treatment planning, orthodontic records are needed. Orthodontic models are an integral part of these records. Digital photography and radiography, together with digital models, have replaced stone models. The aim of the study was to compare the differences between measurements in order to evaluate the effectiveness and user-friendliness of three software programs. MATERIALS AND METHOD: Digital models of 75 patients (25 Class II, 25 Class II, 25 Class III), who presented with different malocclusions. Three different software programs were tested (Orthomodel, O3DM, 3Shape Orthoanalyzer). The cases in the study were selected according to the following criteria: permanent dentition, excluding two (disto-occlussal and mesio-occlusal) or three (mesio-occlusal distal) face restorations, no dental abnormalities, attrition or caries. One researcher compared 28 different measurements using the three different software programs.

RESULTS: Intraclass correlation coefficient values were between 0.904 and 0.994 for Orthomodel, 0.944 and 0.988 for O3DM, 0.968 and 0.992 for 3Shape. All measurements were within the 95 per cent confidence interval.

CONCLUSION: There were no differences between the three programs for accuracy, effectiveness and reliability and no statistically significant differences between them (P > 0.05). There were, however, some differences between the user-friendliness of the programs.

RETROSPECTIVE ANALYSIS OF SELF-REPORTED NEGATIVE 172ASPECTS OF ORTHODONTIC TREATMENT IN ADULTS M D Cotrina Llorente, B Gutiérrez Mosquera, B Llidó, M Díaz de Atauri, M Varela,

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AIM: To retrospectively analyze the subjective perception of various negative aspects of orthodontics by adult patients and to relate this perception with some characteristics of the patients and treatment.

SUBJECTS AND METHOD: Ninety-four patients orthodontically treated during adulthood over the last 25 years responded anonymously to a questionnaire including: a) demographic information and treatment modality and b) four questions regarding self-perception of the negative aspects of their treatment. Qualitative responses to these items were related to age, gender, treatment modality, and appliances employed, as well as the amount of time since the completion of treatment. Statistical analysis was performed using the Mann-Whitney and Kruskal-Wallis tests.

RESULTS: Only 14 per cent of patients reported having experienced a great deal of pain during treatment, while 6.5 per cent had no pain, and 79.5 per cent, little or some pain. It was reported by 8.6 per cent that the appliance had affected their appearance greatly, as compared with 11.8 per cent of patients who reported no change and 79.6 per cent, little or some change. Of those responding, 17.2 per cent stated that the appliances used had made hygiene significantly more difficult, while 8.6 per cent experienced no such difficulty, and 74.2 per cent, little or some difficulty. Lastly, 24.5 per cent of patients who completed the survey felt the treatment had seemed very lengthy, 8.5 per cent responded that it was not lengthy at all and 67 per cent believed it was not lengthy or somewhat lengthy. A statistically significant correlation was found between perception of intense pain and interdisciplinary treatment, younger patient age at the time of the survey and less time elapsed since the completion of treatment.

CONCLUSION: Perception of the negative aspects of orthodontics by adults is not intense. With the passage of time patients forget their experience of pain. Interdisciplinary treatment leads to increased perception of pain more frequently than conventional methods.

173 OCCLUSAL PLANE MODIFICATION DURING ORTHODONTIC TREATMENT OF SKELETAL CLASS II DIVISION 1 MALOCCLUSIONS B Crovato, P Fontana, F Soldo, D Dalessandri, L Visconti, Department of Orthodontics, University of Brescia, Italy

AIM: To assess the variation of the occlusal plane (OP) in subjects treated with a propeller universal light (PUL) appliance to correct a skeletal Class II division 1 malocclusion.

SUBJECTS AND METHOD: Sixteen subjects (9 females, 7 males) aged 12-15 years (mean: 13.4 years), presenting a skeletal Class II division 1 malocclusion. Inclusion criteria: stage of maturation of the cervical vertebrae CS3; 14 and 24 completely erupted; increased overjet (< 6 mm); increased overbite (< 6 mm). Diagnostic documentation (study models, photographs, dental pantomograph and cephalometric projection lateral side teleradiography) was obtained pre-treatment. The position of the functional OP (Ricketts) in comparison with Xi and the total length of the mandible (Co-Xi - Xi-Pm) was assessed at the beginning and end of treatment. The PUL was worn for 6 months, approximately 16 hours a day, and for 6 months only at night. Cephalometric superimpositions on Ba-Na were carried out to evaluate chin position.

RESULTS: At the beginning of treatment, the OP intersects Xi in all cases. At the end of PUL treatment, OP passed under Xi in 15 subjects, and only one passed through Xi. The value of Co-Xi - Xi-Pm increased in all cases, but this was not statistically significant.

CONCLUSION: The correction of a Class II malocclusion appears to be mainly due to the change in orientation of the OP (counterclockwise rotation) and following mandibular positional adaptation, with improvement of the soft tissue profile.

174 USE OF A MOUTHWASH AND AN ORAL GEL, CONTAINING HYDROGEN-PEROXIDE AND HYALURONIC-ACID IN ORTHODONTIC DERIVED ORAL-LESION TREATMENT

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AIM: During the early phases of removable and fixed orthodontic treatment, due to the traumatic action of these devices, oral lesions can occur. Such lesions can reduce patient cooperation. The aim of this *in vivo* study was to test the efficacy of a combined mouthwash and oral gel, both containing 5.16 per cent hydrogen peroxide and 0.1 per cent hydronic acid, in reducing pain and healing time of this type of traumatic lesion.

SUBJECTS AND METHOD: Thirty patients with orthodontic derived oral lesions were randomly split into two groups: A (n = 15), treated with a placebo mouthrinse and a placebo oral gel, and B (n = 15), treated with the hydrogen peroxide and hyaluronic acid mouthwash and oral gel. Group C, 30 patients with untreated orallesions served as the control. After removal of traumatic factors, all patients daily registered on a visual analogue scale (VAS) scale for 1 week their pain intensity. This was evaluated by a blinded additional operator who registered lesion healing speed and the presence of discolouration or side effects.

RESULTS: No patient showed side effects or tooth discolouration. Group A had a mean VAS value and the healing process duration was not statistically different from that in group C. Group B had a mean VAS value 1.95 points lower and a healing process 1.98 days on average faster than group C and a mean VAS value 1.89 points lower and a healing process 2.05 days on average faster than group A.

CONCLUSION: This mouthwash and oral gel associated protocol is effective on pain reduction and faster healing of orthodontic derived oral lesions, after traumatic agent removal. Absence of side effects facilitate patience adherence to this protocol.

175 EFFECT OF EXPANSIVE TRANSLATIONAL ORTHODONTIC TOOTH MOVEMENT DISTANCE ON THE PERIODONTIUM. A STUDY IN RATS J C Danz¹, C Katsaros², A Stavropoulos¹, ¹Department of Periodontology and Oral Gerontology, University of Aarhus, Denmark and ²Department of Orthodontics and Dentofacial Orthopedics, University of Bern, Switzerland

AIM: To evaluate the effect of expansive translational movement distance on the periodontium using a newly developed experimental model in rats. The null hypothesis was that there is no difference regarding marginal bone level, and the level of the gingival margin between a control group, a group with half a tooth width expansive translational movement (HF50) and a group with one tooth width expansive translational movement (HF100).

MATERIALS AND METHOD: Sixteen male albino Wistar rats (3-4 months old) were randomly and equally assigned to two groups. Using a 0.016×0.022 inch TMA transpalatal spring inserted into tubes bonded on the second and third molars, bilateral expansive translational tooth movement was initiated. The spring exerted a relatively high force, that decreased with deactivation of the spring from 22.9 ± 1.5 to 10.3 ± 1.4 g, per tooth. A transpalatal bar, fixed on the first molars, prevented opening of the midpalatal suture. The animals in the HF50 and HF100 groups were sacrificed 8 and 13 weeks after appliance application, where a movement approximately 50 per cent (facial root at the alveolar border) and 100 per cent (facial roots over the alveolar border) of tooth width, respectively, had occurred. Ten rats, without any appliances, served as the controls. A frontal section on every facial root of all molars was identified on the microcomputed tomographic data with a resolution of 12 micrometers and precisely transferred to the microtome for histological undecalcified preparation. One-way analysis of variance was used for group comparisons.

RESULTS: Twelve rats successfully completed the experiment. Alveolar bone dehiscence developed and was most severe in the HF100-group. Gingival recession occurred in a minority of the cases in the HF100-group.

CONCLUSION: Expansive tooth movement in rats with a relatively high force beyond the alveolar bone housing leads to pronounced periodontal breakdown with bone dehiscences, including development of gingival recession in some cases of large/extreme expansion.

176 CRANIOFACIAL MORPHOLOGY IN IRANIAN SHORT STATURE CHILDREN

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AIM: To evaluate the craniofacial morphology of Iranian short stature patients.

SUBJECTS AND METHOD: Fifty patients (25 males, 25 females) aged 12-13 years, of short stature. Seventy-three subjects with a Class I malocclusion matched for age, were selected as the control group. On each radiograph 14 points were selected to calculate eight angles (SNA, SNB, ANB, S-N-Pog, y-axis, basal angle, FMA, Go-Gn-SN) and one linear measurement (SN).

RESULTS: Short stature children had a smaller anterior cranial base. While a more retruded mandibular position and convex profile (P < 0.05) was seen in male patients,

a more protruded maxilla and convex profile was observed in female patients (P < 0.05). There was a statistically significant vertical growth tendency in female patients, while in short stature male children this tendency was not significant.

CONCLUSION: Short stature subjects have a shorter cranial base and convex profile. Functional appliances can form part of the treatment in male patients, and headgear in female patients.

177 INFLUENCE OF NON-CONVENTIONAL ELASTOMERIC LIGATURES ON CERAMIC BRACKETS

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AIM: To compare the frictional forces generated by three types of monocrystalline ceramic brackets with conventional elastomeric ligatures (CEL) and non-conventional elastomeric ligatures (NCEL) during the alignment of maxillary apically displaced teeth.

MATERIALS AND METHOD: All tests were carried out in a dry state on a universal testing machine with a testing model consisting of five monocrystalline ceramic brackets of each type (from the maxillary right second premolar to the right central incisor) 0.022 inch preadjusted brackets. The canine bracket was bonded to a sliding bar that allowed for various vertical positions. The frictional forces generated by 0.012 and 0.014 inch superelastic nickel titanium wires with CEL and NCEL at various amounts of canine misalignment (1.5, 3, 4.5 and 6 mm) were recorded. Comparisons between the different types of bracket/wire/ligature systems were carried out by means of ANOVA on ranks with Tukey *post-hoc* test (P < 0.05).

RESULTS: No significant difference was found among the three types of monocrystalline brackets when coupled with 0.012 inch with NCEL, but when coupled with 0.014 inch Radiance® with NCEL there was a statistically significantly greater force than for Inspire Ice® and Pure® with NCEL. A significantly greater amount of force was generated with CEL when compared with NCEL for all the tested variables, with the exception of Pure with 0.012 inch superelastic nickel titanium wire at 1.5 and 3 mm canine misalignment where similar forces were found. CONCLUSION: NCEL are able to reduce friction on monocrystalline ceramic brackets.

178 CEPHALOMETRIC PARAMETER VALUES IN PATIENTS WITH ACHONDROPLASIA

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AIM: To present cephalometric parameter values in patients with achondroplasia. SUBJECTS AND METHOD: Data from 13 patients aged between 14 and 29 years (7 females, 6 males). The diagnosis of achondroplasia was confirmed genetically in all patients. None of the subjects had been treated orthodontically.

RESULTS: The mean SNA angle value was 79.2 degrees. In nine cases the value was lower, indicating jaw retrusion, which can lead to development of an anterior occlusion. The mean SNB angle was 78.4 degrees. However, in eight subjects, this was a result of a retrognathic position of the mandible. The mean ANB angle was 0.8 degrees. In only five subjects was the value within normal range. After applying the Wits index as a standard complementary to ANB, the number of patients in whom mandibular prognathism exceeded maxillary prognathism decreased to five. The mean value of ML-NL angle was 34.2 degrees. In nine patients the NS-BA angle was

below the normal range, indicating that the skull base angle was tightened, which is characteristic of the radiographic picture of achondroplasia. The mean N-S-AR angle was 117.8 degrees. Closing of the angle compared with the norm (1.2 below the norm range) and the statistical significance (P < 0.05) point to a higher tendency within the studied group concerning closing of the skull base angle as measured laterally. The anterior face height index, N-SP/SP-GN, was 62.2 per cent, which is considerably below the mean norm value norm.

CONCLUSION: It seems that the characteristic picture of achondroplasia is not observed in every patient. Cephalometric parameters may be more or less than or the same as the norm.

179 GINGIVAL CREVICULAR FLUID ANALYSIS IN PATIENTS TREATED WITH CONTINUOUS ORTHODONTIC FORCES AND A CYCLICAL FORCE DEVICE***

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AIM: To analyze, in a preliminary study, gingival crevicular fluid (GCF) changes in patients undergoing orthodontic treatment with fixed appliance and with fixed appliances associated with a novel cyclic device (AcceleDentTM).

SUBJECTS AND METHOD: Five patients treated with a cyclical force device in combination with fixed appliances in one arch only (treatment group). The device, which the patients placed and activated daily for 20 minutes, applied very light vibrations to the dentition by gentle pulsing. The control group comprised five patients treated with fixed appliances only in one arch. The intensity of the force applied was continuous (maintained for long periods of time). The patients selected had good general and oral health. Before each fluid measurement was assessed, the degree of gingival inflammation through scores of plaque index (PI) and bleeding on probing (BOP) was determined. GCF sampling was carried out on the mesial and distal sides only in subjects without inflammation. GCF was obtained with the application of Perio Paper Strips (Oraflow[™] New York, USA) for 30 seconds at a depth of 1 mm. Sampling was carried out before force application, after 1 hour, and 1 and 3 weeks from the beginning of treatment. Quantitative analysis was obtained through an electronic analyzer (Periotron 8000, OraflowTM). The strips were then placed in a buffered solution of NaCl, stored at -80° C and analyzed at a later time by ELISA to measure IL-1ß concentration to evaluate the influence of the device.

RESULTS: During orthodontic treatment, the forces produced tissue-degrading enzymes and inflammatory mediators, and an increase of flow rate occurred before the biochemical changes.

CONCLUSION: Although the study has not yet been concluded, the hypothesis is that the pulsating force up-regulates and down-regulates some cellular signalling pathways, resulting in faster tooth movement.

180 EVALUATION OF BLOOD FLOW AND ELECTROMYOGRAPHIC ACTIVITY OF PERIORAL MUSCLES

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AIM: Although visual inspection of muscular tension of the mental region (MTMR) and electromyographic (EMG) activity of the perioral muscles are commonly used to evaluate lip incompetence, it is difficult to make quantitative evaluation using a contactless method. It has been reported that blood flow (BF) and EMG activity of

the extremity muscles increases in parallel with an exercise load. However, the relationship between the change in BF and EMG activity in the orofacial region remains to be elucidated. Therefore, the purpose of this study was to examine the influence of lip seal on perioral muscles and establish a new method for evaluating lip incompetence using laser Doppler perfusion imaging.

SUBJECTS AND METHOD: Two groups of patients (n = 15 each) with (experimental group) and without (control group) MTMR while lip sealing. Both BF and EMG activity of the superior and inferior orbicularis oris and mentalis muscles were measured in the mandibular rest position with the lips in contact (C-condition) and apart (O-condition). The Wilcoxon signed-rank test (P < 0.05) was used to compare the two conditions. The ratios of BF and EMG activity in the C-condition to those in the O-condition (C/O ratio) were plotted in a scattergram and used to classify the subjects using a discriminant analysis based on Mahalanobis distances.

RESULTS: In the experimental group, both BF and EMG activity of all the muscles in the C-condition were significantly larger than those in the O-condition. No significant differences were found in the control group. Correct classification into two groups was achieved for more than 80 per cent of all muscles, and the C/O ratio in the experimental group showed a distinct and wide distribution compared with that in the control group.

CONCLUSION: Both BF and EMG activity of the perioral muscles may be useful for the quantitative evaluation of lip incompetence.

181 EFFECT OF DIFFERENT SURFACE CONDITIONING METHODS ON SURFACE ROUGHNESS AFTER ORTHODONTIC DEBONDING

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AIM: Bonding and debonding are the basic stages of orthodontic treatment. Different surface conditioning methods can be used for teeth, or a porcelain crown during bonding. The aim of the present study was to evaluate the effect of three different conditioning methods: acid gel, air blasting and laser on enamel and porcelain surfaces using atomic force microscopy (AFM).

MATERIALS AND METHOD: Four porcelain samples, designed in the same way, and four teeth chosen at random (n = 4). The tooth specimens were prepared and a flat area obtained. Porcelain specimens (Vitablocs Mark II) measuring, $10 \times 10 \times 10$ mm, were designed. Firstly 9.6 per cent hydrofluoric acid and 37 per cent ortophosphoric acid were used for the porcelain and tooth surfaces, respectively. Sandblasting was the same for the teeth and porcelain specimens. An Er:YAG laser was applied to the teeth and the ceramic surfaces. AFM was used to observe surface roughness at three time intervals: before and after conditioning, and after debonding. Three measurements were performed for each specimen using a standardized rectangular spot (n = 12). Data were statistically analyzed by two-way ANOVA and Tukey HSD tests.

RESULTS: Significant changes occurred in all surfaces after conditioning and after debonding, except for laser irradiation to porcelain (P < 0.05). The differences after conditioning with laser to porcelain and debonding were not statistically significant. Sandblasting was the most effective method to roughen both porcelain and enamel (P < 0.05). The values after debonding were similar for all porcelain surfaces, but different from initial values. For teeth, differences in initial and after debonding values were not statistically significant.

CONCLUSION: Enamel surfaces can return to initial roughness after debonding but not to porcelain surfaces.

182 RETROSPECTIVE STUDY OF TOOTH TRANSPLANTATIONS UP TO 14 YEARS OF FOLLOW-UP.

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AIM: To retrospectively study autotransplanted teeth with as long as possible followup period in order to provide information on the long-term clinical outcome of autotransplanted teeth.

SUBJECTS AND METHOD: The first group consisted of 38 subjects (47 teeth) that have been described previously (Kallu *et al.*, 2005). The second group comprised 90 teeth (71 subjects) transplanted from 2004 to 2010. Of the total of 109 subjects (137 teeth) that were invited for recall, 68 patients (87 teeth) responded positively. Eleven patients could not participate because of loss of teeth. Although some patients had no re-examination visit, data from all 109 subjects were included in the sample. The follow-up period varied from 1 week to 14.5 years. Radiographic and clinical parameters were tested using Fisher's exact test.

RESULTS: Forty-four patients (51 teeth) showed a follow-up of <5 years with a survival rate of 88 per cent. Almost all teeth showed partial or full obliteration of the pulp. Many teeth showed further root development, but normal root length was only exceptionally reached. Twenty-one per cent of the teeth in the recall group showed a type of root resorption.

CONCLUSION: Autotransplantation can be a valid alternative in young adolescents for replacing a missing tooth because of agenesis or trauma. The optimal time to transplant is when the root has reached two-thirds to three-quarters of the final root length.

183 TONGUE IMPACT ON A MIDPALATAL DEVICE IN CHILDREN

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AIM: To describe total tongue impulse and contact time during repeated swallowing of children in the mixed dentition to obtain clinically relevant information about the vertical impulse transfer of the tongue onto a palatal appliance.

SUBJECTS AND METHOD: Twelve children of different ethnic backgrounds (5 males, 7 females; aged 6–10 years). Along the palatal raphe, centred between the first molars, a plastic button was attached parallel to the occlusal plane at a 5 mm distance to the palate on a 0.5 mm thick splint. A miniature pressure transducer was fixed to the plastic button. Each child drank five cups filled with 10 ml of water during one recording run. This was repeated four more times for a total of five recording runs and 25 cups of water for each child. This procedure of five runs was again repeated one to four weeks later. The time interval δt_k when the impulse transfer to the button via the tongue was above the baseline, then the integrals of the force F(t) over these time intervals and finally the total impulse transfer during a recording run as well as the duration during which the tongue transferred an impulse to the appliance were determined.

RESULTS: There was a considerable variation in the means of impulse transfer and duration of contact time during positive pressure of the tongue on the button. Even the same child did not have repeatable impulse transfers on both days, and the

standard deviations were very large. The total duration of contact time also varied considerably.

CONCLUSION: Total impulse transfer by the tongue during a recording run varies enormously between children (interindividual) and also on different days within the same child (intraindividual).

184 A VALIDATION STUDY OF TWO RAPID PROTOTYPING TECHNOLOGIES FOR THE REPRODUCTION OF DIGITAL CASTS*** C Dietrich¹, A Ender², A Mehl², Departments of ¹Orthodontics and Pediatric Dentistry and ²Preventive Dentistry, Periodontology and Cariologie, Center for Dental Medicine, University of Zürich, Switzerland

AIM: While digital study casts are becoming popular, orthodontists occasionally needs a physical model for demonstration purposes. The aim of this study was to validate the accuracy of two different rapid prototyping technologies for the production of orthodontic models from digital study casts by comparing them with the original three-dimensional (3D) data. The null hypothesis tested is that there is no difference between the original digital cast and the reproduced casts.

MATERIALS AND METHOD: The STL data set of five digitized plaster models were used to produce physical models. The rapid prototyping technologies used were stereolithography (Viper, 3D Systems; Darmstadt, Germany) and the new 3D printing (Eden 260V, Objet Ltd.; Rehovot, Israel). For each technology, nine copies were produced under ideal conditions. Afterwards the physical models were digitized with a reference scanning device (Alicona Infinit Focus, Alicona Imageing, Graz, Austria) with a known trueness and precision. In each group five model data sets were superimposed with the original STL data sets to evaluate trueness and with each other to determine precision of the reproduction method. The deviation between two data sets is presented as the (90-10)/2-percentile from all measured distances. Statistical differences between the groups were tested with one-way ANOVA and the *post-hoc* LSD test. Superimposition images were evaluated visually for deviation patterns.

RESULTS: There were average differences of 63 μ m for the SLA-models and 75 μ m for the Objet-models to the original STL data set. Different deviation patterns were visible in both groups. Larger deviation in the distal parts of the SLA group and larger deviation in steep surfaces for Objet group up to 100 μ m were visible.

CONCLUSION: Both stereolithography and the newer 3D printing seem to be reliable methods to reproduce orthodontic study models for diagnostic purposes.

185 FAILURE OF BONDED RETAINER IN THE MAXILLA: A PRELIMINARY INVESTIGATION

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AIM: To analyse the nature of failure causes and the rate of unforeseen incidents of maxillary retainers within a minimum of 5 years in retention.

SUBJECTS AND METHOD: Participants were selected consecutively from a larger pool of patients who were called up for routine annual examination following orthodontic therapy. The inclusion criteria were: at least 5 years in retention, age 20 to 30 years, orthodontic treatment performed and completed at the same clinic, full documentation available. Twenty patients were recruited out of which 19 still had a maxillary retainer. The records of these patients were analysed for incidents associated with maxillary retainers (bonding failures, wire fractures or loosening of the retainer).

RESULTS: Of the 19 patients, 11 (57.9%) had no incidents related to the maxillary retainer during retention. In two patients (10.5%) the retainer had been removed; one due to interference with the lower anterior teeth and the other as it was part of the initial treatment plan. In one patient (5.3%) fracture of the wire was observed. Five patients (26.3%) experienced bonding failures causing rebonding, and in two patients (10.5%) the retainer was replaced due to an accident. Overall, in 31.6 per cent an incident was reported that was due to the retainer itself (bonding failures, wire fractures and interferences).

CONCLUSION: A bonded maxillary retainer is an efficient tool to retain achieved alignment, but shows a high incidence rate of 31.6 per cent. Although all incidents are were considered as minor, periodic monitoring during retention seems highly advisable, as the causes for failure are manifold.

186 EVALUATION OF SUCCESSFUL TREATMENT OF PATIENTS WITH A UNILATERAL POSTERIOR CROSSBITE

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AIM: To present the possibilities for treatment of a unilateral posterior crossbite using a Fränkel-3 functional appliance in the early mixed dentition

SUBJECTS AND METHOD: Forty-five patients (20 boys, 25 girls, mean age 7 years 2 months) with a unilateral posterior crossbite with midline deviation treated using the Fränkel-3 functional appliance. Diagnosis was based on clinical functional examination and analysis of study casts. Dental casts taken before and after treatment and dental records were used for analysis of treatment effects.

RESULTS: All crossbites were corrected, functional deviations were eliminated and no relapse was observed. Treatment of the unilateral posterior crossbite involved expansion of the maxillary arch, removal of occlusal interferences and elimination of the functional shift. The width of the maxilla increased on average by 2.6 mm in the canine region and 1.9 mm in the molar region. Another advantage of early treatment (primary or early mixed dentition) was the improvement of maxillary arch length deficiency secondary to maxillary constriction, because the permanent incisors are afforded more space before or during eruption than if the crossbite is treated at a later age.

CONCLUSION: The Fränkel-3 functional appliance by is a useful and effective therapeutic alternative for the treatment of a unilateral posterior crossbite.

187 TENSILE PROPERTIES OF ORTHODONTIC ELASTICS BEFORE AND AFTER ARTIFICIAL AGEING

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AIM: Orthodontic elastics can be used in orthodontic treatment with buccal or lingual appliances to correct intermaxillary jaw discrepancies. The aim of this *in vitro* study was to investigate the tensile properties of orthodontic elastics before and after artificial ageing with a test set-up according to ISO 21606:2007.

MATERIALS AND METHOD: Eight different types of orthodontic elastics from seven brands were delivered from commercially available stock. Per type, two groups with 10 specimens each were formed. The specimens were mounted in a universal testing machine, extended at a rate of 100 mm/minute to 4 times the initial length and held at this stage for 5 seconds. After 5 seconds, extension was lowered to 3 times the initial length, and after 30 seconds, force (F0) was determined in the control group.

Specimens of the other group were stored in water after pre-stretching with the threefold length maintained. After 24 hours of artificial ageing, the remaining force (F1) was determined for each specimen. Data were statistically analyzed by one-way analysis of variance and *post-hoc* Tamhane test, using the Statistical Package for Social Sciences 17 (SPSS Inc., Chicago, Illinois, USA). The level of significance was set to P = 0.05.

RESULTS: Artificial ageing significantly influenced F (P < 0.001). Force values decreased between 27.8 and 45.5 per cent due to artificial ageing.

CONCLUSION: The amount of force reduction depends on the type of elastics used. Elastics should be changed at least after 24 hours to guarantee the desired forces.

188 FACIAL FORM AND INSULIN SENSITIVITY IN ADOLESCENCE: IS THERE AN ASSOCIATION?

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AIM: To explore if there is an association between facial form and insulin sensitivity in adolescence.

MATERIALS AND METHOD: The faces of 4747 15-year-old British adolescents were laser scanned during an annual follow-up clinic of the Avon Longitudinal Study of Parents and Children. The final sample comprised 2158 adolescents (1017 males, 1141 females) aged 15.4 years (SD 0.3 years), who fulfilled the following criteria: Caucasian, good-quality laser scans and complete data records for Tanner's pubertal stage, fasting insulin, fasting glucose, and body mass index. Facial images were processed and landmarked using internally developed subroutines for a commercial software. Facial form (size and shape) was analysed using principal component analysis. Surface-based average faces of adolescents with low (10th percentile) and high (90th percentile) insulin sensitivity were constructed separately for males and females and superimposed. The relationship between the first four principal components (representing the highest proportion of normal variance in facial form) and insulin sensitivity was estimated using univariable and multivariable general linear models.

RESULTS: The first principal component (face height) explained less than 1 per cent of the variation in insulin sensitivity. The average male face of the low insulin sensitivity group was 3.2 mm wider, had a 2.3 mm shorter nose, and 2.3 mm less protrusive lips than the average male face of the high insulin sensitivity group. The average female face of the low insulin sensitivity group was 1.7 mm wider, had a 0.8 mm more protrusive chin, a 1.3 mm shorter nose, and 1.3 mm less protrusive lips than the average female face of the high insulin sensitivity group.

CONCLUSION: There is only a very weak association between face height and insulin sensitivity in Caucasian British adolescents. Facial form of adolescents with low and high insulin sensitivity differs qualitatively and quantitatively.

189 CORRELATION BETWEEN THE FIRST AND SECOND CERVICAL VERTEBRAL DIMENSIONS AND HEAD POSTURE

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AIM: To describe the morphology of the first (C1) and second (C2) cervical vertebrae in different anteroposterior skeletal patterns, and to determine their correlation with head posture.

MATERIALS AND METHOD: Cone-beam computed tomographs of 60 patients evaluated in the natural head position (NHP). The subjects were classified into three groups: Class I, II, and III. The dimensions of C1 and C2 (seven linear measurements) were measured in the axial, coronal, and sagittal planes of the scans. From the lateral cephalograms derived from the 3D images, head posture was assessed according to Solow and Tallgren. Statistical analysis of variance (ANOVA) was performed.

RESULTS: The horizontal inner anteroposterior diameter of C2 was shorter in Class I subjects compared with Class II (P < 0.05). Numerous correlations between NHP and the cervical dimensions were found, among which NSL-OPT had a negative correlation with the horizontal inner anteroposterior diameter of C1 and C2.

CONCLUSION: The horizontal inner anteroposterior diameter of C2 is affected by an anteroposterior skeletal pattern. The Class II group had an increase of the anterior inclination of the cervical column and, therefore, a more extended head posture. In contrast, the Class III group showed a lower head posture. This study confirms the relationship between cervical vertebral anatomy and head posture.

190 HYPODONTIA AND SEVERE MALOCCLUSION IN THREE FEMALES WITH INCONTINENTIA PIGMENTI

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AIM: Incontinentia pigmenti (IP) is a rare X-linked dominant disorder caused by mutations in the NEMO-gene located on chromosome Xq28. It is characterized by skin lesions; dental, ocular, neurologic, nail and hair defects; as well as central nervous system features. The disease is predominant among females with an inherited mutant dominant copy of the NEMO-gene, which is lethal in males. The syndrome is mostly clinically diagnosed at birth or during infancy based on distinctive skin lesions. Dental manifestations are the second most frequent feature and range from delayed or incomplete eruption, peg-shaped teeth to hypodontia, both dentitions can be affected. This presentation describes the oral, dental and facial phenotypes of three female patients with IP who presented with mild to severe hypodontia and malocclusion and to identify the genetic defect of the NEMO-gene that would confirm the clinical suspicion.

MATERIALS AND METHOD: For orthodontic diagnosis and treatment planning anamnestic data, dental casts, clinical photographs, panoramic and lateral radiographs were collected from three patients and one affected mother. DNA was isolated from peripheral blood samples and submitted for mutation analysis of the NEMO-gene to confirm the clinical genetic diagnosis of IP.

RESULTS: In the present IP patients the upper lateral incisors, second premolars in both jaws and lower incisors were congenitally missing. All three patients had similar dental characteristics: hypodontia and peg-shaped teeth. Two patients had partial anodontia of the lower anterior jaw. In profile all three patients showed various skeletal characteristics.

CONCLUSION: Hypodontia is an important health problem as it persists throughout life. Therefore this problem requires adequate dental and orthodontic treatment planning from the time of diagnosis to oral rehabilitation by a multidisciplinary team consisting of a paediatric dentist, a prosthodontist, an orthodontist and a maxillofacial surgeon.

191 FRICTIONAL RESISTANCE OF SELF-LIGATING AND CONVENTIONAL BRACKETS LOADED BY TORQUE AND ANGULATION MOMENTS***

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AIM: To evaluate the influence of torque and angulation moments on the friction generated during arch guided tooth movement.

MATERIALS AND METHOD: A total of 40 different 0.018 and 0.022 inch brackets and tubes were examined. The archwire guided tooth movement was simulated using a 0.016×0.022 inch (0.018 inch slots) and a 0.019×0.025 inch (0.022 inch slots) stainless steel wire. The measurements were performed with the robot-based measurement system. Friction was measured during simultaneous application of torque and angulation moments with a magnitude of ± 10 Nmm.

RESULTS: The lowest friction values (0.8 N) were found using passive self-ligating and conventionally ligated brackets. Titanium brackets showed slightly lower frictional forces. The application of angulation moments produced a proportional increase of friction in all studied bracket/tube-wire combinations. In contrast, torque moments of the same magnitude resulted in frictional forces at least three times larger. Particularly high frictional forces were generated by conventionally ligated monocrystalline ceramic brackets and by some active self-ligating bracket systems.

CONCLUSION: Torque moments have not yet been considered as a factor influencing friction. This study showed that a torsional conflict between bracket and wire produced larger frictional forces than angulation moments. This may explain the impairment of mesiodistal tooth movements especially encountered when moving molars.

192 ONE-YEAR TREATMENT EFFECTS OF THE ERUPTION GUIDANCE APPLIANCE. A RANDOMIZED CLINICAL TRIAL

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AIM: To study the occlusal and dentoalveolar effects of the eruption guidance appliance (EGA) in 7-8 year old children after 1 year of treatment.

SUBJECTS AND METHOD: The study design was a randomized clinical trial. Forty-eight children (mean age 7.7 ± 0.5 years) were randomly assigned to a treatment (N = 25) or a control (N = 23) group. The inclusion criteria were fully erupted upper central incisors and an Angle Class I or Class II molar relationship with one or more of the following: deep bite (at least two-thirds overlap of the incisors), increased overjet >5 mm, or moderate anterior crowding with an overjet of 4 mm or more. All treatments were carried out using an EGA (LM Activator®) every night and 2 hours/day. Dental casts were obtained at start of the study (T1), and after 1 year (T2). Cephalograms were taken of all subjects at T1 and of the treatment group at T2.

RESULTS: At T1, no significant differences were found between the groups. At T2 significant differences between the treated subjects and controls were found for overjet, overbite, sagittal relationship and mandibular crowding. The mean overjet in the treated subjects decreased from 4.9 to 2.8 mm and overbite from 3.4 to 2.1 mm. A slight increase in both overjet and overbite was seen in the controls. The number of subjects with a Class II molar relationship decreased from 46 to 4 per cent in the treatment group and from 54 to 45 per cent in the control group. In the treatment group the number of children with crowding of the lower incisors decreased from 71 to 25 per cent, compared with an increase from 55 to 64 per cent in the controls.

CONCLUSION: The significant occlusal and dentoalveolar improvements in the treated subjects after 1 year suggest that the EGA can be an effective treatment option in the mixed dentition.

193 INTENSITY OF AGE-RELATED CHANGES IN SKULL PARAMETERS IN CLASS II DIVISION 2 CHILDREN

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AIM: To study the intensity of age-related changes in the cerebral and facial parts of the skull of Angle Class II division 2 children to detect the morphological structures differing from their normal growth intensity in the primary dentition.

MATERIALS AND METHOD: Sixty-two lateral teleroentgenograms of the head. Thirteen longitudinal and 14 vertical parameters of the facial and cerebral parts of the skull of 30 children (7-12 years of age) in the primary dentition and 32 children (12-15 years of age) after this period were measured.

RESULTS: The intensity of age-related changes of many longitudinal and vertical parameters of the skull differed widely from normal ones. This intensified abnormality of the facial skull resulting in occlusion and face configuration abnormality.

CONCLUSION: The data obtained showed that children with an occlusion identified as Angle Class II division 2 should be treated as early as possible.

194 PERCEPTIONS OF DENTAL APPEARANCE AND ORTHODONTIC TREATMENT NEED AMONG TEENAGERS

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AIM: To estimate whether dental appearance, evaluated by the grade of the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) chosen by subjects, is reliable and may be predictive of potential cooperation.

SUBJECTS AND METHOD: Two hundred and ninety five subjects (152 boys, 143 girls), aged 12 to 14 years. Dental appearance was assessed both by the subjects themselves and by an examiner using the AC of the IOTN. Grades 1-4 of the AC indicate 'no need', grades 5–7 'moderate need' and grades 8–10 'definite need' of orthodontic treatment.

RESULTS: Only seven subjects (2.3%) classified themselves as definite need (grades 8–10), whereas the examiner placed 11 subjects (3.7%) in this category. Nine subjects (3.0%) classified themselves in the moderate need category (grades 5–7) and the examiner classified six subjects (2.0%) in this category. Most of the subjects (94.5%) chose grades 1–4, representing no need for orthodontic treatment. The examiner placed 278 subjects (94.2%) in this category. There was a significant positive correlation between the examiner's and subjects' evaluations of the AC (P < 0.01). According to the examiner's assessment, there was no statistically significant difference between males and females ($\chi 2 = 4.21$, P > 0.05). There was also no significant difference in the self-evaluation of dental appearance between males and females ($\chi 2 = 8.75$, P > 0.05) according to the AC.

CONCLUSION: The AC of the IOTN clearly reflects the self-perceived need for orthodontic treatment. Dental appearance, expressed by the grade of AC chosen by the subjects, is reliable and could help to identify individuals interested in orthodontic treatment who would cooperate and consequently might derive the greatest benefit.
195 IDEAL TIMING OF PERMANENT FIRST MOLAR EXTRACTIONS. A SYSTEMATIC LITERATURE REVIEW

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AIM: To systematically review the literature on the influence of the timing of permanent first molar (PFM) extractions on spontaneous space closure.

MATERIALS AND METHOD: Electronic Medline, Ovid and Web of Science search supplemented by manual searching was conducted to identify randomized clinical trials, prospective and retrospective cohort studies on timing of PFM extractions with a minimum of six patients having been re-examined clinically at a follow-up visit or re-evaluated by plaster model analysis. Assessment of studies and data abstraction was performed independently by two reviewers.

RESULTS: The search, up to May 2011, provided 190 titles and 53 abstracts with full-text analysis of 24 articles, resulting in four studies meeting the inclusion criteria. By maxillary meta-analysis, good to perfect clinical outcome was estimated in 89 per cent (95% CI 85%-94%). By mandibular meta-analysis, the influence of PFM extraction timing, extractions performed during 8-10.5 and 10.5-11.5 years of age showed a significantly superior spontaneous clinical outcome with a probability of 54 per cent and 60 per cent likelihood to achieve good to perfect clinical result. Patients younger than 8 years of age or older than 11.5 years of age showed less favourable results of 34 and 41 per cent good to perfect clinical outcome, respectively.

CONCLUSION: Prevention of complications after PFM extractions is an important issue. Maxillary meta-analysis showed no scientific evidence for ideal extraction timing. Mandibular meta-analysis demonstrated that extractions between 8 and 11.5 years of age tended to show a superior (P = 0.02, P = 0.04) spontaneous clinical outcome.

196 COMBINED SKELETAL ANCHORAGE PLATES AND REMOVABLE TITANIUM MOLYBDENUM ALLOY TRACTION SPRINGS IN GROWING PATIENTS WITH MAXILLARY DEFICIENCY

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AIM: To evaluate the efficiency of bone anchored maxillary protraction (BAMP), using combined skeletal maxillary miniplates and a removable titanium molybdenum alloy traction spring appliance (TTSA), in Class III malocclusion patients.

SUBJECTS AND METHOD: Twenty-five patients in the prepubertal or pubertal skeletal growth periods. All had skeletal and dental Class III malocclusions with maxillary deficiency, normal vertical or horizontal growth patterns, and an anterior crossbite. The samples were categorized into two groups: group A comprised seven girls and five boy (mean age: 11.91 years) who received treatment using BAMP. A force of 350 to 400 g per side was applied to the TTSA from the titanium miniplates (Hubit, Korea) inserted on the lateral nasal wall of the maxilla. Total treatment time was 6.9 ± 2.63 months. Group B (untreated controls) comprised seven girls and six boys (mean age: 11.05 years). Lateral cephalograms were obtained at the beginning (T1) and end (T2) of treatment in both groups and analyzed with independent-sample *t*-tests (P < 0.05).

RESULTS: The miniplates were able to withstand the orthopaedic forces exerted during active treatment. Cephalometric findings showed highly significant sagittal measurements of the maxilla, as well as significant improvements in the mandibular skeletal measurements at point B, where SNA and SNB angles improved significantly between T1 and T2 (P < 0.001) without maxillary incisor movement. Statistically significant increases were observed in the vertical dimension, where rotation of the mandible and increased face height were evident.

CONCLUSION: Compared with growth of the untreated Class III subjects, this treatment approach can be advantageous for correcting Class III patients with mild/moderate maxillary deficiency.

197 PHOSPHATE-BASED GLASS: THE POTENTIAL FOR USE AS AN AESTHETIC AND ANTIBACTERIAL ORTHODONTIC BRACKET MATERIAL M L Eide, Orthodontic Department, Eastman Dental Institute and Hospital, London, England

AIM: To identify compositions of ion-doped phosphate-based glass (PBG) with aesthetic and antibacterial properties for use as an orthodontic bracket material.

MATERIALS AND METHOD: PBG disks containing antibacterial ions (copper, gallium and silver) were produced. Aesthetic properties were assessed visually and with a spectrophotometer. Constant depth film fermentation was used to form *Streptococcus mutans* biofilm under intraoral conditions with control bovine enamel disks. The disks were sampled at days 1, 3 and 14. Disk biofilms were removed and the diluted supernatant cultured on blood agar plates to assess the numbers of colony-forming units (CFUs). Disks were also subjected to Live/Dead® staining and confocal laser scanning microscopy (CLSM).

RESULTS: Silver and gallium-doped PBG disks showed better aesthetics than copper-doped PBG. CLSM analysis of biofilms showed the amount of live and dead bacteria to increase from day 1 to 14. Biofilm closest to the disk surface had relatively smaller amounts of cellular material compared with areas of biofilm furthest away. There were no statistical differences in mean CFUs/biofilm of PBG disks compared with enamel on day 1. There were statistically significant differences between the mean CFUs/biofilm of silver samples as compared with enamel on day 3 (P < 0.05). On day 14, there was a statistically significant difference in mean CFUs/biofilm of silver 3 mol% compared with other disk samples (P < 0.05).

CONCLUSION: Compositions of silver and gallium-doped PBGs may serve as aesthetic bracket material. PBGs of these compositions may reduce attachment of bacteria to the glass surface. A balance between the antibacterial properties of the bracket and the degrading surface layer of the material that reduces attachment of bacteria would need to be addressed for PBGs to be applied as a potential orthodontic bracket material.

198 GENDER DIFFERENCES IN TREATMENT NEED IN ROMANIAN ADOLESCENT ORTHODONTIC PATIENTS

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AIM: To test whether the severity of malocclusion in adolescent orthodontic patients is different between genders, in order to explain the preponderance of girls in orthodontic practice.

SUBJECTS AND METHOD: Three hundred and sixty adolescent orthodontic patients (252 females, 108 males), between 11 years 10 months and 19 years 1 month of age at the start of treatment. The need for orthodontic treatment was assessed by means of the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN; Brook and Shaw, 1989), with five grades: grades 4 and 5 representing high priority for orthodontic treatment.

RESULTS: An objective treatment need was recorded for 52.22 per cent of patients (grades 4 and 5) with the following gender distribution: 54.7 per cent for males and 51.2 per cent for females. No statistical difference with regard to the DHC of the IOTN grades was found between genders.

CONCLUSION: There was no gender difference for treatment need in Romanian adolescent orthodontic patients, although there is a preponderance of girls in orthodontic practice.

199 PATIENT AGE AND VERTICAL FACIAL MORPHOLOGY INFLUENCE THE LOCATION OF THE MANDIBULAR FORAMEN RELATIVE TO THE OCCLUSAL PLANE

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AIM: Successful inferior alveolar nerve block anaesthesia necessitates knowledge of the exact location of the mandibular foramen. It is typically advised to place the site of insertion of the needle 1 cm above the occlusal plane. The aim of this study was to determine whether the distance between the mandibular foramen and the occlusal plane (vertical position of mandibular foramen) is related to the age or the vertical facial morphology of the patient.

MATERIALS AND METHOD: Lateral cephalometric radiographs from 141 patients (average age 10.4 years; range 6.3-14.6 years). Pearson's correlation and multiple linear regression analysis were performed between the vertical position of the mandibular foramen, age, and six vertical facial dimension variables.

RESULTS: The vertical position of the mandibular foramen was significantly correlated with all considered variables, especially with age (r = 0.692, P < 0.001), the intermaxillary angle (r = -0.575, P < 0.001), and lower facial anterior soft tissue ratio (r = -0.764, P < 0.001). Regression analysis models explained more than 70 per cent of the variation of the vertical position of the mandibular foramen.

CONCLUSION: Taking into consideration age and the facial morphology of the patient may better help locate the mandibular foramen, which is a prerequisite for a successful and safe inferior alveolar nerve block.

200 A SYSTEMATIC REVIEW OF THE RELATIONSHIP BETWEEN OVERJET, LIP CLOSURE AND ANTERIOR TOOTH TRAUMA

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AIM: In 2008 the health technology assessment report dealing with 'oral health after orthodontic treatment with fixed appliances' was published. Therefore, the aim of this systematic review was to determine if increased overjet (iOJ), incompetent lip closure (iLC), and malocclusion influence the prevalence of anterior tooth trauma.

MATERIALS AND METHOD: A literature research using predetermined keywords was conducted in a variety of databases (PubMed, Medline, Web of Science, DIMDI, Cochrane Library) up to March 2011. References in the selected papers were examined and a hand search was also performed. Two independent investigators evaluated the identified articles using predetermined inclusion and exclusion criteria. RESULTS: After removing duplicates (n = 6), 92 articles were screened. According to title and abstract, 64 articles were excluded. In total, 28 full-text articles were assessed for eligibility. Finally, 25 studies were included in qualitative synthesis and 10 in quantitative synthesis. The variance of the values for iOJ ranged from 3-9 mm. 17 articles (68%) implied values of 3-3.5 mm as iOJ, whereas three articles (12%) evaluated 4 or 5 mm, respectively, as iOJ. When comparing the odds ratios (OR) for

iOJ and normal OJ (0-3 mm), they ranged from 1.5-6.5 depending on OJ size. The relationship between increased risk of trauma and iLC was investigated in seven articles (28%). A Class II malocclusion was considered to be the reason for increased trauma risk in two articles. All studies included had an evidence level II or III.

CONCLUSION: Juveniles with an OJ <3 mm have approximately twice as much probability of anterior tooth trauma as those with an OJ less than 3 mm. The probability for anterior tooth trauma increases almost four times if the OJ is <6 mm. OR increases with OJ. The larger the overjet the greater the probability of sustaining a dental traumatic injury.

201 REAL-TIME CELL ANALYSIS OF THE CYTOTOXICITY OF COMPONENTS OF ORTHODONTIC COMPOSITES ON GINGIVAL FIBROBLASTS***

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AIM: To evaluate the cytotoxic effects of three orthodontic composite materials.

MATERIALS AND METHOD: Light Bond (Reliance), Kurasper F (Kuraray), Grengloo (Ormco) were prepared according to the recommendations of the manufacturers. Gingival fibroblasts were isolated from gingival connective tissue of systemically healthy subjects and incubated in Dulbecco's modified eagle's medium culture for 72 hours according to ISO 10993-5 standards. Gingival fibroblasts were maintained with Dulbecco's modified eagle medium containing 10 per cent foetal bovine serum. A real-time cell analyzer (RT-CES, xCELLigence; Roche Applied Science) was used to evaluate cell survival. After seeding 200 mL of the cell suspensions into the wells (5,000 cells/well) of the E-plate 96, gingival fibroblasts were treated with bioactive components released by the composite materials and monitored every 15 minutes for 88 hours. For the proliferation experiments, one-way analysis of variance (ANOVA) and Tukey-Kramer multiple comparisons tests were used.

RESULTS: There was no significant difference between the cell indices of the control and study groups at 24 hours. When evaluated at 48 hours, Kurasper F and Grengloo showed statistically significant differences (P < 0.05). Light Bond showed statistically significant differences (P < 0.01) and reduced vital cell numbers when compared with the control group. When evaluated at 88 hours, Light Bond showed significant differences (P < 0.01) and Kurasper F and Grengloo significant differences (P < 0.05) compared with the control group.

CONCLUSION: The results indicate that the long cycle increased cytotoxicity of the tested materials. However, the results remain unclear, and further studies using different test methods are needed. Research efforts should focus on assessing the long-term biological effects of orthodontic composites.

202 MAXILLARY INCISOR SIZE AND NUMBER IN AN IRANIAN CLEFT LIP AND PALATE POPULATION

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AIM: A cleft lip and palate (CLP) is a major malformation of the oral and maxillofacial region. In addition to different cleft-associated problems, tooth number

and size abnormalities may decrease the success of orthodontic treatment in these patients. The present study calculated the permanent maxillary incisor size and number in CLP patients.

SUBJECTS AND METHOD: In this cross-sectional descriptive study, 88 CLP patients (33 females, 55 males) with good dental casts and panoramic views referred between 2010-2011 were selected from Hazrate Fatimah hospital and some orthodontic clinics. The mesiodistal widths of the permanent maxillary incisors were calculated on study casts and abnormalities of the number, tooth impaction or erupting teeth determined by panoramic radiographs. Tooth dimensions were statistically compared with the standard norms of the healthy population by one-sample *t*-test.

RESULTS: Sixty-six individuals (25 females, 41 males) had a unilateral and 22 individuals (8 females, 14 males) a bilateral CLP. The mean mesiodistal width of the right and left central and lateral was 8.3, 8.28, 6.22 and 6.55 mm, being significantly smaller than the standard norms (8.69, 8.69, 6.79 and 6.79 mm; except for the left laterals) (all: P < 0.0001). Seventy-three individuals (82.9%) had missing centrals or laterals, with the highest values for the left laterals (39 cases). Supernumerary teeth were observed in five patients (5.7%) and erupting teeth in 10 (11.4%).

CONCLUSION: The permanent maxillary incisors in CLP patients are significantly smaller than the standard norms of society and should be considered for orthodontic treatment. The number of missing teeth was very high in comparison with supernumerary teeth.

203 MANDIBULAR MIDLINE SYMPHYSIS REDUCTION OSTEOTOMY: A REVIEW

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AIM: To investigate mandibular symphyseal reduction osteotomy as an alternative method to correct a crossbite produced during orthognathic surgery. The advantages and disadvantages of this procedure as well as indications and contraindications were reviewed. The study determined the initial post-operative stability until debond, the average amount of transverse reduction achieved, and the incidence and type of untoward sequelae.

SUBJECTS AND METHOD: Ten patients who underwent surgical mandibular symphyseal reduction osteotomy in conjunction with mandibular lengthening/shortening. Measurements of the intermolar and intercanine width were carried out pre-operatively, at the time of surgery and at debond, to determine the average amount of transverse reduction performed, and if this was maintained. A number of parameters were measured in the post-operative phase of orthodontic treatment, namely treatment duration and archwire sequences, splint tolerance and alternatives and type of fixation. Periodontal and dental sequelae were evaluated by visual clinical assessments. Alterations in nerve function were reported postoperatively and at the time of debond.

RESULTS: The average amount of constriction with mandibular midline osteotomy surgery was approximately -3.4 mm buccally (mesiobuccal cusp of the first molar) with an average total minimal change in intercanine width of -1 mm. Post-operatively no great relapse was detected. Visual periodontal and dental sequelae were diagnosed only in one patient. No permanent alterations in nerve function were reported. The limit of constriction was approximately 10 mm without periodontal or temporomandibular joint function contraindications.

CONCLUSION: Successful outcomes were achieved using the mandibular symphyseal osteotomy in conjunction with a bilateral sagittal split osteotomy to correct a crossbite.

204 COMPLICATIONS ASSOCIATED WITH THE SURGICAL INSERTION AND REMOVAL OF PALATAL IMPLANTS: A RETROSPECTIVE STUDY R Fäh, M Schätzle, Department for Orthodontics and Pediatric Dentistry, Center for Dental Medicine, University of Zürich, Switzerland

AIM: To record the frequency of complications associated with the insertion and removal of Straumann® Orthosystem palatal implants.

MATERIALS AND METHOD: A retrospective review of the records of patients who had undergone orthodontic treatment using a Straumann® Orthosystem palatal implant for anchorage during 1999–2010. All major complications associated with the surgical intervention of insertion and removal of the implant were noted.

RESULTS: Until the end of December 2010, 104 charts were reviewed. Out of 104 implantations, 43 explantations could be analyzed. For insertion the following complications were found: loss of implant during the healing phase: 15 (14.4%), no primary stability: seven (6.7%), prolonged pain: seven (6.7%), secondary bleeding: six (5.8%), perforation of nasal floor: two (1.9%), necrotic mucosa anterior of the implant: two (1.9%), sensory disturbance of the anterior palate: one (1%). For explantation the complications were: disturbed wound healing: three (7%), perforation of nasal floor: one (2.3%), secondary bleeding: one (2.3%), fracture of the implant: one (2.3%).

CONCLUSION: A wide spectrum of complications was found in the present study. Fortunately, the majority of them can be handled by the dentist and do not lead to permanent injury. However in one patient prolonged hypaesthesia of the anterior palate was found. Although small, the risk of a permanent damage to the nervus incisivus still remains and patients must be well informed.

205 EVALUATION OF TWO MINISCREW ANCHORED RAPID PALATAL EXPANSION DEVICES

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AIM: Rapid palatal expansion (RPE) is a commonly used procedure in adolescent patients with maxillary transverse deficiency. Conventional appliances using the dentition for anchorage may show side effects i.e. dental tipping and periodontal overload. The aim of this case study was to evaluate the effects of two miniscrew anchored RPE devices.

MATERIALS AND METHOD: Two different RPE devices were tested in adolescents. The full skeletal anchorage device consisted of four-miniscrew anchorage (Dual Top JS 2×12 mm) in the anterior and the posterior palatal regions. The hybrid skeletal anchorage device consisted of two-miniscrew anchorage (Dual Top JS 2×12 mm) in the anterior palatal region and dental anchorage in the posterior palatal region. Expansion was accomplished by palatal split screws (Forestadent Type S), which were activated twice daily. The expansion effects were calculated between the start of treatment and 28 activations.

RESULTS: The full skeletal anchorage device showed a higher degree of transverse expansion (73% anterior, 91% posterior) without dental side effects. The hybrid anchorage device showed a lower but uniform degree of transverse expansion (43% anterior + posterior) combined with a tipping of dental anchorage.

CONCLUSION: The full skeletal anchorage device seemed to be more efficient for RPE, without dental side effects. In selected expansion cases this device may be a beneficial option.

206 INFLUENCE OF SURFACE CONDITIONING OF CERAMIC RESTORATIONS BEFORE METAL BRACKET BONDING

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AIM: To compare the shear bond strength (SBS) and Adhesive Remnant Index (ARI) of four different veneering ceramic materials to metal brackets. Additionally, it was examined whether it is possible to overcome the etching method using hydrofluoric acid, which is noxious. Instead of this treatment, air particle abrasion with 25 μ m aluminium trioxide, silane coupling application and etching with 37 per cent orthophosphoric acid as pre-treatment procedures of the veneering ceramics before bonding was investigated.

MATERIALS AND METHOD: Two surface conditioning methods of four ceramic materials before bracket bonding were examined: in group 1 air particle abrasion with 25 μ m aluminium trioxide (4 seconds at a pressure of 2.5 bars) and subsequently a silane coupling agent (Espe Sil, 3M Unitek, Monrovia, USA) was applied on one side of each ceramic specimen (10 per group). In group 2 one side of each sample was etched with 37 per cent orthophosphoric acid for 2 minutes followed by a silane application (Espe Sil). After this procedure self-ligating metal brackets, SmartClip (3M Unitek) were bonded to the ceramic blocks and a thermocycling process started. Then, SBS and ARI were measured. To determine statistical differences, one-way ANOVA and Tukey *post-hoc* test were performed. The level of significance was set at $\alpha = 0.05$.

RESULTS: Sandblasting with 25 μ m aluminium trioxide and the use of orthophosphoric acid (37%) seem to prepare the surface of the ceramic restoration sufficiently before bracket bonding.

CONCLUSION: The level of SBS values observed seems to be sufficient for bracket bonding. Hydrofluoric acid is no longer justifiable for preparing the surface of dental ceramic restorations before bracket bonding.

207 ANTEROPOSTERIOR CHANGES IN MANDIBULAR CLASS II PATIENTS TREATED WITH THE BALTERS BIONATOR

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AIM: To investigate the effects of the standard Class II Balters Bionator on the treatment of mandibular Class II cases (Bionator group) compared with an equivalent untreated sample (control group) using two different methods: conventional cephalometric analysis (CCA) and geometric morphometrics (GM; thin-plate spline analysis).

MATERIALS AND METHOD: Sixty-two lateral cephalometric radiographs were evaluated in the Bionator group (34 males, 28 females). Their ages ranged from 10 years to 13 years 8 months during treatment (mean treatment time: 2 years 2 months). In the control group, 44 radiographs were used (16 females, 28 males) between the beginning and end of observation. Their ages ranged from 7 years 3 months to 14 years 2 months. The observation period lasted 2 years on average, ranging from 1 year 3 months to 4 years 5 months. Method error evaluation was calculated using Dahlberg's formula and showed no statistical error between the first and second readings. For statistical analysis of CCA, the Mann-Whitney non-parametric test was employed and for GM, Procrustes analysis was performed and ANOVA applied.

RESULTS: The control group showed no statistically significant differences in the correction of a mandibular Class II in both CCA and GM. CCA of the Bionator group revealed that increases in the mandibular body and ramus, in the effective length of the mandible and in anterior face length were statistically significant measurements. Through GM analysis (deformation grids) a distortion on the horizontal axis of the grid revealed a significant change in the mandible in the anterior direction, conducive to correction of the malocclusion.

CONCLUSION: There was a significant difference between the start of treatment and completion in the Bionator group but not in the corresponding control group ages. This finding demonstrates that treatment caused individuals to change, confirming the effectiveness of facial orthopaedics in mandibular Class II malocclusion cases.

208 BLINDED VERSUS UNBLINDED EVALUATIONS OF ORTHODONTIC OUTCOME: DOES IT MAKE A DIFFERENCE?

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AIM: Biases resulting from unblinded assessments are well documented in the medical literature, but not in orthodontics. The aim of this study was to investigate the impact of blinded versus unblinded treatment evaluations in skeletal Class II patients.

SUBJECTS AND METHOD: The research consisted of two separate studies, one investigating cephalometric measurements, the other aesthetic evaluations. The material of the first study consisted of pairs of cephalograms obtained from 24 skeletal Class II children, before and after growth modification treatment. Orthodontists (n = 10) were asked to assess six linear and angular measurements that are commonly used to quantify mandibular growth. The material for the second study consisted of 40 pre- and post-operative photographs of skeletal Class II adults, treated by surgical mandibular advancement. Orthodontists assessed facial and profile attractiveness by means of 100 mm visual analogue scales. In both studies, measurements were taken under two different conditions: 1) records presented oneby-one, with the examiner blinded to the pre- and post-treatment status, and 2) records presented as matched-pairs side-by-side with pre-post status disclosed. In order to minimize recall bias, the two sets of measurements were taken at least four weeks apart.

RESULTS: Both cephalometric and aesthetic treatment evaluations in skeletal Class II patients were significantly influenced by prior knowledge of the pre-post status (P < 0.01). The mean bias amounted to 1.7-2.1 mm and to 1.5-2 degrees for linear and angular measurements, respectively. Ratings of before-after attractiveness almost doubled when performed under unblinded condition as compared with blinded evaluations.

CONCLUSION: Prior knowledge of pre- and post-treatment status markedly influences cephalometric and aesthetic evaluations, with a bias towards a more favourable outcome. The pre- and post-treatment status of patients should not be disclosed to examiners assessing the outcome of orthodontic clinical trials.

209 *IN VITRO* EVALUATION OF OPENING RESISTANCE OF SELF-LIGATING BRACKETS

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AIM: To evaluate the opening resistance of some self-ligating brackets (SLB), to make a comparison between new brackets and those subjected to 10 opening/closing cycles, to assess the presence of weak points and to evaluate the strength range necessary to open tested SLB.

MATERIALS AND METHOD: Three types of SLBs were used: Damon, F1000 and GAC-In Ovation. A new bracket was tested without an opening/closing cycle and five brackets were tested for teeth 11,14 and 16 with 10 opening/closing cycles with a 0.014 inch stainless steel tensile wire. A universal testing machine (Instron model 6633) was used at a 5 mm/minute speed of load application.

RESULTS: There were no significant differences for open brackets subjected to opening/closing cycles when compared with new brackets. The strength necessary to open the brackets fluctuated from 5 to 23 kg. For the GAC-In Ovation SLB the wire exited from the slot without clip breakage. F1000 and Damon SLB lost their clip; this was not always preceded by gradual plastic deformation.

CONCLUSION: The opening resistance of SLB is not influenced by opening/closing cycles; the strength range necessary for their opening ensure their resistance in mouth. No weak points were found.

210 POSTURAL CHANGES IN CERVICAL VERTEBRAE AND MASTICATORY MUSCLE TONE BEFORE AND AFTER LASER LINGUAL FRAENECTOMY

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AIM: To explore postural changes in the cervical vertebrae (C1-7) and the tension of the masticatory muscles pre- and post-fraenectomy.

SUBJECTS AND METHOD: Twenty paediatric patients (mean age 9.5 years, range 7–12 years, 12 males, 8 females) were screened using simple surface electromyography (sEMG) in order to evaluate the activity of the masticatory muscles at rest and during clenching and swallowing. Romberg's test and a photographic study, supported by a millimetre scale to assess the orthostatic posture, were undertaken and latero-lateral teleradiography with cephalometric tracing according to Giannì and Rocabado to estimate the craniocervical relationship was carried out. The fraenectomy was performed with a diode laser (890 nm).

RESULTS: Pre-fraenectomy sEMG outcomes indicated a clear differential of electrical activity with an imbalance of the muscles examined, masseter and anterior temporal (AT), than to standard and functional basal balance. After fraenectomy there was a return of basal values to the norm, in order to underline a better mandibular posture. The values of AT 1 month post-fraenectomy were significant (P < 0.05) with respect to the data pre-surgery both in scan 9 which rates muscular activity at rest and scan 11 during clenching on cotton rolls. Cephalometric studies showed a tendency to normalize previously altered cervical lordosis. Additionally, the postural change of the hyoid bone as regard the cervical vertebrae, especially C3, and retrognathion, more posteroinferior point of jaw symphysis, after surgery compared with the previous measurement (P < 0.05). Romberg's test that showed greater static instability pre-surgery decreased after fraenectomy.

CONCLUSION: A short lingual fraenum has not only static interrelations with the oral cavity but also dynamic connections with cervical posture and muscular basal organization, therefore fraenectomy favours the restoration of the basal euronia and physiological cervical lordosis

211 ANALYSIS OF THE ROTATIONAL POSITION OF THE MAXILLARY FIRST PERMANENT MOLAR

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AIM: To evaluate the rotational position of the maxillary first molar in subjects in the permanent dentition, comparing different methods in order to establish the best way to analyse its position and consequences.

MATERIALS AND METHOD: Randomly selected dental casts of 54 subjects were placed on a platform and the horizontality of the occlusal plane checked with an iHandy level. They were digitized with a Canon EOS 1000D camera and the position of the maxillary molars measured using Friel's method for angular and Ricketts' method for linear measurements. Angular measurements were performed twice and the mean calculated. All analyses were performed on both molars. In order to determine the efficacy of the two methods, the accuracy of the main parameters (i.e. specificity, sensitivity, etc.) was measured using the criteria of two experienced orthodontic researchers as the gold standard.

RESULTS: While the observations made of the two experienced orthodontists gave very similar results, the two auxiliary methods showed a low performance. Based on these findings, it should be highlighted that less experienced observers should use Friel's method as its results are closer to those obtained with the gold standard.

212 CEPHALOMETRIC CHARACTERISTICS IN SUBJECTS WITH SLEEP-RELATED BREATHING DISORDERS AND PRIMARY NOCTURNAL ENURESIS***

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AIM: Primary nocturnal enuresis (PNE) is a multifactorial disease related to sleeprelated breathing disorders (SRBD). Studies have shown that the craniofacial pattern can be a reliable indicator to predict risk for SRBD in enuretic children. This study analyzed the cephalometric characteristics in children with PNE and correlated them with the severity of SRBD, identified by polysomnography (PSG).

SUBJECTS AND METHOD: Thirty-four subjects with PNE (21 boys; mean age 9.3 years) and 60 healthy children (35 boys; mean age 9.3 years) matched for age and gender distribution. Lateral cephalometric analysis including oropharyngeal evaluation and overnight PSG were performed. The Apnoea-Hypopnoea Index (AHI) and Oxygen Desaturation Index (ODI) were calculated. Statistical analysis was performed by *t*-, chi- square, and Pearson's correlation tests.

RESULTS: The PNE children showed a higher AHI (P = 0.000) and ODI (P = 0.000) than the controls. The following parameters were significantly reduced: anterior cranial base length Se-N (P = 0.000), maxillary and mandibular body length, A'-PNS (P = 0.000) Go-Pg (P = 0.000), distance of the hyoid bone from the Frankfort plane AH-FH (P = 0.044), from the cranial base AH-SN (P = 0.005), from the third cervical vertebra AH-C3 (P = 0.040) and from Menton AH-Me (P = 0.036), tongue length V-T (P = 0.007) and upper pharyngeal airway space Phw1-Psp (P = 0.000). Pearson's analysis showed a negative correlation with AHI and ODI and Se-N, A'-PNS and Go-Pg.

CONCLUSION: PNE and OSA children had typical cephalometric characteristics.

213 THE SIZE OF THE SELLA TURCICA IN SKELETAL CLASS I, CLASS II AND CLASS III SERBIAN SUBJECTS

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AIM: The sella turcica is part of the cranial base in which the pituitary gland is located. It is considered that there is a correlation between the size of the cranial base and therefore the sella turcica as its integral part, and malocclusion. The purpose of this study was to measure the size of the sella turcica in Serbian subjects with different skeletal types, to determine the linear dimensions of sella turcica, the existence of sexual dimorphism and the connection between sella turcica size and certain malocclusions.

MATERIALS AND METHOD: Lateral cephalometric radiographs of 90 individuals with an age range of 18–22 years were taken and distributed according to the values of ANB angle; 30 Class I, 30 Class II, and 30 Class III. The sella turcica on each radiograph was analysed and measured to determine the linear dimensions of length, depth, and diameter. A Student's *t*-test was used to calculate differences in linear dimensions.

RESULTS: The lowest value of all three parameters was observed in Class II patients and the highest in Class III patients. No significant differences in linear dimensions between genders could be found.

CONCLUSION: There is a correlation between the size of sella turcica and certain malocclusions. The size of the sella turcica in this study can be used as reference standards for further investigations involving the sella turcica area in Serbian subjects.

214 NO COMPLIANCE INTERCEPTIVE TREATMENT OF CLASS III MALOCCLUSIONS WITH A NEW LOW-FRICTION APPROACH

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AIM: To evaluate the dentoskeletal effects produced by a low-friction system in subjects with Class III malocclusions associated with midface length deficiency.

SUBJECTS AND METHOD: Twenty-four Class III subjects (mean age: 8.2 years) consecutively treated with preadjusted brackets, superelastic nickel titanium round archwires, and low-friction ligatures (Slide). Lateral cephalograms were available at the start of treatment and at the correction of the anterior crossbite. The mean treatment duration was 17.6 months.

RESULTS: Early treatment induced statistically significant dentoskeletal changes characterized by an improvement in midface length associated with an increase in overjet due to proclination of the upper incisors.

CONCLUSION: Early treatment of a Class III malocclusion with a low-friction system produced favourable dentoskeletal modifications with no need for patient compliance.

215 EFFECTS OF RAPID AND SLOW MAXILLARY EXPANSION ON THE ALVEOLAR PROCESSES OF THE FIRST PERMANENT UPPER MOLARS

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AIM: To evaluate the *in vivo* effects of slow (SME) and rapid (RME) maxillary expansion techniques on the maxillary alveolar processes in patients with posterior crossbites in order to verify which of the two techniques is less harmful to alveolar bone tissue.

MATERIALS AND METHOD: Low dose computed tomography (CT) scans were collected from subjects with posterior crossbites treated with two-banded expanders. The expander was cemented on the first permanent molars and activated with two

different modalities: rapid (RME, three turns/day, 0.75 mm/day) and slow (SME, two turns/week, 0.50 mm/week) maxillary expansion. CT examinations were performed before (T0), and 5 months after the first activation of the expander (T1). The sample consisted of 20 patients, 12 subjects [6 males, 6 females, mean age \pm standard deviation (SD) 9.4 \pm 2.3) belonging to the RME group and eight subjects (4 males, 4 females, mean age \pm SD 9.4 \pm 1.6) of the SME group. CT data were analysed by means of dedicated software. For each subject, the alveolar processes of the maxillary first molars were segmented at both T0 and T1, and rendered in three dimensions. Bone volume and tissue densities (Hounsfield units) were computed.

RESULTS: Intragroup analysis (T1 versus T0) showed a decrease in the mean tissue density of the palatal portion of the alveolar process of the first maxillary molar, and an increase in tissue volume after treatment. No significant differences between groups (RME versus SME) were found.

CONCLUSION: The expansion modalities analysed do not have different effects on the quality of the alveolar bone of the upper first permanent molars.

216 CEPHALOMETRIC OUTCOME OF TWO TYPES OF PALATAL REPAIR IN COMPLETE UNILATERAL CLEFT LIP AND PALATE

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AIM: Palatal scarring after surgical closure of a complete unilateral cleft lip and palate (CUCLP) is believed to be one of the major causes of facial growth derangement. The aim of this study was to evaluate maxillofacial morphology after two different types of palatal repair in children with CUCLP undertaken by a single surgeon.

SUBJECTS AND METHOD: As part of a one-stage closure of the cleft lip and palate, the technique of hard palate repair differed in the two groups. In the exposed group (n = 37, mean age 11.1 years) a modified von Langenbeck technique was used resulting in denudation of the bone surface of the non-cleft side only. In the unexposed group (n = 61, mean age 10.9 years) a vomerplasty for coverage of palatal bone was applied. Lateral cephalograms of both groups were compared using the Eurocleft protocol. Fourteen angular variables were measured and two ratios were calculated.

RESULTS: Skeletal morphology in both groups was comparable. Maxillary incisor inclination and interincisal angle were more favourable in the unexposed group (P = 0.001 and 0.04, respectively). Soft tissue facial convexity (gs-prn-pgs angle) was less favourable in the unexposed group (P = 0.009). However, the other variable reflecting facial convexity (gs-sn-pgs) did not show an intergroup difference (P = 0.219).

CONCLUSION: Modification of palatal repair did not affect skeletal maxillofacial morphology in preadolescent children, but it resulted in better inclination of the maxillary incisors.

217 TREATMENT EVALUATION AND STABILITY OF TWO SELF-LIGATING SYSTEMS: A TWO-YEAR FOLLOW-UP CLINICAL TRIAL

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AIM: To assess post-treatment changes in the transverse dimension and inclination of the posterior teeth following treatment with an active (Damon 3MX) and passive (In-Ovation R) self-ligating (SL) bracket systems.

SUBJECTS AND METHOD: Seventeen Damon patients (9 males, 8 females) with a mean starting-age of 16.9 years, and 15 In-Ovation patients (7 males, 8 females) with a mean starting-age of 15.4 years. To be included, the patients had to be at least 2 years in retention. Digital casts at the start, finish and retention were analyzed. Transverse arch width and buccolingual inclinations of canines, premolars, and first molars in both the upper and lower arches were measured using three-dimensional customized analysis.

RESULTS: A positive correlation between expansion and buccal inclination was found for both SL systems. The Damon system produced more buccal tipping of the mandibular canine and first premolar (P = 0.001 and P = 0.004, respectively), than the In-Ovation system. Most of the expansion achieved was maintained, however more expansion lead to more relapse. No uprighting of the buccally inclined teeth was measurable during retention.

CONCLUSION: The two systems differed with respect to transverse expansion. Despite the use of fixed and removable retainers, in both systems the amount of transverse relapse was correlated to the amount of expansion. No uprighting of the 'tipped out' teeth could be verified.

218 CORTICOTOMY IN THE TREATMENT OF IMPACTED CANINES

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AIM: To evaluate, in a preliminary study, the effectiveness of corticotomy in the treatment of impacted canines.

SUBJECTS AND METHOD: Fourteen patients, aged between 21 and 26 years, presenting monolateral impaction of a maxillary canine with a Class I occlusion. All underwent radiographic examination at the beginning (T1) and end (T2) of treatment (panoramic, lateral radiographs, and computed tomographic scan only at T1). Orthodontic treatment was focused on space appropriation in the arch for the impacted tooth and then on traction of the canines directly on the archwire. Due to the age of the patients, during surgical exposure of the impacted canine, a corticotomy procedure was performed following vertical cuts of the alveolar bone in order to induce facilitated orthodontic extrusion. Bonding of the impacted to a metal ligature modelled with several holes. The direction of force applied to the canines was vertically orientated.

RESULTS: All treated canines were successfully brought into a correct position achieving good periodontal health in a reduced time and without detrimental effects related to anchorage reactional forces. The introduction of localized interproximal corticotomy in the treatment of impacted canines was able to create a significant amount of demineralization around the teeth in the areas of tooth movement, thus decreasing treatment time.

CONCLUSION: Corticotomy in the treatment of impacted canines could represent a valid, reliable and minimally invasive procedure (performed during surgical exposure) allowing correction of the position of impacted canines, also in adult patients, which generally are less susceptible to extrusion.

219 NEUROMUSCULAR CHANGES AND TEMPOROMANDIBULAR DISORDERS IN NAVY SCUBA DIVERS

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AIM: To determine the prevalence of temporomandibular disorders (TMD) and neuromuscular system variations in navy scuba divers and to identify risk factors for the development of TMD signs and symptoms before and after diving using a questionnaire, electromyography, stabilography, and cone beam computed tomography (CBCT).

SUBJECTS AND METHOD: Twenty males aged 30 to 42 years. Each diver answered a questionnaire and underwent neuromuscular tests and muscular and postural examinations before (T0) and after (T3) diving, and CBCT.

RESULTS: The prevalence of TMD symptoms at T3 was approximately 93 versus 32 per cent at T0. The neuromuscular answers at T3 were highly different from the situation at T0 [percentage overlapping coefficient T0-T3 P = 0.0001 (P < 0.001]; impact T0-T3 P = 0.0087 (P < 0.01); also postural aspect were different at T3 (P < 0.01). Clenching seemed to be the greatest risk factor for pain in the masticatory muscle system while holding the mouthpiece, and after diving. Limited mouth opening and clenching were responsible for the symptoms in the temporomandibular joints at T3. Exposure to cold water for long periods of time caused the mandible to protrude and, together the tendency to bite harder on one side, can result in dysfunction.

CONCLUSION: Scuba divers exhibiting TMD-related symptoms have the greatest risk of developing temporomandibular joint dysfunction and neuromuscular changes during and after diving. After diving, TMD is also a common problem in divers who were asymptomatic before the dive.

220 RETROSPECTIVE SELF-ASSESSMENT OF SOME POSITIVE BIOPSYCHOSOCIAL FACTORS OF ORTHODONTICS IN ADULT PATIENTS S J García Rosas, B Llidó, M D Cotrina Llorente, M D Cotrina Peregrín, P García-Camba, Department of Orthodontics, Fundación Jiménez Diaz Hospital, Madrid, Spain

AIM: To retrospectively assess the self-reported impact of orthodontic treatment on several positive biopsychosocial aspects in adults, and to analyze the influence of the length of time elapsed since the conclusion of treatment.

SUBJECTS AND METHOD: Ninety-four adult patients (19.8% male, 80.2% female; age range, 20-60 years), treated 1-25 years previously, anonymously responded to a questionnaire containing the following items: A) patient information, year treatment was completed, treatment modality, and appliance employed, and B) eight items on self-assessment of aesthetic, functional, and emotional aspects. Statistical analysis was performed using the Kruskal-Wallis and Mann-Whitney tests.

RESULTS: Aesthetic factors: Eighty-six per cent of the patients considered that the aesthetics of their smile had improved, and 48 per cent found their appearance to be more youthful. Only 4 and 22 per cent found 'little' or 'no improvement,' respectively. Oral health: Sixty-seven per cent believed their oral health had greatly improved, 49 per cent expected their teeth to last longer due to treatment, and 74 per cent believed that they took much greater care of their oral health following treatment. Of these, only 10, 21, and 8 per cent, respectively, believed that these aspects had improved little or not at all. Emotional factors: Forty-four per cent reported a significant improvement in their self-confidence, 28 per cent said that their social relations were much better, and 19 per cent stated that their intimate relations had improved. A significant correlation was observed between a longer period of time

elapsed since the conclusion of treatment and self-perceived improvement in social and intimate relations.

CONCLUSION: Adults who are orthodontically treated have a positive view of the benefits of treatment both aesthetically and in terms of their oral health. Their perception of improved social and intimate relations increases with the passage of time following treatment.

221 HOW CAN WE OPTIMISE CLINICAL PHOTOGRAPHS AND VIDEOGRAPHS FOR ORTHODONTIC AND ORTHOGNATHIC PATIENTS? A Gederi, Departments of Orthodontics, Queen Mary's Hospital, Sidcup, Kent and King's College London Dental Institute, England

AIM: To determine the quality of clinical photographs taken at an orthodontic department for orthodontic and orthognathic cases.

MATERIALS AND METHOD: For this prospective audit, 30 random sets of records were chosen from patients seen during October 2011 in the orthodontic department at Queen Mary's Hospital, Sidcup, Kent, England. There were equal number of cases from operators with different levels of experience i.e. consultants, senior registrars and junior registrars (10 of each group). The photographic records were analysed for their adequacy of consent and quality. Additional views such as symmetry shots in the supine position and videography were trialled and operators questioned on their usefulness. The data collected was assessed independently by two examiners and according to a defined protocol to reduce the risk of subjective error.

RESULTS: There was an adequate standard of extraoral photographs taken in 80 per cent of cases. Intraoral photographs could be improved in the areas of focusing, retraction, presence of saliva bubbles and fogging. The use of additional views such symmetry shots also improved the diagnosis of asymmetries in 76 per cent of patients when compared with extraoral photographs alone. Most operators (83%) felt videography would be a useful adjunct to photographs for the planning of orthognathic cases.

CONCLUSION: This audit has highlighted the need for a departmental manual on orthodontic photography. It also suggests how some of the features on modern photography equipment could be used to enhance clinical photographs. Additional views such as symmetry shots and videography taken routinely for orthognathic cases may be of benefit in diagnosis and treatment planning.

222 BED PARTNERS' EVALUATION OF THE EFFICACY OF MANDIBULAR ADVANCEMENT DEVICES IN THE TREATMENT OF ADULT OBSTRUCTIVE SLEEP APNOEA PATIENTS***

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AIM: To determine the subjective efficacy of mandibular advancement devices (MADs) in the treatment of adult obstructive sleep apnoea (OSA) patients from the perspective of their bed partners.

SUBJECTS AND METHOD: Forty-five adult Chinese OSA patients and their bed partners were recruited consecutively as part of a prospective randomized crossover trial for treatment with two MADs. The Epworth Sleepiness Scale (ESS) and an inhouse questionnaire were used at baseline and at two follow-up points to assess daytime sleepiness, symptom improvement and sleep quality following treatment.

RESULTS: Data was available for 34 of the recruited patients and their bed partners. The ESS score improved significantly for bed partners after treatment with both MADs (P < 0.01) with a better result for the monobloc (P < 0.05). A significant difference was found in bed partners' sleep quality post-MAD treatment (P < 0.01) and reported co-sleeping at night was significantly increased (P < 0.05) with a better result for the monobloc (P < 0.05). Symptoms were reported to have improved for both MADs (P < 0.01).

CONCLUSION: OSA patients' bed partners reported significant improvements in their own sleep quality and OSA symptoms in the patients. The monobloc MAD was favoured for reducing daytime sleepiness and co-sleeping.

223 CORROSION-FREE STERILIZING OF ORTHODONTIC PLIERS

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AIM: To assess the corrosion effect and damage to the cutting power of orthodontic ligature-cutting pliers induced by frequent surgical sterilization. Sterilization is a three step procedure: pliers are dipped in a water-diluted disinfectant and rinsed in water, then washed with another product diluted with demineralized water before steam sterilization. Dipping and rinsing can be done either with tap water or demineralized water. The two procedures were compared.

MATERIALS AND METHOD: Dentaurum®, ETM® and RMO®, each of whom provided a set of 20 ligature-cutting pliers. Each sample was divided into two equal lots (1) and (2) of 10 pliers. All pliers were first used to cut 20 RMO® 0.010 inch thickness stainless steel ligatures to reproduce normal wear of cutters in practice. They were then submitted to a complete cycle of surgical sterilization. This procedure was repeated 20 times for each cutting plier. Tap water was used for the first two steps (dipping and rinsing) of the sterilizing procedure for pliers in lot 1 of each manufacturers' sample. Demineralized water only was used for pliers in lot 2. Metal-corrosion and wear sustained by pliers were examined with digital binocular lenses after each new sterilization procedure.

RESULTS: Pliers from all lots labelled 1 treated with tap water showed considerable corrosion and wear from the very start of the repeated sterilizing procedures. Wear on the cutting edges of the pliers made them literally useless. Their aspect was also impaired. Pliers from all lots labelled 2 treated with demineralized water remained corrosion free and clean from the start to the end of the procedures.

CONCLUSION: Orthodontic ligature-cutting pliers appear to withstand frequent surgical sterilization procedures provided demineralized water is used to prepare them before steam sterilization. The use of tap water is to be avoided.

224 TEMPOROMANDIBULAR DISORDERS AND TINNITUS. IS THERE A CONNECTION?

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AIM: Connections between temporomandibular disorders (TMD) and tinnitus have previously been suggested. At present there is no causal treatment for tinnitus. The purpose of this study was to evaluate the effect of bite splint therapy on tinnitus and to determine if this effect persisted after a follow-up period of one to three years.

SUBJECTS AND METHOD: Twenty-two patients (11 males, 11 females; mean age 48.4 ± 12.9 years), diagnosed with tinnitus and TMD. The patients answered a questionnaire on three occasions and were clinically examined on two occasions during a period of two to three years. The patients were treated with a bite splint

(Michigan type). A visual analogue scale (VAS 0-100 mm) was used for self-scoring of tinnitus at baseline, after one year and then again after 24-36 months.

RESULTS: A reduction of tinnitus was reported from baseline (mean VAS 77 \pm 22 mm) to after one year (50 \pm 27 mm) and persisted at follow-up (55 \pm 30 mm). Patients also reported a reduction of muscle tenderness from 14 \pm 10 at baseline to 7 \pm 7 after one year, and jaw tenderness from 1.4 \pm 1.7 at baseline to 0.2 \pm 0.5 after one year. Eight patients (36%) reported improvement of 50 per cent or more of their tinnitus after one year and 5 (23%) of them still at the 24-36 month follow-up.

CONCLUSION: Although this study is too small to be conclusive, it indicates that TMD treatment may have a positive effect on tinnitus. A further investigation in a larger test group is desirable.

225 LONG-TERM CHANGES IN MICROBIOLOGY AND CLINICAL PERIODONTAL VARIABLES AFTER ORTHODONTIC TREATMENT

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AIM: To monitor, in a longitudinal prospective study, patients' microbiological and clinical parameters before and up to 2 years after fixed appliance orthodontic treatment.

SUBJECTS AND METHOD: Twenty-four patients (10 males, 14 females, aged 14.6 \pm 1.0 years). Fourteen were treated with headgear (headgear group) and received bands on the upper first molars before bonding brackets to the remaining upper teeth. The other 10 patients were treated with brackets only. Microbiology (sub- and subgingival), periodontal probing depth (PPD), bleeding on probing (BOP) and gingival crevicular fluid (GCF) were assessed at baseline (T1), at bracket removal (T2), 3 months (T3) and 2 years (T4) post-treatment. Statistical comparison was made over time and between the banded and bonded sites.

RESULTS: A significant increase in pathogenicity (decrease in the ratio between aerobic and anaerobic bacteria) of dental plaque was seen from T1 to T2. Between T2 and T3 a decrease in pathogenicity was noted. A further normalization towards the baseline values was seen at T4. The clinical variables PPD, POB and GCF flow showed a significant increase between T1 and T2. PPD reduced between T2 and T4, resulting in the absence of significant differences between T1 and T4. Between T2 and T4 the parameters POB and GCF flow decreased, but remained somewhat higher compared with baseline. The banded and bonded sites showed the same tendency.

CONCLUSION: Placement of fixed orthodontic appliances has a significant impact on microbial and clinical periodontal parameters. These changes seem to be temporary and largely normalized 2 years post-treatment.

226 SIZE OF ATLAS AND AXIS IN ADULTS WITH HYPOPHOSPHATEMIC RICKETS – A COMPARATIVE STUDY.

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AIM: Deviations from normal anatomy of the cervical column are frequent in some pathologic conditions (cleft and obstructive sleep apnoea patients) and in severe malocclusions. Hypophosphatemic rickets (HR) are rare diseases characterized by deficient mineralization of the bones due to abnormal renal wasting of phosphate. Cephalometric studies of HR-patients have shown that the osseous structures of cartilaginous, as well as of intramembranous origin, are affected in the cranium. The cervical vertebrae are bony structures of cartilaginous origin. The aim of this study was to describe the size of the atlas and axis in adults with HR in comparison with healthy controls.

MATERIALS AND METHOD: Standardized profile radiographs of 36 patients with HR (24 females, 12 males), aged 18-74 years, and 49 controls (26 females, 23 males), aged 18-79 years. The outcome cephalometric variables were: a) the height of the anterior tubercle of the atlas, b) the height of the dorsal arch of atlas, and c) of axis, d) the length of atlas, and e) the height of dens. Comparison between HR patients and controls was performed by linear regression analyses adjusting for age and gender.

RESULTS: There were significant ($P \le 0.05$) differences between HR patients and controls in the following outcome variables [mean HR patients (SD), mean controls (SD)]: height of the anterior tubercle of atlas 12.85 (1.89), 11.23 (2.38); height of the posterior arch of atlas 11.96 (1.46), 11.19 (1.71); height of the posterior arch of axis 20.78 (3.60), 17.42 (8.65); length of atlas 54.37 (3.34), 52.84 (4.43).

CONCLUSION: In HR patients, the horizontal and vertical dimensions of axis and the height of the posterior arch of axis were large in comparison with healthy controls.

227 EVALUATION OF INTERRADICULAR SPACE IN THE POSTERIOR MAXILLARY AREA FOR PLACEMENT OF MINI-IMPLANTS

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AIM: To measure the narrowest maxillary interradicular space between the second premolar and first molar by means of cone-beam computed tomography (CBCT) in order to determine the ideal site for placement of mini-implants.

MATERIALS AND METHOD: CBCT scans of 31 patients were retrospectively analysed. Measurements were made 3, 6 and 9 mm from the alveolar crest and the narrowest mesiodistal interradicular space at each level was measured from the buccal side. Between group comparison was carried out by two-sided ANOVA. The alpha error was set at 5 per cent.

RESULTS: The mean interradicular space was 2.35 ± 0.49 , 2.42 ± 0.69 and 2.83 ± 0.77 mm at 3, 6 and 9 mm from the alveolar crest, respectively. Significant differences were found between levels 3 and 9 mm (P = 0.04).

CONCLUSION: Placement of mini-implants for orthodontic anchorage requires careful analysis of the insertion site. Use of CBCT allows quantification of the available space for implant insertion. This work suggests that ideal interradicular space is too apical from the alveolar crest so the angle of insertion must be considered in order to achieve an optimal position without the risk of root damage and to increase cortical bone contact.

228 *IN VITRO* STUDY OF THE INFLUENCE OF NICKEL-CONTAINING MATERIALS ON ORAL INFLAMMATION***

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AIM: Nickel (Ni) is one of the main elements in orthodontics. Different effects of Ni are described in the literature, ranging from an induction of local inflammation to allergic reaction and cancerous/mutagenic properties. Inflammatory reactions such as gingivitis, periodontitis or mechanical induced lesions are frequently observed in the oral cavity. The interrelationship of Ni with those events is still unknown. The aim of this study was therefore to analyze the effect of Ni on oral inflammatory processes *in vitro*.

MATERIALS AND METHOD: The laboratory that analyzed the release of Ni ions from orthodontic materials during treatment was used. Human gingival fibroblasts were exposed to a pro-inflammatory environment [interleukin 1-beta (IL-1B)] or to cell culture medium (control) and additionally stimulated with different Ni-chloride concentrations, low (100 ng/ml), which simulate the clinical situation, and a 10 fold higher dose. At varying time points the expression of pro- and anti-inflammatory mediators as well as markers of matrix degeneration and differentiation were performed. Proliferation, cytotoxicity and wound healing tests were also conducted.

RESULTS: Low Ni concentrations, which are released during orthodontic therapy, increased cell proliferation after 24 hours which returned to control levels after 72 hours. In combination with inflammation, no significant change was found using a low Ni dose. Furthermore, isolated low Ni concentrations resulted in reduced gene expression of pro-inflammatory markers in a time-dependent manner, whereas an isolated high dose demonstrated a significant increase of these mediators after 6 hours comparable with IL-1ß stimulation. In combination with IL-1ß, a slight reduction of these markers was detected. Similar results were found for mediators of matrix degeneration and differentiation.

CONCLUSION: Ni has varying effects on inflammatory processes, depending on the concentration.

229 COMPENSATORY CURVES IN THE FRONTAL PLANE FOR FIRST AND SECOND LOWER MOLARS ACCORDING TO THE SAGITTAL GROUP P Gómez Durán, J M Barrera Mora, J M Llamas Carreras, E Espinar Escalona, E Solano Reina, Facultad de Odontología, Universidad de Sevilla, Spain

AIM: Compensatory dental curves cause alignment of the occlusal planes, in order to adjust condylar movement. The aim of this study was to assess the curve of Wilson for the first and second lower molars to determine the possibility of a relationship between dentoalveolar compensation and malocclusion group.

SUBJECTS AND METHOD: Ten Angle Class I sagittal malocclusion patients, 10 Class II and 10 Class III aged between 19 and 52 years. The diagnostic instrument used was a Kodak 9500 cone beam (CB) three-dimensional (3D) system with Kodak KDIS 3D module® software for analysis. Angular measurements were made between the axis of the first and second lower molars, to quantify the curve of Wilson. Inferential statistical analysis included: ANOVA, Bonferroni analysis and proof of homogeneity for the variation percentage.

RESULTS: Descriptive analysis showed that the curve of Wilson of the maxillary first molar for Class I patients was a mean of 31.40 degrees [standard deviation (SD) 12.06°], Class II a mean of 35.10 degrees (SD 11.16°) and Class III a mean of 38.60 degrees (SD 16.10°). For the maxillary second molars the curve of Wilson was Class I 43.10 degrees (SD 18.30°), Class II 38.10 degrees (SD 8.61°) and Class III 44.30 degrees (SD 15.55°). However, the findings were not significant.

CONCLUSION: Using CB images, no relationship was found between the curve of Wilson for the first and second lower molars and the different malocclusion groups.

230 CONE BEAM COMPUTED TOMOGRAPHY AS A DIAGNOSTIC METHOD FOR MEASURING DENTAL DISCREPANCIES

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AIM: To assess the reliability and accuracy in measuring mesiodistal tooth sizes and also the calculation of Bolton's Index, using cone beam computed tomography

(CBCT) and to compare them with the same measurements obtained using a twodimensional (2D) digital method.

SUBJECTS AND METHOD: Fifty randomly selected patients. Plaster study models and a CBCT image were made for all of them. The CBCT used was the Picasso Master 3D® (Ewoo Technology, Korea) with a voxel resolution of 0.1 mm and a field of view of 0.4×0 , 4×0.4 mm. The images were sent in DICOM format to InVivo Dental to be segmented and to obtain three-dimensional images of the models. The study casts were digitized and measured using the 2D digital method. Tooth measurements were then measured from both models.

RESULTS: There was no significant difference between the measurements of either method. The differences existing between the methods were clinically acceptable

CONCLUSION: CBCT allows more precise diagnosis, by providing information on the three-dimensions of the orofacial structures. CBCT digital models were as accurate and reproducible as the digital models obtained from plaster casts for calculating dental measurements and Bolton's Index.

231 *IN VITRO* EVALUATION OF POSSIBLE COLOUR CHANGES ASSOCIATED WITH ENAMEL ETCHING METHODS

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AIM: To determine possible colour changes of different etching methods.

SUBJECTS AND METHOD: Three hundred and fifteen teeth divided into three groups: phosphoric acid, self-etching primer (SEP) and ER:YAG laser. Each group had three subgroups of staining solutions: coffee, mouthwash or water. After bracket bonding, half of the teeth were stored in solutions while the other half were removed before staining. All teeth were then subjected to whitening. A spectrophotometer was used for measurement at baseline, after debonding, staining and whitening. L*, a* and b* colour parameters were recorded according the CIEL*a*b* and ΔE colour differences were calculated.

RESULTS: After discolouration the enamel did not change noticeably since the brackets covered the surface. However after debonding, a substantial change occurred with coffee. Regardless of etching method, coffee caused more staining and less bleaching. As for etching with phosphoric acid and SEP, similar results were seen with discolouration and bleaching; while laser etching showed inconsistent values.

ANALYSIS OF TOOTH AGENESIS IN A PORTUGUESE POPULATION A Gonzalez-Allo¹, M D Campoy Ferrer¹, J Moreira², J Ustrell³, T Pinho², Departments of Orthodontics, ¹University of Murcia, Spain, ²Instituto Superior de Ciências da Saúde-Norte/CESPU, Portugal and ³University of Barcelona, Spain

AIM: To retrospectively evaluate the prevalence and pattern of hypodontia in the permanent dentition, including and excluding third molars, in a Portuguese sample. SUBJECTS AND METHOD: The study group comprised 2888 patients, observed between 2005 and 2009. The patients were examined for evidence of hypodontia and presence or absence of primary teeth in those that presented agenesis. The age range varied from 7 to 21 years. In order to study third molar absence, subjects aged below 14 years were excluded. Statistical analysis was performed using the SPSS®.

RESULTS: Excluding third molars, the prevalence of tooth agenesis was 6.1 per cent. Tooth agenesis was found more frequently in females than in males, although the difference was not statistically significant (P > 0.05). The tooth most commonly missing was the mandibular second premolar, followed by the maxillary lateral incisor, and maxillary second premolar. There was a significantly higher prevalence

of missing third molars in the agenesis group than in the non-agenesis group. There was a correlation between second premolar and upper lateral agenesis with agenesis of their primary.

CONCLUSION: A relationship exists between agenesis in the permanent and primary dentition.

233 G-CHAIN: TEMPORARY ANCHORAGE DEVICES FOR PRE-PROSTHETIC MOLAR UPRIGHTING

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AIM: To test the clinical efficacy of essential mechanics made up of a retromolar temporary anchorage device (TAD) and elastic modules in pre-prosthetic treatment.

SUBJECTS AND METHOD: Thirty-two patients (12 females, 20 males, mean age: 44 years) presenting with a Class I occlusion, missing mandibular first molars with severe mesial inclination of the mandibular second molars. The treatment plan was to upright the second molars by means of mechanics consisting of one TAD (Spider Pin, HDC Sarcedo Italy, length 12 mm, diameter 1.3 mm) inserted in the retromolar area and three buttons bonded on the vestibular, palatal and mesial surface of the second molar. The distal force system was developed by three single pieces of elastic chain joined together with a metallic ligature and tied on the head of the miniscrew; the free ends of the elastic chain were connected to the vestibular, palatal and mesial button (G-Chain). The vestibular and palatal traction produced a distal and uprighting movement avoiding undesired rotation of the molar, while the mesial elastic, passing over the occlusal surface of the crown and the screw. Panoramic radiographs were obtained at the beginning and end of treatment, before insertion of implants in the areas of the missing teeth.

RESULTS: All patients ended the orthodontic pre-prosthetic treatment with correct mandibular second molar inclination, avoiding the need for fixed appliances and allowing reliable insertion of the implants.

CONCLUSION: The essential mechanics described are effective in producing molar uprighting movement, avoiding occlusal re-equilibration and detrimental effects on premolars, and limiting orthodontic appliance use.

234 APPLICATION OF TRANSGENIC FLAX SCAFFOLDS FOR BONE REGENERATION

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AIM: Modification of flax fibres to create biologically active dressings is of scientific and practical interest. Flax fibres, derived from transgenic flax expressing three bacterial genes for the synthesis of poly-3-hydroxybutyric acid (PHB), have better mechanical properties than unmodified flax fibres, do not show any inflammatory response after subcutaneous insertion, and have a good *in vitro* and *in vivo* biocompatibility. The aim of this study was to examine the applicability of composites containing flax fibres of genetically modified (M50) or non-modified flax (wt-Nike) within a polylactid acid (PLA) or polycaprolactone (PCL) matrix for bone regeneration.

MATERIALS AND METHOD: Bone defects were made on the skulls of adult rats and subsequently covered with biocomposites composed of PHB-producing flax fibres and in the PLA or PCL matrix. After four weeks the skulls were harvested and subjected to molecular-biological and histological examination.

RESULTS: A significant elevated mRNA expression of IGF1 with PLA and PLAwt-Nike composites could be found. The mRNA amount of MMP8 and osteocalcin was significantly decreased in all biocomposite treated cranial tissue samples compared with controls, whereas the expression of all other tested transcripts did not show any differences. The Runx2 mRNA expression was only significantly downregulated in bone tissue treated with PCL membranes. Histological analysis showed that new composite of PLA containing genetically modified flax fibres was conductive to a better bone regeneration with a small soft tissue formation in comparison with the PCL composites.

CONCLUSION: It is assumed that flax composites are able to stimulate bone regeneration, whereupon composites from transgenic flax plants producing PHB showed faster bone regeneration than composites of non-transgenic flax plants. The PLA composites seem to be better for bone regeneration then PCL membranes.

235 EFFECT OF MECHANICAL VIBRATION ON ROOT RESORPTION ASSOCIATED WITH ORTHODONTIC FORCE: A MICRO-COMPUTED TOMOGRAPHIC STUDY

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AIM: To examine the effect of mechanical vibration on the extent of root resorption craters associated with the application of a controlled orthodontic force.

SUBJECTS AND METHOD: Fourteen patients (11 females, 3 males) aged 12.1 to 15.5 years, requiring premolar extractions for orthodontic purposes. A controlled buccal tipping force of 150 g was applied bilaterally to the maxillary first premolars of each patient for an experimental period of 4 weeks (28 days). Using a split-mouth procedure, each patient was randomly assigned a 'vibration' and 'non-vibration' side. A buccally directed vibration of 113 Hz, using an Oral B HummingBird unit, was applied to the maxillary first premolar on the vibration side for 10 minutes/day. At the end of the experimental period, the maxillary first premolar teeth were extracted. Each sample was imaged using a micro-computed tomographic scan X-ray system (SkyScan 1172, SkyScan, Aartselaar, Belgium), and then analyzed with specially designed software to determine the volumetric measurements of the resorption craters. **RESULTS:** Overall, there was a significant difference in the total root resorption volume between the vibration and non-vibration sides (P = 0.003), with vibration reducing the amount of resorption by, on average, 33 per cent. Except for the buccal surface, all other tooth surfaces and vertical thirds exhibited a reduction in root resorption volume with vibration; however, only the palatal surface was significant (P = 0.006) while the mesial surface and apical third were marginally significant (P =0.018 and P = 0.019, respectively). Regression analyses of all regions showed that the amount of reduction in resorption volume associated with vibration was correlated with the amount of resorption experienced by the control teeth. This was evident especially on the mesial and palatal surfaces (P < 0.001 and P = 0.006, respectively). CONCLUSION: Mechanical vibration as applied in this study shows the potential of its use in preventing or reducing orthodontic root resorption.

236 INCIDENTAL SINONASAL FINDINGS IN CONE-BEAM COMPUTED TOMOGRAPHY IMAGING – WHAT IS THE CLINICAL SIGNIFICANCE?

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AIM: To evaluate the prevalence and potential clinical significance of incidental sinonasal findings in cone beam computed tomography (CBCT) scans.

MATERIALS AND METHOD: A retrospective analysis of CBCT images from 500 consecutive scans. The assessment of potential clinical significance of incidental sinonasal findings was accomplished by the design of a set of guidelines, which may ultimately lead to a better evaluation of incidental sinonasal CT abnormalities by non-sinonasal specialists, such as orthodontists.

RESULTS: Incidental sinonasal findings were detected in 84 per cent of the CBCT images studied; findings with a higher likelihood of clinical significance were seen in 24.2 per cent of the scans assessed.

CONCLUSION: The prevalence estimation of clinically important incidental sinonasal findings of approximately one-fourth of the evaluated images appears to be a relevant number, as this proportion correlates with a group of patients that would likely require an otolaryngology referral to further query the necessity of treatment.

237 CEPHALOMETRIC EVALUATION OF CHILDREN WITH FAMILIAL MEDITERRANEAN FEVER

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AIM: To evaluate and compare craniofacial morphology between patients with familial Mediterranean fever (FMF) and a healthy population.

MATERIALS AND METHOD: Standardized lateral cephalograms of 32 FMF patients (mean age: 11.50 ± 2.72 years) and 32 healthy controls (mean age: 11.86 ± 2.19 years). Cranial and dentofacial parameters were measured using a cephalometric analysis program (Nemoceph Imaging Cephalometric and Tracing Software S.L., Spain). All statistical analyses were conducted using the Statistical Package for Social Sciences, version 17.0.0 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were calculated for all measurements, and the independent *t*-test was used to evaluate intergroup differences.

RESULTS: ANB angle was significantly greater in the FMF group (P < 0.05). Differences in SNA and SNB angles were insignificant. Anterior (P < 0.001) and posterior (P < 0.05) face heights were significantly shorter in the FMF group. Mandibular body length (P < 0.001) and condylion to gnathion (P < 0.05) measurements were significantly shorter in the FMF group. The upper lip was more protrusive in the FMF group (P < 0.05). U1–NA (mm; P < 0.001) and L1–NB (mm; P < 0.05) measurements were significantly shorter in the FMF group.

CONCLUSION: Significant differences exist between the craniofacial morphology of patients with FMF and a healthy population.

238 EFFECTS OF DIFFERENT INTRACORONAL BLEACHING METHODS ON SHEAR BOND STRENGTHS OF ORTHODONTIC BRACKETS

A Y Gungor¹, E Ozcan², H Alkis³, H Turkkahraman³, ¹Department of Orthodontics, University of Akdeniz, Antalya ²Department of Endodontics, University of Mustafa Kemal, Hatay and ³Department of Orthodontics, University of Süleyman Demirel, Isparta, Turkey AIM: To evaluate the effects of different intracoronal bleaching methods on the shear bond strengths (SBS) of orthodontic brackets.

MATERIALS AND METHOD: Sixty freshly extracted mandibular incisors randomly divided into four equal groups. After filling of the root canals, the root fillings were removed 2 mm apical to the cementoenamel junction and zinc-phosphate cement base (Adhesor, Spofa Dental, Markova, Czech Republic) was placed 2 mm thick. Group I served as the control. Intracoronal bleaching was performed with 37 per cent carbamide peroxide (Whiteness Super Endo, Dentscare, Itda joinville, Brazil) in group II, hydrogen peroxide (Opalacence endo, Ultradent Products Inc., South Jordan, Utah, USA) in group III and sodium perborate (Sultan Healthcare, Englewood, New Jersey, USA) in group IV. Orthodontic brackets were bonded with a light cure composite resin and cured with a light emitting diode. After bonding, the SBS of the brackets were tested with a Universal testing machine.

RESULTS: Analysis of variance indicated a significant difference between groups (P < 0.001). The highest values of SBS were measured in group I (control). The SBS in groups II, III, and IV were significantly lower than those of group I (P < 0.001). The lowest values were measured in group III. The SBS in groups I and IV were significantly higher than those of group III (P < 0.001, P < 0.05, respectively). No significant difference was found between groups II-III, and II-IV (P > 0.05).

CONCLUSION: Intracoronal bleaching application significantly affects the SBS of orthodontic brackets on human enamel. Bleaching with sodium perborate more adversely affects SBS than other bleaching agents.

239 SHEAR BOND STRENGTHS OF ORTHODONTIC BRACKETS ON DIFFERENT PORCELAIN TEETH

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AIM: To compare the shear bond strength (SBS) of orthodontic brackets bonded to different porcelain teeth.

MATERIALS AND METHOD: Three types of ceramic crowns were fabricated by one technician and allocated to one of three groups as follows: conventional porcelain fused to metal crowns (Ceramco3, Dentsply, Pennsylvania, USA), IPS e.max ceramic crowns (Ivoclar Vivadent AG, Schaan, Liechtenstein), porcelain fused to zirconia crowns (Zirkonzahn GmbH, Gais, Italy; Noritake Co., Tokyo, Japan). The brackets were bonded with hydrofluoric acid (HFA) and a silane etching protocol. After bonding, the SBS of the brackets was tested with a Universal testing machine.

RESULTS: ANOVA showed a significant difference between the groups (P < 0.001). The IPS e.max group showed the highest SBS (P < 0.001). No significant difference was found between ceramo-zirconia and ceramo-metal groups (P > 0.05). Chi-square comparison revealed no significant difference in adhesive remnant index scores between groups (P > 0.05).

CONCLUSION: When HFA and silane etching was used, IPS e.max crowns showed the greatest SBS of orthodontic brackets. Therefore these crowns are recommended for restoration of teeth before orthodontic treatment.

240 ADULT PATIENT SATISFACTION AFTER NON-SURGICAL ORTHODONTIC TREATMENT: A RETROSPECTIVE STUDY

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AIM: To analyze the satisfaction of adult subjects who had undergone non-surgical orthodontic treatment in the previous 25 years.

SUBJECTS AND METHOD: A retrospective study was performed in 94 adult patients whose treatment had been completed over the past 25 years (19.8% males, 80.2% females; aged 20-60 years). The patients were asked to anonymously complete a shortened modified Kiyak satisfaction questionnaire with four options for each item (1: significantly, 2: somewhat, 3: not much, and 4: not at all). Moreover, they were asked to score their satisfaction from 1 to 10. The satisfaction level was related to: gender, evaluator age, time elapsed from the end of treatment, previous orthodontic history, need for interdisciplinary procedures and type of brackets. Possible associations were assessed by means of Mann-Whitney and Kruskal-Wallis tests (P < 0.05). The global satisfaction level (1-10) was reached by using the arithmetic mean and standard deviation (SD).

RESULTS: Most participants showed high satisfaction as a result of orthodontic treatment (mean score 8.9, SD 1.10). The answer 'significantly' was selected by 84 per cent of patients with respect to fulfilment of their expectations, 94.7 per cent with respect to having made a correct decision and 92.6 per cent with respect to recommending treatment to another patient. No patients selected the 'not at all' option for any question. A significant association was found for the correct decision of having orthodontic treatment and the female gender (P < 0.05), for the recommendation of orthodontic treatment to another patient, and more than 5 years from the end of treatment (P < 0.05).

CONCLUSION: Adult patient satisfaction with conventional or interdisciplinary non-surgical orthodontic treatment was very high. As the time period increases from the end of treatment, patients are more likely to recommend orthodontics to others.

241 RELATIONSHIP OF THE SLOPE OF THE FOREHEAD WITH SKELETAL AND DENTAL PROTRUSIONS

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AIM: To evaluate the relationship between the slope of forehead and many values which represent skeletal and dental protrusions.

SUBJECTS AND METHOD: Seventy patients (51 girls, 19 boys, mean age: 14.75 ± 2.42 years). Angular and distance values were measured for all subjects on digital cephalometric radiographs by using Quick Ceph 2000. The slope of the forehead was determined using the forehead angle and the distance of the soft tissue glabella to the nasion perpendicular line (NPL). SNA, SNB, ANB, FMA, NLA angles and Pog to N;FH, A to N FH, upper incisor edge to NPL was also measured. To evaluate the correlation between the slope of the forehead and skeletal and dental protrusion, Pearson or Spearman correlation coefficients (r) were estimated according to homogeneity of variance.

RESULTS: There was a significant high negative correlation between the forehead angle and the distance of glabella (r = -0.868, P < 0.001). A significant high inverse correlation was found between the forehead angle and upper incisor distance (r = -0.819, P < 0.001). There was a significant high positive correlation between glabella distance and upper incisor distance (r = +0.744, P < 0.001). There was no significant correlation between the slope of the forehead and SNA, SNB, ANB, FMA, NLA angles. Significant low correlations were found between the slope of the forehead angle, r = -0.324, P < 0.01 for glabella distance) and A to N-FH (r = +0.327 P < 0.01 for forehead angle, r = -0.282, P < 0.05 for glabella distance).

CONCLUSION: The slope of the forehead is considered to be in relationship with upper incisor protrusion. With a steep forehead the upper incisors are protrusive and with a flat forehead they are retrusive. In subjects with a steep forehead the upper incisors are more prognathic than in patients with a flat forehead.

242 SKELETAL AND DENTAL MATURITY IN PATIENTS WITH PALATALLY AND BUCCALLY LOCATED MAXILLARY CANINES V Habiby¹, I Kjær¹, I J Christensen¹, H Budtz², H Larsen², ¹Department of Orthodontics, University of Copenhagen and ²Department of Odontology, Municipal Dental Service of Aarhus, Denmark

AIM: Displaced maxillary canines can be located palatally (PDC) or buccally (BDC). Studies have found that the aetiology behind these ectopic displacements is different. Late dental development has previously been highlighted as one possible aetiologic factor in PDC cases. However, dental maturity has not been associated with skeletal maturity in these cases. The aim was to test the hypothesis that the discrepancy between dental and skeletal maturity is different in PDC and in BDC.

MATERIALS AND METHOD: Pre-treatment dental pantomograms, hand-wrist radiographs and clinical information of 61 non-syndromic orthodontic patients with ectopic maxillary canines (42 females, 19 males). Forty-seven had a PDC and 14 a BDC; median age 12.6 and 13.6 years. Dental and skeletal maturity scores were measured according to Demirjian (1973) and the TW2 method (Tanner *et al.*, 1975). Logistic regression was used for analysis of dental development and skeletal maturity modelling probability of PDC.

RESULTS: The probability for a PDC increased with delayed dental development for a given skeletal age (P = 0.10). The odds ratio for PDC was 1.50 [95% confidence interval (CI) 1.01-2.23] for skeletal maturity and 0.84 (95% CI: 0.55-1.29) for dental maturity.

CONCLUSION: Late dental maturity, in combination with early physical maturity, seems to be an important aetiological factor in PDC, but not in BDC. Clinically, the prediction of the risk of palatal ectopia of maxillary canines can be improved by analyzing and comparing skeletal and dental maturity.

Demirjian A 1973 A new system of dental age assessment. Human Biology 45:2

Tanner J M, Whitehouse R H, Marshall W A, Healy M J R, Goldstein H 1975 Assessment of skeletal maturity and prediction of adult height (TW2 method). Academic Press, London

243 THE TRUE HORIZONTAL PLANE VERSUS CONVENTIONAL CEPHALOMETRIC REFERENCE PLANES

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AIM: To study the relationship between conventional cephalometric reference planes and the true horizontal plane (THP).

MATERIALS AND METHOD: Lateral cephalometric radiographs obtained in the natural head posture (NHP) of a random sample of 200 male and 205 female 12-yearold southern Chinese. The radiographs were digitized twice with the Cassos program, and the data was averaged. The THP was defined as a perpendicular to the true vertical plane/plumb line. THP was drawn through Sella. The inclination between THP and five common cephalometric reference planes was assessed, i.e. to (1) Sellanasion plane–SNP, (2) Frankfort horizontal plane (FHP), (3) Constructed (Frankfort) horizontal plane (CHP), (4) Functional occlusal plane (FOP), and (5) Upper occlusal plane (UOP).

RESULTS: The gender difference between THP and the five cephalometric planes varied from 0.9 to 2.0 degrees, the differences being statistically significant for SNP, FH and CHP, respectively. The mean inclination to THP was smaller for FHP [males (M)/females (F) -1.4 **/ 0.6 ns] and CHP (M/F -0.9 ns / 1.2 **) than for SNP (M/F - 8.4 ***/ -6.4 ***), FOP (M/F 11.9 ***/ 12.8 ***), and UOP (13.1 ***/ 14.0 ***). The individual variations for the conventional cephalometric reference planes to THP were between -23.5 to +31.8 degrees, with a large range to each of the individual planes.

CONCLUSION: The mean difference for THP versus FHP and CHP was rather small, but there was a marked mean difference to the other three reference planes. This means there is a systematic bias when using any of these three planes as a reference plane. For many individuals the difference of the inclination of their THP to of any of the five conventional cephalometric reference planes is at great risk of being substantial and subsequently of clinical significance.

244 A CEPHALOMETRIC EVALUATION OF A FEMALE FILIPINO ADULT POPULATION USING THE MOORREES MESH COORDINATE SYSTEM

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AIM: To determine the mean cephalometric norms of female Filipino adults using the Moorrees mesh coordinate system.

MATERIALS AND METHOD: Standardized lateral cephalograms of 30 Filipino females. The sample met the following inclusion criteria: Filipino ethnicity; 18-35 years of age; Class I occlusion with minimal spacing or crowding; full complement of permanent teeth (excluding third molars); acceptable facial profile and no previous orthodontic treatment. The diagram was scaled based on the anterior cranial base and upper anterior face height. The X and Y coordinates of all landmarks were calculated on the tracings, with the right, lower corner of the mesh diagram as the origin. The mean proportionate locations of the cephalometric landmarks of the adult Filipino females were compared with other ethnic groups. A one-sample *t*-test was used for statistical analysis

RESULTS: Female adult Filipinos had a shorter mandibular length and ramus height, upward cant of the posterior palatal plane and more protruded incisors in comparison with other ethnic groups.

CONCLUSION: Differences in craniofacial morphology exist among this Filipino sample and other ethnic groups. The differences between the craniofacial pattern of the Filipino sample group and others are primarily due to the higher positioning of sella in the cranium.

245 MAXILLARY ALVEOLAR ARCH GROWTH CHANGES IN ROMANIAN CHILDREN WITH A BILATERAL CLEFT LIP AND PALATE***

L-G Halitchi¹, L Pruna², G Aprodu³, D Apostol⁴, ¹Department of Orthodontics, University Apollonia, Iași ²Department of Discreptive Geometrics, Technical University Gh. Asachi, ³UMF Gr.T.Popa, University Children's Hospital St. Mary and ⁴Department of Paediatric Surgery, University Children Hospital St. Mary, Iași, Romania AIM: To identify functional adaptations of the oral cavity to the disrupted palatal architecture in children with a bilateral cleft lip and palate (BCLP), to evaluate and measure maxillary growth, and to identify the reactive morphological pattern that can be identified from the dimensional changes in the first six years of life.

SUBJECTS AND METHOD: Forty-four patients (30 boys, 14 girls, between 2 months and 6 years of age) with a BCLP operated on by the same surgical team and a control group. The maxillary casts were analysed and four direct measurements were made: anterior and posterior diameter of the maxillary alveolar arch, length of the alveolar arch and palatal depth. Student's *t*-tests, both simple and bivariate, were performed using the Statistical Package for Social Sciences, version 13 (SPSS Inc., Chicago, Illinois, USA).

RESULTS: There was a significant difference between the dimensions of the alveolar maxillary arch in children with a BCLP compared with the healthy control group. BCLP patients had narrower maxillary arches, a smaller posterior 0.32 mm, a flattened palate 0.62, a larger anterior diameter 6.99 mm and a longer maxillary arch 4.02 mm compared with the control group.

CONCLUSION: The mathematical model of the maxillary arch in BCLP children allowed visualisations of the differences in the curve allure of the maxilla.

246 EVALUATION OF PALATAL BONE DENSITY IN ADULTS AND ADOLESCENTS FOR APPLICATION OF SKELETAL ANCHORAGE DEVICES S H Han¹, M Bayome², J Lee², H-H Song³, Y-A Kook², ¹Department of Orthodontics, St. Vincent Hospital, ²Department of Orthodontics and ³Division of Biostatistics, The Catholic University of Korea, Seoul, Korea

AIM: To measure cortical and cancellous bone densities of the palatal area in adolescents and adults, and to compare bone quality among placement sites for temporary anchorage devices (TADs).

MATERIALS AND METHOD: One hundred and twenty cone beam computed tomographic scans obtained from 60 adolescents (mean age, 12.2 ± 1.9 years) and 60 adults (24.7 ± 4.9 years). The measurements of palatal bone density were made in Hounsfield units (HU) at 72 sites at the intersections of eight mediolateral, and nine anteroposterior reference lines using InVivoDentalTM software. Repeated measures analysis of variance was used to analyze intra- and intergroup differences.

RESULTS: The cortical and cancellous bone densities in adults (816 and 154 HU, respectively) were significantly higher than those in adolescents (606 and 135 HU; P < 0.001 and = 0.032, respectively). In the adult group the anterior and middle areas had significantly higher densities than the posterior area (P = 0.002 and 0.009, respectively). Interestingly, the anterior portion of the cortical bone in adolescents had similar density values to the posterior portion of the cortical bone in adults. Gender comparison revealed that females had greater cortical bone densities (769 HU) than their male counterparts (654 HU; P < 0.001).

CONCLUSION: Palatal bone densities were significantly higher in adults than in adolescents, and the anterior palatal areas of adolescents were of similar values to those at the posterior palate of adults. In both adults and adolescents, females had greater cortical bone densities than their male counterparts. These findings may be helpful for the clinicians to enhance successful application of TADs in the palate for the treatment of adolescents.

247 REBONDING ORTHODONTIC BRACKETS: EFFECT OF SANDBLASTING WITH TWO PARTICLE SIZES

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AIM: To evaluate the effect of sandblasting brackets with two different sizes of aluminium oxide particles on the shear bond strength (SBS) of rebonded brackets.

MATERIALS AND METHOD: Forty new upper central incisor brackets (Victory Series®, 3M Unitek) were bonded to bovine incisors with Transbond Plus Self-Etching Primer. SBS was measured with a universal testing machine (Autograph AGS-1KND) with a crosshead speed of 1 mm/minute. The debonded brackets were divided into two groups: SO50 group: brackets were sandblasted with aluminium oxide powder of 50 μ m; SO110 group: brackets were sandblasted with aluminium oxide powder of 110 μ m. Bonding/debonding procedures were repeated three times for each bracket. A new tooth was used for each successive bond procedure. Scanning electron microscopy (SEM) observations of the bracket base were made after each sandblasting sequence. SBS for each group were compared individually for each bonding/debonding sequence by means of the Kruskal-Wallis and Mann-Whitney tests (P < 0.05), applying the Bonferroni correction (P < 0.016). SBS of the two groups were compared across the three bonding/debonding sequences using a *t*-or Mann-Whitney test (P < 0.05).

RESULTS: For the SO50 group, significant differences (P < 0.016) in SBS were found between the first and following re-bonds, but no significant differences were found between the second and third rebondings (P > 0.016). In the SO110 group, significant differences (P > 0.016) were found between the first and following rebondings and between the second and third rebondings. No significant differences were found in the SBS of the two groups when they were compared across the three bonding/debonding sequences (P > 0.05). SEM images showed a similarity between both groups.

CONCLUSION: The SBS of rebonded brackets was similar, independent of the particle size used for sandblasting.

248 TREATMENT RATE AND RESIDUAL NEED FOR ORTHODONTIC TREATMENT AMONG ADOLESCENTS IN THE NORTH OF NORWAY A Haseid, C-G Crossner, H Kerosuo, Institute of Clinical Dentistry, University of Tromsø, Norway

AIM: To find out the frequency of orthodontic treatment and residual need for treatment among 16-18-year-olds in the three northern counties of Norway.

SUBJECTS AND METHOD: Adolescents born in 1992 were selected by random sampling from the national register (n = 450). The three northern counties, Nordland, Troms and Finnmark and urban/rural areas were equally represented. The study consisted of a mailed questionnaire and dental casts obtained by the local dental office. A total of 237 adolescents (53%) agreed to participate (52% boys, 48% girls). The mean age at examination was 16.9 years (SD 0.5). Orthodontic treatment need was assessed on dental casts using the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN) and the Norwegian Need for Orthodontic Treatment Index (NOTI). Definite treatment need (=DHC grades 4-5 or NOTI groups A and B) was considered as residual treatment need.

RESULTS: Treatment rate in the total sample was 35.5 per cent. Residual treatment need was found in 16 per cent of the participants according to the DHC and in 5 per cent according to the NOTI. Significantly more overall treatment need (DHC 3-5 and NOTI groups A, B and C) was detected when using the DHC (49%) than when using the NOTI (20%). No significant differences between the three counties or rural/urban areas regarding the treatment rate, DHC or NOTI were found.

CONCLUSION: Orthodontic treatment rate in the north of Norway seemed to coincide with the national average in Norway. The DHC of the IOTN may be more sensitive in detecting orthodontic treatment need than the NOTI.

249 ACCURACY AND RELIABILITY OF DENTAL REPLICA MODELS CONSTRUCTED BY DIFFERENT RAPID PROTOTYPING TECHNIQUES A Hazeveld, J Huddleston Slater, J van der Meer, Y Ren, Department of Orthodontics, University Medical Centre Groningen, Netherlands

AIM: Plaster models in orthodontic practices are increasingly being replaced by their digital versions, which have a number of advantages. In order to fully transfer to a digital orthodontic practice, an alternative for plaster models should be found when physical dental models are needed for teaching or appliance manufacturing. Rapid prototyping (creation of a model by adding layers of material) is a computer-based method to reconstruct physical models from a three-dimensional (3D) digital file. The aim of this research was to evaluate the accuracy and reliability of dental replica models constructed by different rapid prototyping techniques.

MATERIALS AND METHOD: Twelve lower and upper conventional plaster models were selected and served as the gold standard with which replica models were compared. The plaster models were scanned with a dual sensor laser scanner (RPS 450, Laser Design Inc., Minneapolis, USA) to form high resolution 3D surface models in .STL-files. These files were converted into physical models using two different rapid prototyping techniques: Digital light processing (DLP) and jetted photopolymer (JP). One observer measured the height (clinical crown height) and width (mesiodistal measurements) of all teeth (first molar to first molar) in all models (plaster and replica) using a digital calliper. This was carried out five times with a 2 week interval between the repeated measurements.

RESULTS: Intraobserver agreement was high (ICC >0.97). The mean absolute error in height measurements was 0.12 mm for the DLP models and 0.14 mm for the JP models. The mean absolute error in width measurements was 0.16 mm for the DLP models and 0.17 mm for the JP models.

CONCLUSION: The accuracy and reliability of dental replica models constructed by the two tested rapid prototyping techniques is clinically acceptable and is therefore a good alternative to conventional plaster models.

250 COMPARATIVE STUDY OF IMAGE QUALITY AND DOSIMETRY OF CONE BEAM AND LOW-DOSE MULTISLICE COMPUTED TOMOGRAPHY E Hofmann¹, K Hertrich¹, M Schmid², U Hirschfelder¹, M Lell³, Departments of ¹Orthodontics, ²Medical Informatics and ³Radiology, University of Erlangen, Germany

AIM: To evaluate image quality of different cone-beam computed tomography (CBCT) and low-dose multislice spiral CT (MSCT) scanners in dental imaging. The amount of exposure was measured for all scanner systems.

MATERIALS AND METHOD: A human cadaver head was examined with three different MSCT and five CBCT scanners. The radiation dose was measured using a Rando-Alderson-Phantom. To obtain the CBCT data, standard protocols were used. For MSCT, tube voltage and tube current were modified to accomplish acceptable image quality while keeping the radiation dose as low as possible. The image quality of dental MSCT and CBCT was determined by examining a total of 22 teeth. The following structures were assessed using interactive multiplanar reformations: enamel-dentine and pulp interface, periodontal ligament space in the cervical, middle and apical root thirds.

RESULTS: Inter-observer agreement was different between the different groups of raters, group 1/group 2: $\kappa = 0.684$ [0.530, 0.787]; group 1/group 3 $\kappa = 0.629$ [0.418, 0.757]. CBCT systems were rated superior to MSCT in terms of image quality for all dental structures. The differences in image quality were statistically significant for the CBCT and MSCT, but not within the CBCT and MSCT groups. Effective dose ranged from 0.05 to 0.12 mSv (MSCT) and 0.02 to 0.13 mSv (CBCT).

CONCLUSION: The examined devices showed significant differences regarding the effective dose. Especially in the CBCT, the variance was particularly distinct. With the same and/or a smaller effective dose the image quality for the MSCT was judged significantly poorer, however the differences did not seem clinically significant.

251 AN *IN VITRO* STUDY OF FACTORS AFFECTING THE PRIMARY STABILITY OF ORTHODONTIC MINI-IMPLANTS

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AIM: To evaluate the effects of cortical bone depth and density, mini-implant features (length, design, core diameter), and insertion technique (insertion angle, cortical punch) on mini-implant primary stability. The effect of mini-implant re-insertion was also investigated.

MATERIALS AND METHOD: A total of 260 Infinitas[™] mini-implants of two lengths (6 and 9 mm), two core diameters for a body diameter of 1.5 mm (0.8 and 0.9 mm), and four designs (two tapered, two cylindrical) were inserted into synthetic bone blocks and the maximum insertion torque (MIT) was recorded. The cortical layer of the blocks varied in terms of density (30 and 50 pounds per cubic foot) and depth (1 and 2 mm). Three angles of insertion (90, 75 and 60 degrees) and two methods of insertion (direct and cortical punch) were compared. Forty mini-implants were removed and their re-insertion torque measured.

RESULTS: A significant increase in average MIT occurred when the cortical density was increased and when mini-implants were re-inserted. The 1.5 mm diameter cylindrical design had a significantly lower median MIT than the 1.5 mm tapered and 2.0 mm cylindrical designs. Length, cortical bone depth, insertion angle, use of a cortical punch and core diameter did not did not have statistically significant effects on MIT.

CONCLUSION: Mini-implants achieve greater primary stability in higher density cortical bone. Tapered 1.5 mm diameter and 2.0 mm cylindrical designs offer greater primary stability than the 1.5 mm cylindrical design. Re-inserting mini-implants results, on average, in significantly higher MIT. Pre-drilling may be advisable to prevent excessive insertion torque or mini-implant fracture where cortical density is high or where re-insertion is performed. Increased core diameter may confer increased fracture resistance without excessively increasing insertion torque.

252 A CEPHALOMETRIC COMPARISON OF MEDIEVAL SKULLS WITH A MODERN POPULATION

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AIM: To compare the craniofacial characteristics of medieval skulls and modern Norwegians.

MATERIALS AND METHOD: Lateral cephalometric radiographs were obtained of 27 Norwegian medieval skulls (13th to 15th century) which were determined for age and gender, and excavated in Trondheim, Norway. Twenty-seven craniofacial

parameters were compared with corresponding variables from a matched sample of 27 modern Norwegians. In addition, occlusal attrition was recorded in the medieval group. Differences between the samples were analyzed using the *t*-test, and inter- and intraexaminer reliability was examined by intraclass correlation coefficient.

RESULTS: The flexure of the cranial base (N-S-Ba) was more obtuse in the medieval group, and the gonial angle was significantly smaller. The length of the anterior cranial base was not significantly different. Vertical skeletal parameters were not significantly different, except for ramus height that was increased in the medieval group. Anterior face height was not associated with the level of attrition. Maxillary prognathism was not significantly different, but the mandibular sagittal position was more retrognathic in the medieval skulls when related to the base (S-N). Sagittal relations based on the Frankfort plane were however no different. Possible reasons for the differences were analyzed. Females had smaller linear dimensions than males in both samples. The male medieval mandible was more retrognathic than the modern; this difference was not observed in females.

CONCLUSION: Medieval and modern maxillomandibular characteristics were generally similar. The main difference was in flexure of the cranial base that was increased in the medieval sample. Differences between medieval and modern males and females followed the same pattern as was seen in the pooled sample. Linear dimension were significantly greater in the males.

253 RELATIONSHIP BETWEEN CERVICAL COLUMN CURVATURE AND THE SAGITTAL POSITION OF THE JAWS

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AIM: To evaluate posture and curvature of the cervical column, introducing a modified constructed angle in order to evaluate cervical column curvature in a relaxed position in relation to sagittal jaw position.

MATERIALS AND METHOD: Lateral cephalograms of 56 females and 44 males, mean age 13.49 years, with no anomalies, taken in the natural head position. Steiner and Wits analyses were used to evaluate the sagittal position of the jaws. Modified constructed, CVT/HOR and OPT/HOR angles were used to evaluate cervical column posture and curvature. The patients were classified into three groups according to Angle's classification.

RESULTS: There was a significant positive correlation between the modified constructed angle and sagittal jaw relationship (both P < 0.05). There was also a significant correlation between OPT/HOR and ANB and Wits parameters in Class II patients (P < 0.05, P < 0.01). This relationship was limited to CVT/HOR and ANB in Class III patient but this was not strong (P < 0.05). Age did not affect curvature or posture of the cervical column.

CONCLUSION: There is a positive correlation between the modified constructed angle and sagittal jaw relationship, and a significant correlation between cervical column posture and ANB; Wits in Class II patients.

254 ZOLEDRONIC ACID RESTORES TOOTH MOVEMENT AND ORTHODONTICALLY INDUCED ROOT RESORPTION IN THE OSTEOPOROTIC ANIMAL

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AIM: Zoledronic acid is a potent and novel bisphosphonate that has recently been shown to effectively reduce fracture risk in patients who received once-yearly medication for the treatment of post-menopausal osteoporosis. However, the effect of zoledronic acid on orthodontic tooth movement and orthodontically induced root resorption in an osteoporotic animal model systemically treated with zoledronic acid has not been elucidated. Therefore, the present study was performed.

MATERIALS AND METHOD: Ten-week-old female Wistar rats were divided into three groups; ovariectomy, ovariectomy with zoledronic acid and control. Ovariectomy was performed on two groups that had ovariectomy with or without zoledronic acid. Two weeks after ovariectomy, zoledronic acid was only injected into a group of ovariectomy with zoledronic acid. Four weeks after ovariectomy, 25 g nickel-titanium closed-coil springs were applied between the upper incisors and left first molar. Tooth movement was observed by micro-computed tomography and root resorption was measured using laser and electron scanning microscopes.

RESULTS: The amounts of tooth movement and orthodontically induced root resorption were significantly increased in the ovariectomy group compared with the control group. However, there was no significant difference in the amount of tooth movement and orthodontically induced root resorption between the ovariectomy with zoledronic acid and control groups. Zoledronic acid inhibited the excessive tooth movement and orthodontically induced root resorption observed in ovariectomized rats.

CONCLUSION: The excessive amount of orthodontic tooth movement and the orthodontically induced root resorption in ovariectomized rats might be restored to a normal level by taking zoledronic acid.

255 MANDIBULAR MOLAR PROTRACTION SUPPORTED BY TEMPORARY ANCHORAGE DEVICES

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AIM: To analyze the efficacy of temporary anchorage devices (TADs) during protraction of the mandibular second molars.

SUBJECTS AND METHOD: Nineteen adult patients (age mean 33 ± 1.3 years) with missing mandibular first molars, a Class I occlusion and light crowding in both arches. Two miniscrews (Abso Anchor 1.2×7 mm) were placed in the buccal alveolar bone between the roots of canines and first premolars to provide absolute anchorage for protraction of the second and third molars into the atrophic edentulous areas. All devices were immediately loaded with a closed NiTi coil of 150 g. All patients were subjected to panoramic and lateral radiography.

RESULTS: Only two miniscrews failed before orthodontic treatment completion, the other 17 patients were successfully treated. Space closure was achieved by means of sliding mechanics on a stainless steel archwire (0.18×0.25 inches). More than 12 mm of protraction was achieved in 19 months without modification of mandibular incisor torque. Increases in alveolar ridge width and vertical bone height were noted mesial to the second molar. Good posterior occlusion and contact points were achieved.

CONCLUSION: This technique is a simple procedure and an immediate, effective and valid anchorage source in patients with missing first molars requiring protraction of the second and third molars into the atrophic edentulous areas. The loss of two devices was not due to immediate loading but to the fact that the site of the soft tissues had not healed properly. 256 SHAPING THE MAXILLARY ARCH OF CLEFT PATIENTS USING A SELF-LIGATING SYSTEM

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AIM: To show the treatment of patients with alveolar bone clefting with severe deformities of the maxilla treated with the Damon® system without using any additional appliances to shape the maxilla before bone transplantation into the cleft region.

SUBJECTS AND METHOD: Eight patients (3 females, 5 males) with open osseous clefts jaw palate (7 unilateral, 1 bilateral) and severe deformities of the maxilla (2 unilateral crossbites, 6 bilateral crossbites) treated by the same orthodontist. The patients' ages at the time of bracket placement (Damon® 3MX/Q, Ormco, Orange, California, USA) ranged from 8 years 1 month to 16 years 5 months leading to very different initial situations. Thus, the bonding protocol, the torque prescription, and the archwire sequence, as well as the use of auxiliary elements (e.g. open coils) needed to be chosen individually. No supplementary fixed or removable appliances were used. Pre-surgical, computed tomographic (CT) scans were taken and investigated with the IQ-View® software (IQ-Lite 2.5.0, Image Information Systems Ltd., London, UK) to evaluate the cleft region as well as the shape of the maxilla, and to compare both with the pre-treatment CT scans.

RESULTS: In all cases the required expansion and shaping of the maxillary arch before bone transplantation into the cleft region could be performed with the Damon® system only. CT scans showed expansion of the maxilla enlarging the cleft diameter.

CONCLUSION: The Damon® system seems to be an effective alternative in the preoperative treatment of cleft patients utilizing its expanding effect. Compared with conservative appliances used for this purpose (e.g. quadhelix) the following advantages can be found: continuous controlled force application, shaping of the arch and correction of the tooth positions with the same appliance at the same time, no palatal appliance needed and therefore high patient comfort.

257 LEVEL OF RESIDUAL MONOMER RELEASED FROM ORTHODONTIC ACRYLIC MATERIALS

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AIM: To quantify the amount of residual monomer leached from four different orthodontic acrylic materials prepared with two different manipulation methods by high pressure liquid chromatography (HPLC).

MATERIALS AND METHOD: Eighty cylindrical specimens (5 \times 25 mm) divided into eight equal groups. The specimens were prepared with four acrylic materials: Orthocryl Neon Blue (Dentaurum), Orthocryl EQ (Dentaurum), Orthoplas (Vertex), O-80 (Imicryl) and two different manipulation methods (doughing and salt-pepper). Methyl methacrylate concentrations were determined by HPLC analyses of the extracts after specimen immersion in a methanol solution. HPLC measurements were made at 2 and 6 hours, 1 day, 1 week, and 3 months. One-way analysis of variance (ANOVA) and Tukey honestly significant difference (HSD) multiple comparison tests were used for the assessment of eluted monomer among the groups. To assess the differences within each group over the various periods, repeated measures ANOVA and paired *t*-tests were used.

RESULTS: HPLC showed that there were statistically significant differences in the amount of eluted monomer among the groups (P < 0.05). Evaluation of the effects of the manipulation techniques showed that monomer release rate was higher in

specimens prepared with the doughing method. When the four acrylic materials were compared using the Tukey HSD test, the highest monomer release was recorded in the specimens made from Vertex in both manipulation techniques. Statistically significant differences were found in the residual monomer at different time intervals (P < 0.001).

CONCLUSION: The salt and pepper method can be recommended for preparation of orthodontic appliances.

258 CORRELATION BETWEEN LATERAL CEPHALOGRAMS AND DIGITAL THREE-DIMENSIONAL FACIAL SURFACE SCANS

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AIM: To identify the correlation between four representative cephalometric facial parameters, and the facial surface on the three-dimensional (3D) facial scans of patients diagnosed with an orthognathic-skeletal Class III malocclusion. The hypothesis tested is that sagittal cephalometric facial analysis parameters in SRIII patients reflects on the facial surface in typical correlations not only in the sagittal, but also in the other two planes which are not described on the lateral cephalogram.

SUBJECTS AND METHOD: Fifty-one skeletal Class III patients divided into three subgroups, depending on the predominant malocclusion component: maxillary retrognathism (n = 15), mandibular prognathism (n = 17) and bimaxillary Class III malocclusion (n = 19). Lateral cephalometric analysis was performed as a standard diagnostic procedure, in all patients, and additional 3D facial scans were obtained. A method was then developed which enabled facial appearance to be described by measuring relevant distances and angles using facial reference points. Statistical analysis was based on Pearson's correlation test (P < 0.05 and P < 0.001).

RESULTS: Most of the facial parameters correlated significantly with Wits appraisal (10 statistically significantly negative correlations, 6 less significant correlations, 5 insignificant correlations). Fewer correlations were found for ANB (2 statistically significant, 4 less significant). Larger deviations from the normal face with Wits values were connected with increasing vertical face length and narrowing of the face in the zygomatic mandibular angle region. Furthermore, facial concavity was increasing. Even though true facial asymmetries were excluded from the sample, asymmetry in the chin region was present in 33.3 per cent.

CONCLUSION: Correlations between one lateral cephalometric parameter, Wits appraisal, and distances and angles on 3D facial scans have been shown.

259 A SURGERY-FIRST APPROACH USING THREE-DIMENSIONAL SIMULATION FOR SKELETAL CLASS III CORRECTION***

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AIM: To introduce a surgery-first approach (SFA) using three-dimensional (3D) simulation programmes for diagnosis and treatment planning following virtual set-up and for making surgical wafers.

MATERIALS AND METHOD: The followings was used for the 3D simulation procedure for SFA: (1) 3D laser scanning of initial model; (2) Superimposing scan data to reconstructed 3D computed tomographic image; (3) three-dimensionally simulate tooth movement for pre-surgical orthodontic treatment by Mimics (Materialise, Leuven, Belgium); final virtual set-up model; (4) Orthognathic surgery simulation with Simplant Pro Crystal (Materialise; (5) Final virtual set-up models replaced with 3D scan data of the initial model again; (6) Making surgical wafers by a rapid prototyping method.

RESULTS: After bimaxillary surgery using the SFA, the lateral profile was improved. Post-treatment records showed a balanced profile with good occlusal relationships, and overjet/overbite within normal range. Cephalometrically the patient's post-treatment profile was almost identical to the norm for Korean female adults.

CONCLUSION: SFA has several advantages in comparison with conventional treatment, such as increased patient cooperation, efficiency and effective decompensation, and a shortened treatment time. On the other hand, it is hard to predict pre-surgical orthodontic treatment in the SFA by manual model set-up, and there are also errors from replacement of models in a semi-adjustable articulator. However, the SFA using 3D simulation could be more predictable and achieve satisfactory treatment outcomes.

260 THREE-DIMENSIONAL QUANTIFICATION OF MAGNETIC RESONANCE IMAGE ARTEFACTS FROM VARIOUS METALS*** H Imai¹, Y Tanaka², N Nomura³, K Ohno², T Ono¹, ¹Orthodontic Science, ²Functional Neurosurgery and ³Institute of Biomaterials and Bioengineering, Tokyo Medical and Dental University, Japan

AIM: To quantify magnetic resonance image (MRI) artefacts that may arise from metals with different magnetic susceptibility (as may be found in orthodontic appliances) using a three-dimensional (3D) artefact model, and to demonstrate the correlation between magnetic susceptibility and artefact volume.

MATERIALS AND METHOD: Ten types of metal [stainless steel (SS), Co-Cr, Nb, Ti, Zr, Mo, Al, Sn, Cu and Ag] were prepared in cylindrical test pieces, 25 mm long and 3 mm in diameter. The magnetic susceptibility of each metal was measured using a magnetic balance. Each metal was embedded in an agarose gel phantom. MRIs of the metals were taken using a 3.0 Tesla MR imaging scanner with fast spin echo and gradient echo conditions. The long axis of the metal was set both parallel and perpendicular to the static magnetic field. 3D models of the artefact were constructed from the images and artefact volume was calculated for each metal.

RESULTS: The artefact volume linearly decreased with decreasing magnetic susceptibility; there was a significant correlation between magnetic susceptibility and artefact volume, as evaluated by the Student's *t*-test. Although Sn possessed the lowest absolute magnetic susceptibility (0.14×10^{-6}) , the artefact volume from Cu (-0.62×10^{-6}) was smaller than that of Sn. This may be because the magnetic susceptibility of Cu was close to that of the agarose gel phantom (-0.58×10^{-6}). The forming direction of the artefact from Ag (-1.39×10^{-6}), which is diamagnetic, was the reverse of that from other paramagnetic metals.

CONCLUSION: The volume of the artefacts decreased with decreasing magnetic susceptibility of metals, until the susceptibility of the metal matched that of its surroundings. When the susceptibility decreased further, a reverse-orientated artefact was formed.

261 EFFECT OF BLEACHING ON THE SHEAR BOND STRENGTH OF ORTHODONTIC CERAMIC BRACKETS AND ON ENAMEL COLOUR

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AIM: To investigate the effect of bleaching on the colouration of tooth enamel and shear bond strength (SBS) of orthodontic ceramic brackets based upon current whitening practice.

MATERIALS AND METHOD: The bleaching and bonding techniques were performed on extracted bovine teeth for the investigation of their colourimetric spectrum and the adhesive bond strength on surface enamel. One group was designated as the control group with no pre-treatment. Another group was treated with a 45 per cent hydrogen peroxide solution prior to bonding. The difference in colour was expressed as the Euclidian distance (ΔE) and parameter details by a spectrophotometer. Bonding procedures were carried out by means of an 'etch and rinse' system. The resulting SBS was analyzed and evaluated using the adhesive remnant index (ARI) scoring. Statistical analysis was performed with the Statistical Package for Social Sciences for Windows 12.0 (SPSS Inc., Chicago, Illinois, USA) using the Kruskal-Wallis and *post-hoc* test. The means and standard deviations were calculated. The significance level was set at $\alpha = 0.05$

RESULTS: Colourimetric analysis revealed statistically significant differences between the original and bleached as well as the bleached and debonded teeth, setting off a blue colour shift. The control group reflected a slight green shift following debonding. There was no significant difference in bond strength between the nontreated surfaces and those treated with peroxide. A one-tailed test resulted in a 0.5 MPa higher SBS level for the bleached specimens whereas the ARI scores did not reveal meaningful disparities in the group levels.

CONCLUSION: Peroxide pre-treatment results in colour differences of teeth. Bonding and debonding procedures seem to have no statistically significant influence on the enamel colour using current materials. Bleaching alone has no effect on SBS.

262 UPPER AIRWAY DIMENSIONS IN DIFFERENT CRANIOFACIAL PATTERNS

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AIM: To retrospectively evaluate oropharyngeal airway dimensions in healthy adult subjects with different skeletal sagittal and vertical patterns.

MATERIALS AND METHOD: Cone beam computer tomographic (CBCT) images of 100 subjects (42 males, 58 females) with different sagittal and vertical skeletal patterns. Inclusion criteria were 17-27 years of age with normal craniocervical inclination (90-110°) and the teeth in centric occlusion. Exclusion criteria were asymmetries, obstructive sleep apnoea, syndromes, facial clefts, and arthritis. CBCT images were analyzed with Dolphin 11.0 software (Patterson Dental Supply Inc., Chatsworth, California, USA). The oropharyngeal airway volume (OAV) and minimal cross-sectional area (CSA) were measured. The data was analyzed with linear multiple regression. The intergroup comparisons of the airway measurements were performed with one-way ANOVA.

RESULTS: Gender, skeletal sagittal and vertical pattern showed a statistically significant influence on upper airway dimensions, and explained 19 and 14 per cent of the variation in the OAV and CSA, respectively. Individuals with a skeletal Class III pattern and normal growth type had statistically significantly (P < 0.05) larger OAV and CSA.

CONCLUSION: Overall, the measurements of skeletal sagittal and vertical patterns were weak predictors of oropharyngeal airway size. The oropharyngeal airway measurements did not vary among subjects with different sagittal and vertical jaw relationships except that the Class III individuals with a normal growth type had larger OAV and CSA compared with Class I and Class II individuals with a normal and vertical growth type.

263 PREVALENCE OF THIRD MOLARS IN A GREEK ORTHODONTIC SAMPLE

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AIM: To investigate the prevalence of third molars (M3s) in an orthodontic sample of Northern Greece, and to examine its possible associations of the number of M3s present per person, with regard to: gender, to the maxilla or mandible and to the left and right sides of the jaws.

SUBJECTS AND METHOD: Two hundred and twenty patients in the permanent dentition (mean age: 13.62 years; range: 9.51-18.22 years). Assessment of the presence of M3s was made on panoramic radiographs both for impacted and erupted teeth. The collected data was subjected to statistical analysis using the Statistical Package for Social Sciences. The chi-square test was used for analyzing the data, while Fisher's exact test was used in cases where the expected frequencies in each cell were less than 5.

RESULTS: All four M3s were found in 79.1 per cent of the patients, three molars in 8.6 per cent, two molars in 7.7 per cent, and one molar in 1.8 per cent. All four M3s were present more frequently in females (47.3%) than in males (31.8%), but there was no significant difference (P = 0.313). No sexual dimorphism was found in the prevalence of M3s between the left and right side or the maxilla and mandible. On the contrary, a significant relationship between the existence of M3s and each side (Fisher's exact test = 100.788, P < 0.001), or each jaw (Fisher's exact test = 24.372, P < 0.001) was found.

CONCLUSION: All four M3s were present in 79.1 per cent of patients. No gender predilection was noted. There is a significant relationship in the number of M3s between each side and jaw.

264 THE IMPACT OF EXTRACTION AND NON-EXTRACTION TREATMENT ON FACIAL AESTHETICS AND SMILE ATTRACTIVENESS G Iodice, G Laino, L Ammendola, G Danzi, R Capuozzo, Department of Orthodontics, University of Naples 'Federico II', Italy

AIM: To evaluate the effects of extraction and non-extraction treatment on the soft tissue profile and smile attractiveness.

SUBJECTS AND METHOD: Ten laypersons, 10 dentists and 10 orthodontists were randomly presented pre- and post-treatment records of 15 Class I and 15 Class II patients treated with and without premolar extractions. Visual analogue scales (VAS) were used to evaluate the patients' profiles and the aesthetic improvement after treatment. The evaluators were also asked to indicate whether or not the patient had undergone extraction treatment.

RESULTS: Overall, the soft tissue facial profile and smile attractiveness for both the extraction and non-extraction samples were similar post-treatment. There were significant differences between the three groups of evaluators.

CONCLUSION: Both extraction and non-extraction treatment protocols seem to have no predictable effect on overall smile aesthetics and dental attractiveness, meaning that if indicated, orthodontic extractions do not necessarily have a deleterious effect on facial aesthetics.

265 SKELETAL AND DENTOALVEOLAR EFFECTS PRODUCED BY THE FUNCTIONAL REGULATOR-2 IN PRE-PUBERTAL CLASS II SUBJECTS M Iovane¹, F L De Gregorio¹, G Perinetti², L Contardo², L Perillo¹, Departments of Orthodontics, ¹Second University of Naples and ²University of Trieste, Italy

AIM: Whether skeletal effects are obtained by functional appliances in Class II subjects is still controversial. In this regard, most available studies do not clearly identify the growth phases (i.e. pubertal or not) of the treated subjects. This controlled retrospective study aimed to evaluate the skeletal changes in Class II subjects produced by Functional Regulator (FR)-2 treatment during the pre-pubertal growth phase.

MATERIALS AND METHOD: The data were derived from records obtained at a University Dental Clinic. A total of 41 treated subjects and a total of 57 untreated controls, all pre-pubertal, matched for malocclusion and age $(8.9 \pm 15 \text{ years})$ and sex (52 females, 46 males) were included. The overall observational period was 1.6 ± 0.8 years for both groups.

RESULTS: In the treated group, only minor skeletal changes were seen after the observational period with little clinical relevance. Most of the changes produced by the FR-2 treatment were at the dentoalveolar level. A further subdivision of the groups into dimensional (short mandible), or positional (retruded mandible) Class II also showed no significant differences in any of the outcomes.

CONCLUSION: The present study has shown that functional treatment of Class II malocclusion by FR-2 during the pre-pubertal growth phase is limited to modification at the dentoalveolar level. Moreover, whether the Class II is dimensional or positional in nature would not constitute a valid indicator of responsiveness to treatment, at least when dealing with pre-pubertal subjects.

266 REDUCED MASTICATORY LOADING DURING GROWTH IMPAIRS SPATIAL MEMORY

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AIM: Previous studies have reported that cognitive function declines in older humans or senescence-accelerated mice when masticatory loading decreases. The purpose of the present study was to investigate cognitive functional changes under conditions of low masticatory loading during a growth period. The hypothesis test was that decreased masticatory loading impairs cognitive function during growth.

MATERIALS AND METHOD: Male Wistar rats, 22 weeks old, were assigned to two groups: control, fed whole pellets; experimental group, fed a liquid diet. Cognitive function was assessed using the 8-radial-maze. The number of reference memory errors (RME), working memory errors (WME), and correct choices (CC) were recorded at 5, 6, 7, 8, and 9 weeks of age. Differences between groups at different ages, as well as between ages within each group, were compared using the Kruskal-Wallis and Mann-Whitney-U tests, with 95 per cent significance. Ultrathin, serial hippocampal sections from 9-week-old rats were processed by conventional methods, and Nissl and Klüver–Barrera stainings were performed to analyze neuronal density in the hippocampal CA1 region.

RESULTS: In the experimental group, WME, RME, and CC were not significantly different from the control group. In the control group, WME significantly decreased and CC significantly increased between 5 and 9 weeks of age. However, RME was not significantly different between 5 and 9 weeks. In the experimental group, WME, RME, and CC were not significantly different between 5 and 9 weeks. In the

experimental group, neuronal density in the hippocampal CA1 region was less than in the control group.

CONCLUSION: Decreased masticatory loading during growth enhanced hippocampal neuronal loss, which led to impaired cognitive function in growing rats.

267 TEMPOROMANDIBULAR JOINT DISORDERS IN TREACHER COLLINS SYNDROME – A CONE BEAM MICROCOMPUTED TOMOGRAPHIC STUDY IN MICE

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AIM: Treacher Collins Syndrome (TCS) is an autosomal dominant defect causing cranioskeletal hypoplasia due to neural crest cell degeneration and insufficient ribosome biogenesis. It is associated with mutation in the Tcof1 gene. Along with other craniofacial deformities and dental anomalies, TCS patients present with defects in the formation of the temporomandibular joint (TMJ). To study TMJ defects in more detail, a mouse model of TCS was used to investigate the formation of the TMJ using microcomputed tomography (μ CT) and histology, with the aim of understanding how congenital TMJ defects arise and may affect normal function.

MATERIALS AND METHOD: Eleven heterozygous TCOF1 deficient mice aged 6 weeks and their wildtype littermates on a dolichos biflorus agglutinin background were analysed by Explore Locus SP μ CT imaging. These mice were then prepared for histology to further analyse the defect using Trichrome staining.

RESULTS: Two of the 11 mice showed an obvious defect in the development of the TMJ, while the other mice appeared to show subtle defects in the condyles. The defects included fusion of the disc to the condylar or the glenoid fossa and ossification of the disc. The defects were often unilateral but did not prevent these mice from feeding normally.

CONCLUSION: TMJ defects observed in Tcof1 mutant mice mimic those observed in patients with TCS making these mice an excellent model for studying congenital TMJ defects.

268 COMPUTED TOMOGRAPHIC IMAGE ANALYSIS OF GROWTH AND DEVELOPMENT AROUND THE MANDIBULAR FOSSA

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AIM: To conduct image analysis of the articular tubercle of the area surrounding the mandibular fossa and of sagittal sections of the articular tubercle, employing computed tomographic (CT) images according to age.

MATERIALS AND METHOD: Ten skull bones for each Hellman's dental stage. Images of these bones were acquired with X-ray CT imaging equipment in the Frankfort plane and at a parallel angle. Acquisition conditions were: X-ray tube voltage, 130 Kv; tube current, 63 mA in bone mode; scanning time, 20 seconds; slice interval, 2 mm, WW 3000 and WL480. Images were transferred and the image was produced. Subsequently, based on images of the thinnest point of the mandibular fossa and of images 2 mm toward the inside and 2 mm toward the outside of this point, the longitudinal distance, horizontal distance, angle, area and mandibular fossa angle of the articular tubercle and articular posterior tubercle were measured.

RESULTS: 1. Growth rates in the longitudinal and horizontal distance and of the area of the articular and posterior tubercles of the thinnest point of the mandibular fossa peaked from Stage IA to Stage IC. From Stage IC to Stage IVC, a moderate increasing trend was observed; from Stage IVC to Stage VA, growth rates declined.

2. The growth rates of the longitudinal distance and of the inner side of the articular tubercle from the thinnest point of the mandibular fossa as well as of the horizontal distance of the articular tubercle peaked from Stage IA to Stage IC. From Stage IC to Stage IVC, a moderate increasing trend was detected; from Stage IVC to Stage VA, growth rates declined.

CONCLUSION: Comparisons regarding the extent of growth between the sections 2 mm on the inner and outer sides of the thinnest point of the mandibular fossa and each of the other items revealed no significant differences in a 4 mm rage as a combination of the two areas.

269 VALIDITY OF THE LOWER BORDER OF THE MANDIBLE AS A REFERENCE TO LOWER INCISOR INCLINATION

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AIM: The lower border of the mandible on a cephalogram is used in orthodontics to measure lower incisor inclination. Orthodontic treatment is mostly undertaken in growing patients, and the border may remodel, leading to errors of methods relying on the lower border of the mandible. Björk's method of cephalometric superimposition utilised structures that are independent of the remodelling of the mandibular border. This study tried to assess whether any of the above methods comes to clinically different outcomes for mandibular incisor inclination.

SUBJECTS AND METHOD: The records of 40 completed subjects between the ages of 12 and 16 years treated with fixed orthodontic appliances. The pre- and mid-treatment cephalograms were traced and the values for the incisal change measured with respect to: Me-Go, Gn-Go and lower border tangent planes. The cephalograms were then superimposed using Björk's stable mandibular structures.

RESULTS: The preliminary results show a greater correlation of the Me-Go, Gn-Go planes as well as the superimposed images. The lower border tangent appears to be the least accurate.

CONCLUSION: Utilising the lower border of the mandible as a reference plane in determining lower incisor inclination, is less accurate and more variable in growing individuals.

270 THE EFFECT OF INCREMENTAL LIP ADVANCEMENT ON INTRAORAL PRESSURE

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AIM: During orthodontic treatment, teeth are often displaced towards the perioral soft tissues. This can affect the equilibrium of forces acting on teeth, which may have implications for long-term stability. The aim of this study was to investigate the effect of incremental advancements of the lower lip on the pressure exerted on the lower labial segment.

SUBJECTS AND METHOD: Intraoral lip pressures were measured using four miniature pressure sensors in eight participants (2 males, 6 females; 20-39 years) who were free of relevant malocclusion. Custom-made acrylic trays for the lower arch were used, with sensors located adjacent to the midline and left canine. The sensors were calibrated using a pressure chamber and the recorded signals were analogue-to-digital converted at 1 kHz, and stored for off-line analyses. For each participant, the lower lip was advanced incrementally by inserting trays with different labial thicknesses (0.5, 2.5 and 4.5 mm). Resting lip pressures were assessed three times

over a 30-second window with the teeth in light contact or apart. Data were analyzed by means of a mixed linear model.

RESULTS: The baseline resting pressures at the midline and canine labial sites were 12.1 and 19.4 g/cm² respectively, the difference being statistically significant (F = 32.1; P < 0.001). The resting lip pressure did not differ between tooth-contact and teeth-apart jaw positions (P = 0.85). Baseline pressure increased markedly after pushing the lower lip forward 2 mm (F = 20.8; P < 0.001), but levelled off as the lip was advanced 2 mm further (P = 0.49).

CONCLUSION: The dose-response relationship between lip advancement and lip pressure is not linear. Slight advancement of the lower lip resulted in an abrupt increase of lip pressure of approximately two-thirds of baseline values. Further advancement of the lip had little influence on intraoral pressure. The short- and long-term adaptation of soft tissue pressure response needs to be further investigated in future studies.

271 SELF-ETCHING ADHESIVES IN ORTHODONTICS: BOND STRENGTH AND ANTI-BACTERIAL PROPERTIES

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AIM: Patients wearing fixed orthodontic appliances are at risk of enamel decalcification, which could be avoided using antimicrobial adhesives for bracket bonding. The aims of this study were: to compare bond strengths produced by Transbond XT (TXT) composite and four self-etching adhesives: Clearfil Protect Bond (CPB), Clearfil SE Bond (CSB), Transbond self-etching primer (TSEP) and iBond in relation to the conventional acid etch adhesive TXT and to determine the anti-bacterial effectiveness of self-etching adhesives against *Streptococcus mutans* and *Lactobacillus gasseri*, the main causes of dental caries.

MATERIALS AND METHOD: One hundred and twenty five brackets were bonded to extracted human premolars using five enamel-conditioning procedures: etching with 37 per cent phosphoric acid; CPB; CSB; TSEP and iBond. Shear bond strength was measured using a universal testing machine (Autograph AGS-1KND) set at 1 mm/minute. Data were analysed with Kruskal-Wallis (P < 0.05) and Mann-Whitney tests applying Bonferroni correction (P < 0.005). Inhibitory effects of the adhesives against *S. mutans* and *L. gasseri* were examined with the disk agar diffusion method. Bacterial adhesion was studied with scanning electron microscopy.

RESULTS: No significant differences were detected between bond strengths produced by CPB, CSB, TSEP and TXT compared with acid-etch. iBond produced less bond strength than the rest (P < 0.001). Significant differences between CSB and TSEP were also found (P = 0.004). CPB and iBond produced a microbe inhibition halo that was greater than with CSB and TSEP. TXT did not produce an inhibition halo. iBond was the only tested product to which the bacteria adhered, mainly *S. mutans*.

CONCLUSION: CPB is an attractive option for bracket bonding as it can reduce the possibility of decalcification due to its antibacterial properties.

272 DENTAL COMPENSATION OF SKELETAL CLASS III MALOCCLUSIONS WITH VERTICAL GROWTH BY EXTRACTION OF THE LOWER SECOND MOLARS

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AIM: To determine the effects on occlusion and dentofacial morphology after extraction of the lower second molars combined with Class III power chains in patients with a moderate skeletal Class III malocclusion and vertical growth pattern.

SUBJECTS AND METHOD: Twenty patients with a mean age of 12.9 years. Inclusion criteria were a Wits of 0 to -5, a posterior growth type of the mandible (Hasund analysis) and the presence of an overjet -2 to 1 mm and overbite -3 to 0 mm. Treatment was performed using a straightwire appliance. During treatment the lower second molars were extracted and the patients wore Class III elastics. Pre- and posttreatment lateral cephalograms and dental pantomograms (DPT) of each patient were analyzed. The following parameters were measured: Wits, ML-NSL, occlusal plane, overjet, overbite, Index, LO1-NPog, LO1-ML, lower lip-E-line.

RESULTS: The treatment led to a change of the mean overjet from 0.5 mm to 2.1 mm and a positive mean overbite from -1.0 to 0.9 mm. The lower anteriors showed retrusion (LO1-ML 88.8 versus 86.7) and translational retraction (LO1-NPog 5.0 versus 3.8 mm). The occlusal plane rotated anteriorly from 18.8 to 13.7. The skeletal values showed a reduced negative Wits from -3.3 to -1.4 mm and an anterior rotation of the mandible (ML-NSL 35.5 versus 32.0). DPT analysis showed an elongation of the eight second upper molars of approximately 1.5 mm, and 15 out of 38 third molars replaced second molars sufficiently.

CONCLUSION: Dental compensation of a moderate Class III with vertical growth by extraction of the lower second molars combined with Class III elastics led to anterior rotation of the occlusal plane and mandible. Eighteen patients showed a physiological overjet and a positive overbite despite an increase in lower face height due to vertical growth.

273 EFFECTS OF MECHANICAL COMPRESSION AND NON-STEROIDAL ANTI-INFLAMMATORY DRUGS ON PERIODONTAL FIBROBLASTS C Jacobs¹, L Nettelhoff¹, D Meila², E Krieger¹, H Wehrbein¹, ¹Department of Orthodontics, University of Mainz and ²Department of Neuroradiology, Hospital

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AIM: There is increasing evidence that non-steroidal anti-inflammatory drugs (NSAIDs) can affect orthodontic tooth movement. The object of this study was to investigate the changes in human periodontal ligament fibroblasts (HPdLF) when static mechanical compression was applied combined with the presence of aspirin or paracetamol.

MATERIALS AND METHOD: Static compressive force is thought to mimic that found *in vivo* during orthodontic treatment. HPdLF were cultured in 5 μ M aspirin or paracetamol and loaded to static compression force *in vitro*. Different strengths (1, 5 and 10%) of SMS were loaded to the HPdLF for 12 hours. Viability was verified by MTT assay, migration by scratch wound assay. Gene expression of RankL, osteoprotegerin (OPG), alkaline phosphatase (ALP) and Cyclin D1 were investigated using real-time polymerase chain reaction (RT-PCR) methods.

RESULTS: Compression with high magnitude (10%) led to a decrease of viability of HPdLF, which was enhanced by the presence of paracetamol. Scratch wound assay showed reduced migration by paracetamol. RT-PCR showed that static compression of 5 per cent led to triplication of gene expression of RankL and a resulting RankL/OPG ratio >1. HPdLF cultured with aspirin or paracetamol showed a reduced increase of RankL. Osteogenic differentiation (ALP) and proliferation (Cyclin D1) of HPdLF was increased by aspirin and paracetamol, whereas compression without NSAIDs only increased ALP, but not Cyclin D1.

CONCLUSION: Static mechanical compression combined with paracetamol decreases viability and migration of HPdLF. Compression forces increase gene

expression of HPdLF for bone modification. Aspirin and paracetamol both lead to reduced changes of these genes and might decelerate orthodontic tooth movement.

274 TREATMENT EFFECTS OF THE R-APPLIANCE AND TWIN BLOCK IN CLASS II DIVISION 1 MALOCCLUSIONS

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AIM: To compare the effects of a differently designed functional appliance (the R-appliance) with a twin-block (TB) treated group.

SUBJECTS AND METHOD: Thirty patients (18 girls, 12 boys) with a mean age of 10.5 ± 0.7 years treated with the R-appliance for 16.2 ± 0.3 months and 25 (11 boys, 14 girls) with a mean age of 11.2 ± 1.3 years treated with a TB for 16.1 ± 1.4 months (control). All had a Class II division 1 malocclusion due to mandibular deficiency. Lateral cephalograms obtained at the beginning (T1) and end (T2) of the study were analysed.

RESULTS: Paired *t*-tests showed that SNB significantly increased in both groups. The incisor mandibular plane angle (IMPA) was reduced in the R-appliance group by 1.9 ± 4.9 degrees (P < 0.04) but increased by 0.5 ± 5.1 degrees (P < 0.6) in the TB group. SNA in the R-appliance group showed an increase of 0.2 ± 1.8 degrees (P < 0.5), while it was decreased by 0.2 ± 1.3 degrees (P < 0.3) in the TB group.

CONCLUSION: Both treatment modalities were successful in moving the mandible forward. However, with the R-appliance, this was achieved without proclination of the lower incisors.

275 THREE-DIMENSIONAL COMPARISON OF BUCCAL AND LINGUAL MOLAR RELATIONSHIPS BETWEEN ANGLE CLASS I AND II SUBJECTS*** S-Y Jang, Department of Orthodontics, Ewha Womans University MokDong Hospital, Seoul, Korea

AIM: To evaluate the consistency of molar relationships in Angle Class I and Class II subjects from the buccal and lingual aspects using a three-dimensional (3D) system.

MATERIALS AND METHOD: Two hundred and thirty two pairs of dental models (380 sides). The molar relationship as evaluated both from the buccal and lingual aspects using 3D digital models, which were generated through surface scanning of the study casts. They were sorted according to the classification defined by Liu and Melsen using Rapidform XOR3 software (Inus Technology Inc., Seoul, Korea).

RESULTS: The majority of the buccal Class I (89.6%) and mild Class II (86.7%) groups had a cusp-to-central fossa relationship at the lingual aspect; however, the severe Class II group had a cusp-to-mesial triangular fossa or marginal ridge relationship.

CONCLUSION: Buccal and lingual molar relationships are not always consistent. Therefore, a more differentiated diagnosis of molar relationships may help in recognizing the true nature of malocclusion.

276 PROFILE CHARACTERISTICS IN CLASS II DIVISION 2 PATIENTS M Janosevic, M Stosic. Department of Orthodontics, Medical Faculty, University of Nis, Serbia

AIM: To evaluate profile characteristics in patients with a Class II division 2 malocclusion.

MATERIALS AND METHOD: Profile radiographs of 48 subjects (23 males, 25 females, aged from 15 to 25 years) with a Class II division 2 malocclusion. Angular parameters were analyzed using the methods of Holdaway and Legan.

RESULTS: Facial convexity angle (<G-SN-PG) was significantly increased in both genders (P < 0.001) but with high variability. No gender dimorphism was observed. As there were broad individual variations in Holdaway angle, confidence intervals (CI) were used for statistical analysis. The existence of disharmonic profiles were identified in both genders (males CI = 8.7-13.9; females CI = 10.2-13.9; standard CI = 5.0-11.0) and in a higher percentage of males (74%) than females (60%).

CONCLUSION: Most of the Class II division 2 malocclusion patients had a convex profile with great variability in males. This malocclusion is also characterised by profile disharmony.

277 BOND STRENGTH OF MOLAR TUBES – AN *IN VITRO* STUDY

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AIM: To measure shear (SBS) and tensile (TBS) bond strengths of orthodontic molar tubes bonded with composite adhesive, to determine the effect of enamel microabrasion and the addition of silane coupling agent on the bond strength of bonded tubes and to report the mode of adhesive failure of debonded tubes.

MATERIALS AND METHOD: One hundred and sixty extracted human third molars divided into four equal groups. Each group was tested in shear and tension (20 specimens/test). The tubes were bonded as follows: G1 (control group): the teeth were acid etched (37% phosphoric acid) followed by bonding agent and composite adhesive (TransbondTM) application; G2: the tubes were bonded as in G1 with the addition of silane coupling agent to the base of the tube before bonding; G3: the enamel surface was treated with 18 per cent hydrochloric acid and pumice (microabrasion) before bonding with composite adhesive; G4: The enamel surface was micro-abraded and the base of the tube was treated with silane coupling agent before bonding. The mode of bond failure was evaluated using the modified Adhesive Remnant Index (ARI; Bishara *et al.*, 1999) and scanning electron microscopy.

RESULTS: Bond strength differed significantly between the tested groups. Adding silane coupling agent to the tube base prior to bonding produced the highest SBS (13 \pm 4.1 MPa) and TBS (11.1 \pm 1.8 MPa) among all tested groups. Micro-abrasion and adding silane coupling agent produced bond strength values comparable with the conventional bonding protocol. Regarding the mode of bond failure, significant differences existed between the tested groups in shear only (P = 0.009). Failure occurred equally at the tooth-adhesive and tube-adhesive interfaces in the control group. When silane coupling agent was applied (and micro-abrasion) most failures occurred at the enamel-adhesive interface. With micro-abrasion, failure occurred at the tube-adhesive interface. In the tensile test, all groups failed mostly at the tube-adhesive interface.

CONCLUSION: Adding silane coupling agent to the base of molar tubes before bonding maximizes the bond strength of the bonded tube.

278 CONCORDANCE IN SKELETAL CLASS AND FACIAL BIOTYPE AMONG DIFFERENT CEPHALOMETRIC ANALYSIS

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AIM: To evaluate the concordance of skeletal Class among Ricketts, Steiner and McNamara cephalometrics and also the facial biotype between Jarabak, Steiner and Ricketts.

MATERIALS AND METHOD: Three hundred and ninety nine randomly selected cephalometric tracings of orthodontic patients that attended within the last 5 years. The measurements recorded and compared were: Steiner's *XY* axis, Ricketts' facial axis and Jarabak's facial height ratio for facial biotype, and Steiner's skeletal Class, Ricketts' skeletal Class and McNamara's difference between maxillary and mandibular length. The data were analysed with the Statistical Package for Social Sciences, version 17.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Concordance percentage and kappa (κ) were performed.

RESULTS: Skeletal Class: concordance between Ricketts and McNamara was 42.2 per cent ($\kappa = 0.18$); between Steiner and McNamara it was 43 per cent ($\kappa = 0.20$); between Ricketts and Steiner 71.1 per cent ($\kappa = 0.5$). Facial biotype: concordance between Steiner and Jarabak was 39.3 per cent ($\kappa = 0.11$); between Steiner and Ricketts 70.7 per cent ($\kappa = 0.49$) and between Jarabak and Ricketts 49.4 per cent ($\kappa = 0.25$).

CONCLUSION: Concordance between Ricketts, McNamara, Jarabak and Steiner for both skeletal Class and facial biotype is fairly low.

279 UNDISTURBED BIOFILM FORMATION ON STAINLESS STEEL ORTHODONTIC BONDED RETAINERS: AN *IN VIVO* STUDY.

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AIM: To compare biofilm formation on orthodontic bonded retainers placed buccally or palatally.

MATERIALS AND METHOD: Four different types of orthodontic bonded retainers, (3 multistrand stainless steel: Quadcat®, Pentacat® and Wildcat®; 1 single strand stainless steel: Forestanit®) were placed on the buccal and palatal sides of the upper arch in 10 subjects. The wires stayed *in situ* for four days during which they were not brushed. The rest of the teeth were brushed with a non-antibacterial toothpaste (Prodent Softmint). The total number of bacteria per centimetre of wire was counted, as well as the number of colony forming units (CFUs). The viability of the biofilm was determined with live/dead staining. Surface topography of the wires and biofilms were evaluated by scanning electron microscopy. One-way analysis of variance (ANOVA) was used to compare the number of adhering CFUs per centimetre of wire length on the four types of wire surfaces. Bonferroni's test was used for *post-hoc* multiple comparisons. Statistical significance was set at P < 0.05.

RESULTS: Significantly more biofilm was formed on all three types of multistrand orthodontic bonded retainers compared with the single strand bonded retainers (P < 0.05). Palatal placement resulted in significantly less biofilm formation on all wire types compared with buccal placement (P < 0.05). Viability of the biofilm on the different types of retainers was not significantly different.

CONCLUSION: In terms of undisturbed biofilm formation, single strand bonded retainers are preferred over multistrand bonded retainers for orthodontic retention. More research is needed however to confirm these results under normal oral hygiene conditions.

280 PREVALENCE AND GENETIC RELEVANCE OF MAXILLARY LATERAL INCISOR HYPODONTIA IN KOREAN TWINS***

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AIM: To investigate the prevalence and genetic relevance of maxillary lateral incisor hypodontia in Korean twins.

SUBJECTS AND METHOD: Three hundred and twenty six Korean twins [234 females, 92 males, mean age: 38.03 years, 136 monozygotic (MZ) and 27 dizygotic (DZ) twin pairs]. Microdontia and other dental anomalies were diagnosed using radiographs, clinical examinations and medical/dental histories. The prevalence and genetic relevance were investigated between MZ and DZ twin pairs. Correlation analysis was performed for statistical analysis.

RESULTS: The total prevalence of maxillary lateral incisor hypodontia in Korean twins was 5.52 per cent (18/326), without any significant gender difference (males 4.3%, females 5.98%). Six of the seven MZ twin pairs with maxillary lateral incisor hypodontia were completely concordant, while only one of the four DZ twin pairs were concordant.

CONCLUSION: Maxillary lateral incisor hypodontia has a high genetic correlation with regard to relative risk and concordance frequency. These relationships are thought to be greater in MZ than in DZ twins.

281 ANALYSIS OF RETRIEVED ORTHODONTIC TEMPORARY ANCHORAGE DEVICES: IS IT POSSIBLE TO RE-USE DRILL-FREE TEMPORARY ANCHORAGE DEVICES?

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AIM: To evaluate problems or limitations at reinsertion of temporary anchorage devices (TADs) by analyzing morphological variations and mechanical properties of retrieved TADs after clinical use.

MATERIALS AND METHOD: The retrieved TADs that had been removed after treatment were sterilized by autoclave. Unused TADs were selected as the control group. The morphology of the retrieved and unused TADs was compared using scanning electron microscopy (SEM). The experimental group was divided into three groups according to the degree of morphological deformation. The surface composition was analyzed using energy dispersive X-ray spectroscopy (EDS) for the head, thread, and tip of the TADs. The insertion torque test was performed to evaluate mechanical differences between the retrieved and unused TADs.

RESULTS: SEM of the retrieved TADs showed significant morphological changes in the tip. EDS showed that the surface of retrieved TADs was contaminated with Ca, Na, P, and K. There was no significant relationship between the degree of morphological change in the tip and the intraoral environment, such as the insertion area, the duration of force application, or gender difference (P > 0.05). The more the tip of the retrieved TAD was deformed, the larger torque insertion was needed at re-insertion.

CONCLUSION: Retrieved TADs after clinical use show a decrease in cutting force due to deformation of the tip structure and surface contamination. Therefore, clinical re-use of retrieved TADs is only recommended on limited occasions such as immediate reinsertion in the same person under sterile conditions.

282 RELATIONSHIP BETWEEN MALOCCLUSION AND MENARCHEAL AGE, AND ITS SECULAR TREND FOR KOREAN WOMEN

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AIM: To assess the mean age of menarche and its secular trend for Korean women and to investigate the relationship between malocclusion and the rate of skeletal maturation using menarche as an indicator.

MATERIALS AND METHOD: Data on the menarcheal age of 931 Korean women born between 1961 and 1997 were collected using a retrospective method. The subjects were divided into three malocclusion groups and four birth-year groups of 10-year intervals. Mean menarcheal age for each subgroup was determined and oneway ANOVA was performed to each malocclusion and birth-year groups (P = 0.05). Two-way ANOVA was also performed for all subjects (P = 0.05).

RESULTS: The mean age of menarche was 12.82 years for Korean women born between 1961 and 1997. A distinct downward secular trend of menarcheal age was noticed (P < 0.05). In the 1961-1970 birth-year group, the Class III malocclusion group showed earlier onset of menarche than the other malocclusion groups (P < 0.05), while there were no significant differences among the three malocclusion groups in other birth-year groups (P > 0.05).

CONCLUSION: There is a positive secular trend towards earlier menarche for Korean women. There is no significant relationship between malocclusion and the rate of skeletal maturation, when menarche is used as the indicator.

283 USE OF SODIUM HYPOCHLORITE TO INCREASE SHEAR BOND STRENGTH OF FLUORIDE-RELEASING RESIN-MODIFIED GLASS IONOMER CEMENT

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AIM: To determine whether deproteinization of human dental enamel surfaces, with 5.25 per cent sodium hypochlorite (NaOCl) before etching, increases orthodontic bracket shear bond strength (SBS) of two adhesive systems: a composite resin and a resin modified glass ionomer cement (RMGIC).

MATERIALS AND METHOD: Seventy-six extracted human premolars were cleaned and randomly divided into four groups (2 experimental, 2 control), with 19 premolars in each group. In groups 1 (experimental) and 2 (control), brackets were bonded using Transbond XT and in groups 3 (experimental) and 4 (control), Fuji Ortho LC (FOLC) was used. The buccal surfaces of the premolars in groups 1 and 3 were deproteinized with 5.25 per cent NaOCl for 1 minute followed by rinsing, drying and acid etching for 30 seconds. Subsequently, the acid was rinsed off, the enamel was dried (and remoistened in the FOLC groups), and orthodontic brackets were bonded, either with primer and composite resin, or with RMGIC. The same protocol was used in the two control groups (2 and 4), except that NaOCl was not used. The teeth were then stored in distilled water at room temperature for a maximum of 24 hours, thermocycled 500 times, between 5 and 55°C, placed in a controlled water bath, at 37°C for 24 hours, mounted on acrylic rings, and debonded using a universal testing machine.

RESULTS: There were no significant differences in SBS between the Transbond XT groups. There were significant differences in SBS between the FOLC groups. The mean SBS for Transbond XT with NaOCl was 9.41 ± 4.46 MPa; for Transbond XT without NaOCl, 8.12 ± 3.10 MPa; for Fuji Ortho LC with NaOCl, 9.64 ± 5.01 MPa; and for Fuji Ortho LC without NaOCl, 5.71 ± 3.87 MPa. SBS was significantly increased using NaOCl in the FOLC group.

CONCLUSION: With NaOCl use, SBS with Fuji Ortho LC is similar to Transbond XT, so that fluoride-releasing RMGICs may possibly be used to bond brackets to reduce the incidence of white spot lesions.

284 RELATIONSHIP BETWEEN THE SLOPE OF THE FOREHEAD AND THE VARIOUS DENTAL ARCH FORMS

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AIM: To evaluate the relationship of the slope of the forehead and various arch forms.

SUBJECTS AND METHOD: Sixty patients (20 girls, 40 boys). Based on arch forms the patients' dental casts were equally divided into three groups: square, tapered and ovoid categories, each containing 20 patients aged 10.93 to 22.24 years (mean age: 15.98 ± 2.55 , 15.7 ± 2.99 and 15.8 ± 1.87 , respectively). Clear templates (3M Unitek) were used to determine arch form. The slope of the forehead was determined by using the forehead angle and the distance of soft tissue glabella to the nasion perpendicular line. These two values were measured for all subjects on digital cephalometric radiographs using Quick Ceph 2000. Statistical analysis was performed using the Statistical Package for Social Sciences, version 13 for Windows (SPSS Inc., Chicago, Illinois, USA). To determine the differences between the groups and the relationship between the slope of the forehead and dental arch forms; one-way ANOVA was used. To evaluate the correlation between forehead angle and glabella distance, Pearson's correlation coefficients (r) were estimated.

RESULTS: There was a significant high negative correlation between the forehead angle and the distance of glabella (r = -0.880, P < 0.001). There was no statistically significant difference between groups (P > 0.05).

CONCLUSION: The slope of the forehead is not considered to be in relationship with dental arch forms.

285 THE ELASTIC OPEN ACTIVATOR IN THE THREE-DIMENSIONAL MANAGEMENT OF LOWER JAW POSITION

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AIM: The elastic open activator (EOA) V4 is a new orthopaedic appliance to manage the three-dimensional position of the lower jaw and temporomandibular joint, especially in the treatment of patients with craniomandibular, craniocervical and craniosacral pain and dysfunctions. It is constructed with specific elements to reach and maintain the therapeutic position.

SUBJECTS AND METHOD: Fifty-eight patients who underwent functional treatment with the EOA-V4. With the help of casts mounted in an articulator (gamma reference) and a three-dimensional (3D) model scanner, the changes of the lower jaw during treatment were examined. The formetic-4D-system was used for functional analysis of the spine, body measurements and posture. All data were analysed using the Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA).

RESULTS: There were significant changes in 3D condylar-position which correlated to the function of the spine and a couple of the metric and angular body measurements.

CONCLUSION: The new orthopaedic appliance EOA-V4 is helpful in the complex interdisciplinary treatment of pain and dysfunction. The changes in 3D-position of the mandible and the temporomandibular joints are evident. It is recommended that the EOA-V4 should be used in patients with functional disturbances.

286 COPPER NICKEL TITANIUM ARCHWIRES HAVE SHAPE MEMORY – FACT OR FALLACY?

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AIM: Nickel titanium (NiTi) alloys have a shape memory capacity. When warm, they can eliminate the plastic deformation inflicted upon them at a lower temperature. This is due to their variable crystalline structures (martensite, R phase, austenite). When a NiTi alloy is warmed, transformations from martensite to R phase and from R phase to austenite generate the shape memory effect. Direct martensite to austenite transformation is also possible. The reverse sequences happen when the alloy is cooled. Measurable thermic reactions occur every time one crystalline structure of an alloy is changed to another. At mouth temperature, only transformations including an R-phase generate shape memory. The aim of this study was to determine whether available NiTi copper archwires have shape memory at mouth temperature.

MATERIALS AND METHOD: Thirty Ormco 35 copper NiTi 0.017×0.025 inch preformed archwires, from two batches, 20 and 10, respectively, were tested. Archwires were gradually warmed from 0°C to 50°C (limits of mouth temperature) using differential scanning calorimetry to measure possible thermic reactions. Cooling was subsequently performed under the same conditions.

RESULTS: Direct martensite to austenite transformations appeared in all 30 archwires when they were heated and austenite to martensite when they were cooled. Presence of an R phase could be detected in none of the tested archwires.

CONCLUSION: No necessary R phase crystalline structure could be evidenced in any of the 35 copper NiTi archwires tested at mouth temperature. This study questions the claim that such archwires have shape memory under normal conditions of orthodontic treatment.

287 SOFT TISSUE AIRWAY DIMENSIONS IN DIFFERENT SKELETAL PATTERNS: A CEPHALOMETRIC COMPARATIVE STUDY

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AIM: To investigate uvulo-glosso-pharyngeal dimensions in subjects with different anteroposterior jaw (AP) relationships.

MATERIALS AND METHOD: Cephalometric radiographs of 58 subjects (38 females, 20 males, aged 14 to 31 years) divided into three groups according to the ANB angle: group 1, skeletal Class I (ANB 1-4°); group 2, skeletal Class II (ANB >4°); and group 3, skeletal Class III (ANB < 1°). In addition, each group was divided into two subgroups according to gender. Statistical analysis was undertaken using analysis of variance and the least significant difference test. Pearson's correlation test was also performed.

RESULTS: Gender differences were found in Class I and Class II subjects. No gender difference was found in Class III subjects. On average, tongue length was significantly longer in Class I males subjects (P < 0.05). In Class II subjects, the hyoid bone was closer to the mandible vertically as compared with Class I and Class III subjects (P < 0.05). In Class II subjects, the hyoid bone was closer to the mandible vertically compared with Class I and Class III subjects. AP skeletal pattern showed a weak but significant correlation with the AP position of the hyoid bone in relation to the mandibular plane (P < 0.05).

CONCLUSION: Uvulo-glosso-pharyngeal dimensions are affected by the AP skeletal pattern.

288 EVALUATION OF ROOT RESORPTION OF PREMOLARS DURING DISTAL DRIFT

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AIM: To evaluate root resorption of upper first premolars during distal drift and distal movement with a force arm.

SUBJECTS AND METHOD: Twenty patients (10 males, 10 females; mean age 15.06 ± 1.49 years) with an Angle Class II malocclusion and severe crowding that had a definite bilateral maxillary premolar extraction indication. Intraosseous titanium miniscrews (Dual-top anchor system 20-G2-008, Guro-Gu, Seoul, Korea) were placed bilaterally in the anterior paramedian region. A modified bone-borne pendulum appliance was used and a force arm was added to move the maxillary first premolar distally on one side [force group (FG)]. The contralateral first premolar was left to drift distally [drift group (DG)]. Before and after distalization, lateral cephalometric radiographs and dental casts were obtained and evaluated. The first premolars were extracted after completion of distalization. The premolars of 10 patients were imaged using a microcomputed tomographic system (SkyScan 1172, SkyScan, Aartselaar, Belgium), and then analyzed with specially designed software for volumetric measurement of resorption craters.

RESULTS: During the mean distalization period of 4.52 ± 0.04 months, the maxillary first premolars of the FG and DG moved distally 2.3 8 ± 0.74 and 1.86 ± 0.79 mm, respectively. Distal movements of the premolars were statistically significant for both groups (P < 0.01). However, no significant difference was observed between the groups (P > 0.05). Total root resorption volume was significantly higher for the FG than for the DG (P < 0.01). Distal and palatal root surfaces showed significant differences between the groups (P < 0.01).

CONCLUSION: No significant difference was observed between the groups for distal movement; however, more resorption was observed for the FG. Therefore, there is no need to add a force arm for distal premolar movement.

289 EVALUATION OF BUCCOLINGUAL BONE THICKNESS AND ROOT PROXIMITY IN PATIENTS WITH SKELETAL CLASS II MALOCCLUSIONS S Karaçay¹, E Yıldırım¹, T Berkay Süer², M Erkan¹, Departments of ¹Orthodontics and ²Maxillofacial Surgery, GMMA Haydarpasha Training Hospital, Istanbul, Turkey

AIM: To evaluate buccolingual bone thickness and root proximity in patients with skeletal Class II malocclusions. Maxillary and mandibular interradicular sites were compared according to growth pattern and gender.

SUBJECTS AND METHOD: Twenty patients with a skeletal Class II malocclusion divided into two groups according to their growth pattern. Group 1 comprised 10 patients (6 girls, 4 boys; mean age of 15.2 ± 3.77 years) who had a horizontal growth pattern (low angle) and group 2, 10 patients (4 girls, 6 boys; mean age of 15.4 ± 3.36 years) who had a vertical growth pattern (high angle). Buccolingual bone thickness and root proximity in the interradicular areas between the first and second molars, second premolar and first molar, and first and second premolars were examined in the maxilla and mandible by three-dimensional cone-beam computerized tomography.

Measurements were done at four different sections; 2.9, 5.8, 8.7 and 11.6 mm from the alveolar crest and the groups were compared with a Mann-Whitney *U*-test.

RESULTS: Comparison of the measurements according to the growth pattern revealed that interradicular sites in the mandible were smaller in patients with a vertical growth pattern (P < 0.01). When the measurements were compared according to gender, it was found that maxillary and mandibular buccolingual bone thickness was higher in boys than in girls (P < 0.01).

CONCLUSION: In patients with a skeletal Class II malocclusion and vertical growth pattern the roots of mandibular teeth are closer to each other. If mini-implant placement is required during the orthodontic treatment of these patients, it is necessary to evaluate the interradicular sites carefully to find the 'safe zone'. When determining the length of the mini-implant, gender has to be taken into consideration since buccolingual bone thickness in girls is not as much as in boys.

290 RELATIONSHIP AMONG THE REST POSITION OF THE TONGUE, LIFTING FORCE OF TONGUE-TIP AND MAXILLARY DENTAL FORM*** R Kasai, S Negishi, K Saitoh, K Kasai, Department of Orthodontics, Nihon University School of Dentistry at Matsudo, Chiba, Japan

AIM: Tooth position is affected by outside pressure from the orbicularis oris muscle and cheeks, and from inside by tongue pressure. Elucidating the position of the tongue is important to predict dental stability after retention. The aim of this study was to elucidate how tongue position during activity and rest influences the maxillary dentition.

MATERIALS AND METHOD: One hundred and ten sets of maxillary dental casts and lateral cephalograms of adults. Dental arch width, tongue palatal distance (TPD) and lifting force of the tongue-tip were measured.

RESULTS: Subjects with a strong lifting force of the tongue-tip showed wide dental arches and a short TPD.

CONCLUSION: Tongue position during rest and activity is associated with maxillary dental arch width.

291 PREDICTIVE VALUE OF BIOMECHANICAL FACTORS FOR PRIMARY STABILITY OF MANUALLY INSERTED ORTHODONTIC MICRO-IMPLANTS A Katalinic¹, B Mady Maricic¹, M Slaj², M Slaj², S Spalj¹, ¹Department of Paediatric Dentistry and Orthodontics School of Medicine, University of Rijeka and ²Department of Orthodontics, School of Dental Medicine University of Zagreb, Croatia

AIM: To explore the predictive value of biomechanical factors: implant design, cortical bone thickness, and implantation forces and torques, for primary stability of manually inserted orthodontic micro-implants.

MATERIALS AND METHOD: Sixty orthodontic micro-implants of three different manufactures: The Aahrus system® (Medicon EG, Tuttlingen, Germany), Dual top® (Jeil Medical Corp., Seoul, Korea) and Ortho Easy® (Forestadent, Pforzheim, Germany). The implants thread lengths were 6 and 8 mm. Thread diameter and tissue collar length were 1.5 and 1.5 mm (Aarhus), 1.6 and 1.5 mm (Dual top), and 1.7 and 2 mm (Ortho Easy). Implants were inserted in bone samples 2×1 cm of the sternal part of swine ribs placed in a specially designed device made for three-dimensional measurement of forces and torques (Croatian Institute of Civil Engineering, Zagreb, Croatia). The implants were manually inserted using a long driver shaft and standard handle. No pilot hole was made. Measurements of implantation vertical forces (N) and torques (Nmm) were recorded using a Picoscope

(Pico Technology Ltd, St Neots, Cambridge, UK). A Periotest M (Medizintechnik Gulden, Modautal, Germany) device was used for assessment of primary stability. Multiple logistic regression analysis was used for statistical analysis.

RESULTS: The most significant factors for lower primary stability of manually placed mini-implants were thin cortical bone (P = 0.032) and longer tissue collar length (P = 0.032) while a narrower thread diameter had borderline significance (P = 0.052). Parameters regarding mini-implant thread length, vertical force and torque variations, as well as the trend of vertical force and torque changing during insertion, were not significant predictors for primary stability.

CONCLUSION: Thick cortical bone, shorter tissue collar length and a wider thread diameter have the highest predictive value for good primary stability of manually inserted orthodontic micro-implants.

292 CRANIOFACIAL MORPHOLOGY IN PAEDIATRIC SLEEP DISORDERED BREATHING – RESEARCH PLAN AND PRELIMINARY RESULTS

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AIM: To retrospectively assess craniofacial differences in skeletal, soft tissue and nasopharyngeal airway features by comparing cephalometric analyses of children with sleep disordered breathing (SDB) with age- and gender-matched retrospective controls and to identify children with obstructive sleep apnoea (OSA) at increased risk of non-curative adeno-tonsillectomy with clinical findings, radiographic analyses and sleep diagnostic tests as predictor variables.

SUBJECTS AND METHOD: Sixty-five subjects with lateral neck radiographs and 65 controls matched for age and gender with lateral cephalograms. Comparison of cephalometric and airway analyses between cases and controls was undertaken to reveal statistically significant differences. All comparisons had angular and ratio measurements to control for magnification. Subgroup analysis was performed to distinguish between primary snorers and OSA.

RESULTS: There is a suggestion of an increased gonial angle in subjects with SDB. Preliminary results await statistical analysis.

CONCLUSION: There would appear to be a need to evaluate craniofacial and airway morphology in the transverse dimension in paediatric sleep disordered breathers.

293 COMPARING ARCH FORMS FROM TEETH AND ALVEOLAR BONE IN AN ASIAN POPULATION

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AIM: To determine if a difference exists between arch forms created from tooth surfaces and those created from alveolar bone

MATERIALS AND METHOD: Cone beam computed tomographs (CBCT) were obtained, using the PaX-Zenith3D imaging system, of 35 individuals of an Asian population, who required orthodontic treatment and demonstrated a Class I molar relationship. The facial-axis (FA) point was chosen to create the arch form from the teeth, and a new point, the Bowman-Kau (BK) point, was used to establish arch form from the alveolar bone. The BK point was defined as a point located at the buccal extent of the alveolar ridge in the axial cross-section taken at the level of the estimated centre of resistance of the tooth with the axes defined by the patient's natural head position. The FA and BK points were plotted on every tooth. A predetermined

algorithm was used to create four separate arch forms per patient. The arch form from FA points was superimposed on that from BK points within an arch and the twodimensional distance between the FA and BK points of each tooth was then calculated (FA-BK distance).

RESULTS: The mean FA-BK distance in females was 1.93 mm (SD 0.65) and 2.83 mm (SD 0.49) for the parameters in the maxilla and mandible, respectively. In males, it was 1.98 mm (SD 0.84) and 2.73 mm (SD 0.58) in the maxilla and mandible, respectively. In females, the difference between the FA-BK distance in the maxilla as compared with the mandible was statistically significant for the central incisors, canines, first premolars, and right second molars. In males, this difference was statistically significant for the canines, first premolars.

CONCLUSION: The arch form defined by the FA points emphatically differs from that defined by the BK points.

294 FACTORS OF MALOCCLUSION RELATED TO ORTHODONTIC TREATMENT DIFFICULTY

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AIM: Orthodontists regularly classify a case as easy or difficult to treat. However, what defines a case as easy or difficult? The aim of this study was to determine which factors of malocclusion and their degree of severity, based on the Index of Orthodontic Treatment Need (IOTN), could play a role in the level of orthodontic treatment difficulty.

SUBJECTS AND METHOD: A questionnaire was sent to 180 specialists in orthodontics in Belgium, of which 71 responded. The orthodontists were asked to express their opinion on the influence of some parameters of malocclusion that make orthodontic treatment more easy or difficult. These parameters of malocclusion evaluated, were more or less the same as those on which the IOTN is based. Each was asked to judge the questions on a Likert scale from 1 to 5, with 1 equal to 'no difficulty at all' and 5 equal to 'a very difficult treatment'. For some questions a differentiation was made between adult and juvenile patients. Some examples of the questions included were: 'How would you estimate the difficulty of orthodontic treatment on a scale from 1 to 5 within the following patients: severe hypodontia (more than one missing tooth in a quadrant), one specific missing tooth, an overjet >9 mm, an overjet between 6-9 mm. Linear models for repeated measures were used to compare the scores as a function of situation (question) and age (adult-juvenile). P < 005 was considered significant. Tukey's adjustments for multiple testing were used for pairwise comparisons between the situations.

RESULTS: Significant correlations were found between the degree of a malocclusion severity and the score of treatment difficulty. There were also statistically significant differences between the adult and juvenile groups; however these interactions were most of the time not clinically significant.

CONCLUSION: Factors of malocclusion and their degree of severity play a role in judging whether treatment is difficult to perform or not.

295 PATTERN OF AGENESIS OF MAXILLARY SECOND PREMOLARS IN PATIENTS WITH MANDIBULAR SECOND PREMOLAR AGENESIS

J Kenrad¹, I J Christensen², I Kjær¹, ¹Department of Orthodontics, Faculty of Health Sciences, University of Copenhagen, and ²Finsen Laboratory Copenhagen University Hospital, Denmark AIM: To analyze the prevalence and distribution of agenesis of maxillary second premolars in patients with agenesis of one or both mandibular second premolars.

MATERIALS AND METHOD: Panoramic radiographs of 4756 children and adolescents from two community dental clinics. Of these 195 cases (107 females, 88 males) presented with agenesis of 270 mandibular second premolars. The 195 patients were categorized according to the region of mandibular agenesis (left, right, bilateral). The prevalence and distribution of patients who simultaneously had agenesis of one or both maxillary second premolars was noted. Intra- and intermaxillary associations of agenesis were analyzed using the chi-square test.

RESULTS: Sixty-nine patients had unilateral agenesis of tooth 35 while 50 had agenesis of tooth 45. Seventy-six patients had bilateral agenesis of the mandibular second premolars. There was a significant association between the right and left side for females but not for males, i.e. girls with agenesis of tooth 35 were likely to have agenesis of tooth 45 and *vice versa*. Thirty-seven cases (28 females, 9 males) simultaneously had agenesis of one or more maxillary second premolars. When comparing the pattern of agenesis in the maxilla and the mandible, there was a significant association of agenesis of teeth 25 and 35, i.e. the left side of the maxilla and mandible, while the association was non-significant on the right side.

CONCLUSION: There is an association between mandibular agenesis and the maxilla. This association is more obvious on the left than on the right side.

296 LONG-TERM OCCLUSAL STABILITY AFTER EARLY TREATMENT ORTHODONTIC PROTOCOL IN PUBLIC HEALTH CARE

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AIM: To study the long-term stability of occlusion in subjects who participated in systematically implemented an early treatment orthodontic programme in public health care.

SUBJECTS AND METHOD: The design was a prospective intervention study. The 85 subjects were of one age cohort living in a rural municipality in Finland, who were examined regularly from 8 to 15 years of age. Those with definite need received treatment according to a pre-planned protocol focusing on early treatment. Sixty-eight subjects (80%) participated in the 20-year examination. The weighted Peer Assessment Rating (PAR) index and Little's Index of Irregularity (LII) were used to evaluate occlusal changes at 15 and 20 years. All participants with a minimum of 5 years post-retention (N = 22) or with no treatment at age 20 (N = 29) were included.

RESULTS: At the 20-year examination 58 per cent of the treated subjects (22/37) had been in retention for over 5 years (mean post-retention time 8.4 years, SD 2.4). Treatments had been implemented with simple appliances, except one subject with a fixed appliance. From 15 to 20 years, the mean PAR score increased slightly from 5.8 (SD 5.1) to 6.6 (SD 4.6), and the mean PAR improvement decreased from 66 to 62 per cent. Among the non-treated subjects the PAR score decreased from 6.6 (SD 5.4) to 5.5 (SD 3.9) during the same time interval. The post-retention changes in mandibular incisor irregularity in the treated subjects varied individually from -0.4 to +3.2 mm, which were roughly similar to changes found in the non-treated subjects. An increase of over 1 mm in the LII was seen in 23 per cent of the treated and in 21 per cent of non-treated participants.

CONCLUSION: The long-term post-retention occlusal changes in this sample were small and generally with no clinical significance. The results suggest that an early orthodontic treatment strategy may have potential for good long-term occlusal stability. 297 CHANGE IN MAXILLARY INCISOR EXPOSURE AND UPPER LIP POSITION WITH MAXILLARY LE FORT I OSTEOTOMIES

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AIM: To prospectively assess the effect of Le Fort I maxillary advancement with or without impaction on changes in upper lip, nasal soft tissues and maxillary incisor exposure at rest and during smiling.

SUBJECTS AND METHOD: Forty-one consecutive patients who had a Le Fort I maxillary advancement with or without impaction. Clinical measurements were taken with sliding digital callipers pre- and post-operatively at 2 weeks, and 3 and 6 months. Lateral cephalometric radiographs were taken and measured pre- and post-operatively at 2 weeks and 6 months. One examiner undertook all measurements. Intra-examiner reproducibility was tested. For clinical measurements, 30 volunteers (16 females, 14 males) were measured at three time-points. For radiographic measurements, 10 lateral cephalometric radiographs were randomly selected and traced twice with an interval of two weeks. This preliminary report is on the results of 14 patients (9 females, 5 males) aged 26.3 years (16.9-44.4 years). All except one received bimaxillary surgery.

RESULTS: The mean pre-surgical ANB was -1.79 degrees (SD 4.42°) and changed by a mean of 4.79 degrees (SD 4.14°). The upper lip soft tissue followed increasingly more closely the hard tissue advancement from subnasale to stomion superius; Sn:A 0.71, Sls:A 0.85, Ls:UIT 2.07. Stronger Spearman correlations were found for horizontal ratios. Upper lip height increased significantly. Widening of the alar base (1.97 mm) and alar (2.79 mm) widths were statistically significant. NLA increased significantly by 5.68 degrees, primarily due to upturning of the nose by 6.57 degrees. There was excellent intra-examiner reproducibility for all clinical and most radiographic measurements; mean intraclass correlation coefficient 0.97 and 0.94, respectively.

CONCLUSION: Upper lip soft to hard tissue ratios increase from subnasale to stomion superius. Nasolabial angle increases primarily due to upturning of the nose. Alar base and alar width as well as upper lip height and maxillary incisor exposure at rest and on smiling increased.

298 CHANGES IN MAXILLARY INCISOR EXPOSURE AND UPPER LIP POSITION WITH MAXILLARY ORTHOGNATHIC SURGERY

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AIM: To systematically review the literature on the changes in maxillary incisor exposure at rest and on smiling and changes in upper lip position after Le Fort I maxillary osteotomies for advancement with or without impaction.

MATERIALS AND METHOD: The electronic databases, Cochrane Library, Medline, Embase and Web of Science, were systematically searched in September 2011. Hand searching involved using key words in Science-Direct, PubMed and reviewing the reference lists of related articles. From the original 979 articles identified, 15 met the inclusion criteria. Eleven were retrospective, two prospective and two reported patients being consecutive. The study details and relevant outcomes were collated on a spreadsheet and their quality assessed.

RESULTS: In total, the 15 studies included assessed 419 patients (266 females, 118 males), mean age 26.4 years (14-57 years). Most underwent bimaxillary surgery. Lateral cephalometric radiographs were taken pre-operatively (within 8 weeks) and post-operatively (3-40.8 months). The mean maxillary hard tissue advancement was 0.94-8.77 mm and vertical movement ranged from 0.56 mm set-down to 4.2 mm impaction. The studies were heterogeneous in terms of sample characteristics, surgery, additional surgical techniques (e.g. ANS recontouring, VY closure, alar base cinch suture) and outcome data reported; hence a meta-analysis was not feasible.

CONCLUSION: The ranges of ratios of soft to hard tissue movement demonstrate that from pronasale (0.24-0.35) to labrale superius (0.36-1.43) the soft tissues increasingly follow more closely hard tissue movement. Increased advancement of the soft tissues in response to hard tissue movement was present when VY closure and alar base cinch sutures were undertaken. Vertically, there is more variability in soft tissue response. None of the studies reported on maxillary incisor exposure change at rest or on smiling. Good quality prospective clinical studies with large samples and with variables accounted for are needed in this field.

299 EVALUATION OF MANDIBULAR GROWTH USING CONE BEAM COMPUTED TOMOGRAPHY IN A RABBIT MODEL

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AIM: To describe three-dimensional (3D) remodelling changes resulting from normal growth in a rabbit model using cone-beam computed tomography (CBCT), and to compare registrations of serials images of the mandible obtained by the Procrustes method with the classical bone implant method.

MATERIALS AND METHOD: CBCT scans were taken of three growing New Zealand white rabbits at baseline and fortnightly for eight weeks. Metallic tantalum 1 mm spheres were implanted as bone reference markers. The data sets consisting of rabbit mandibles acquired at different times were firstly segmented, and then the mandibles were aligned three-dimensionally using a combination of rigid, affine, and non-rigid registration, and three bone implants as invariant features. Surface meshes were extracted and colour maps were then used to visualise mandibular growth. The registration accuracy was quantified by the maximal of the mean minimum distances and by the Hausdorff distance.

RESULTS: The mean absolute error for the image registration procedures was 0.4 mm and never exceeded 1 mm. As revealed by 3D growth maps, mandibular growth vectors were consistent in all rabbits and ranged in size from 0.6 to 5.7 mm. During the study period, vertical ramus growth was more prominent than sagittal and transverse growth, especially at the condyles and the posterior border of the ramus. Both Procrustes and implant methods could be successfully used to quantitatively describe mandibular growth, whereas the qualitative interpretation of remodelling pattern was fairly different. The proposed methods were feasible and reliable, and the animals coped well with the experimental procedures.

CONCLUSION: 3D evaluation of mandibular growth in a rabbit model using CBCT represents a promising approach to be used in future intervention studies.

300 EFFECTS OF RETRACTION FORCE AND ANCHORAGE SYSTEM ON MAXIMUM BITE PRESSURE IN SLIDING MECHANICS***

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AIM: To investigate change of maximum bite pressure (MBP) according to retraction force and anchorage system using the Ewha dynamic occlusion analyzer.

MATERIALS AND METHOD: An *en-masse* retraction model was made with resin teeth coated by silicone to express periodontal ligaments, and these were embedded in resin that had similar elastic modulus to alveolar bone. A strain gauge was attached to the lingual surface of the maxillary right first molar. Different forces were applied by an Instron that operates like a masticatory muscle. Signals from the strain gauge were then transferred to a Bridge Box. Data from each condition were collected; repeatedly undertaken on the resin teeth, passive bracket bonding, archwire engagement and on application of forces of 100, 150, 200, 250, 300 g with a closed coil NiTi spring. After connecting the miniscrew to the anchor tooth, the tests were repeated. Data from the repetition were compared as the MBP value. Analysis of variance (ANOVA) and Spearman correlation coefficient were used for statistical analysis in the SAS system.

RESULTS: Bracket bonding seemed to have no effects, while there was an increase in MBP on engagement of the archwire. This can be explained by buccal splinting of the tooth. As the force of the closed coil NiTi spring increased from 100 to 300 g, MBP decreased, especially at 50-100 and 100-150 g. The amount of decrease tended to reduce as the force of the closed coil spring increased, and this difference was more significant as the force applied by the Instron was increased. However, after connecting of the miniscrew there was no decrease in MBP.

CONCLUSION: When the wire is engaged, there is an increase in MBP. As retraction force became heavier, MBP decreased. This difference was more obvious in higher masticatory force. However indirect skeletal anchorage using a miniscrew could prevent this decrease.

301 ORTHOGNATHIC SURGICAL MOVEMENTS: A CEPHALOMETRIC ASSESSMENT OF OUTCOME

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AIM: To assess the outcome of orthognathic surgical movements in a series of consecutively treated orthognathic patients. The surgical movements achieved were to be assessed from post-surgery cephalograms, and compared with the planned movements produced on the immediate pre-surgery lateral cephalogram.

MATERIALS AND METHOD: This was a prospective audit at York Hospital from July 2009 and December 2010. Anonymised clinical records of all patients undergoing orthognathic surgery were utilised. Pre- and post-surgery (post-wafer removal) cephalometric radiographs digitised with OpalTM software were used to derive the planned movement. This was compared with the actual surgical movement using A-N perpendicular in the maxilla and Po-N perpendicular for the mandible.

RESULTS: Gold Standard: 80 per cent of actual surgical moves to be within 2 mm of the planned move. Sixteen subjects were included; eight met the standard and were within 2 mm of the planned move. The median difference between planned and actual A-N Perp was -0.25 (IQR -2.13 to 0.625) and Po-N perp difference was 1.5 (IQR 0.375 to 2.625).

CONCLUSION: The standard was not met by 30 per cent, as 50 per cent rather than 80 per cent of surgical moves were within 2 mm of the planned move. Surgical movement tended to be less than that planned in the maxilla, and more than planned in the mandible. Fewer than expected subjects were included as few post-surgery radiographs were taken. Alternative methods of recording surgical outcome, i.e. those not involving ionising radiation should be considered.

302 USE OF AN ELECTRIC PULSE TO DETERMINE THE OPTIMAL POSITION OF THE MANDIBLE

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AIM: To improve methods for diagnosis of temporomandibular joint pathology in patients with a transverse occlusion.

SUBJECTS AND METHOD: Fifty-four patients, 15-18 years of age, with a transverse occlusion. A clinical and radiographic examination was carried out and plaster models were obtained. The Mio-stim (Biotronics, Italy) with digital, three-dimensional treatment of the electric pulse, and computer software was used to determine the optimal position of the mandible.

RESULTS: Clinical examination of patients with facial asymmetry showed a right shift of the mandible (65% cases). On radiographs in 64 per cent of cases the articular head of the mandible was located in the articular fossa and on the left out of it. Upper interincisal point was aligned with the median line of face, and in the lower jaw shifted to the right by 1.8-3.0 mm (65% cases) and to the left by 1.5-2.0 mm. Thus, the surveyed patients had a cross-occlusion combined with a transverse incisal occlusion caused by mandibular displacement. The optimum ratio of the upper and lower dentition was determined using electromyostimulation, which was held on the given program. After myostimulation, interincisal misalignment of the upper and lower jaws decreased to 0.5-0 mm (P < 0.05). The ratio for the teeth in the lateral sides of the dentition was physiological.

CONCLUSION: It is recommended to use Mio-stim before orthodontic treatment of patients with a cross-occlusion in combination with a transverse occlusion.

303 POSITIONAL GUIDELINES FOR ORTHODONTIC MINI-IMPLANT PLACEMENT IN THE ANTERIOR ALVEOLAR REGION

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AIM: To investigate the adequacy of potential sites for insertion of orthodontic miniimplants (OMIs) in the anterior alveolar region (delimited by the first premolars) through a systematic review of studies that used computed tomography (CT) or cone beam (CB) CT to assess anatomical hard tissue parameters, such as bone thickness, available space and bone density.

MATERIALS AND METHOD: Medline, Embase and Cochrane Database of Systematic Reviews were searched to identify relevant papers published from 1980 to September 2011. An extensive search strategy was performed including the following keywords: computerized tomography and mini-implants. From the 790 articles identified by the search, eight were eligible for inclusion in the study. Information was extracted for three anatomical areas: maxillary anterior buccal, maxillary anterior palatal and mandibular anterior buccal. Quantitative data obtained for each anatomical variable under study were transferred to qualitative data and through a scoring system provided the results.

RESULTS: The most favourable area for OMI insertion in the anterior maxilla (buccally and palatally) and mandible is located between the canine and the first premolar. The best alternative area in the maxilla (buccally) and the mandible is

located between the lateral incisor and canine, while in the maxillary palatal area it is located between the two central incisors or between the lateral incisor and canine. CONCLUSION: Although there is considerable heterogeneity among studies, there is a good level of agreement for the optimal site for OMI placement in the anterior region among most studies that investigate anatomical-host hard tissue parameters based on CT or CBCT scans. In this context, the area between the lateral incisor and first premolar is the most favourable. However, inter-root distance is a critical factor that should be carefully evaluated in such cases.

304 THE PREVALENCE OF FACIAL ASYMMETRY IN POPULATION ACCORDING TO ANALYSIS OF THREE-DIMENSIONAL FACIAL SCANS K Koberová¹, A Thurzo², S Dianiskova¹, Departments of Orthodontics, ¹Slovak Medical University and ²Medical Faculty, Comenius University, Bratislava, Slovakia

AIM: To research the distribution of soft tissue asymmetry in a population and to evaluate which of the facial thirds is most often affected by asymmetry.

SUBJECTS AND METHOD: Three hundred randomly selected individuals between 20 and 50 years of age. Two groups of the same size (males and females) were scanned with a Di3D face scanner. Multiple scans were done so that the one without any facial expression was chosen as the best for analysis. Symmetry was evaluated in the native software environment Di3D software and also in Dolphin imaging and Anatomage software. Assessment of facial midline definition was undertaken by one researcher. Localization and volume of facial asymmetry was evaluated.

RESULTS: One hundred and one subjects (33%) were found to have clinically apparent asymmetry of the face. When present, asymmetry affected the upper face in only 6 per cent, the midface (primarily the nose) in 35 per cent, and the chin in 78 per cent. These results significantly correlate with the findings of Severt and Proffit (1997).

CONCLUSION: Facial asymmetry in a population is not rare. The results support other studies on facial asymmetry with common prevalence in every third case even in non-orthodontic patients. The prevalence of deviation of the chin to the left approached 90 per cent. These findings are meaningful for clinicians because asymmetry must be identified and planned for prior to initiating treatment.

Severt T R, Proffit W R 1997 The prevalence of facial asymmetry in the dentofacial deformities population at the University of North Carolina. International Journal of Adult Orthodontics and Orthognathic Surgery 12: 171-176

305 EFFECTS OF LOW LEVEL LASER THERAPY ON ORTHODONTICALLY INDUCED ROOT RESORPTION

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AIM: To evaluate the preventive and/or reparative effects of low level laser therapy (LLLT) on orthodontically induced root resorption in rats

MATERIALS AND METHOD: Thirty rats randomly divided into four groups. The left molar was moved mesially for 11 days in all groups. In group 1 the animals were sacrificed at the end of this period. In group 2 the appliances were removed and the teeth were fixed for a healing period. At the end of 14 more days, the animals were sacrificed. Group 3 was the short-term laser group. Starting from the first day of the experiment, the first molar was irradiated every other day with a dose of 4.8 J/cm². The animals were sacrificed after 11 days. Group 4 was the long-term laser group and

laser irradiation was started after the mesialization period had been completed. At the end of 14 more days, the animals were sacrificed. The treatment groups were compared with the controls according to the number of osteoclasts, osteoblast activity, fibroblast activity, number and width of capillaries and the intensities of inflammatory cell infiltration, resorption and RANKL-osteoprotegerin (OPG) activities through histologic and immunohistochemical investigations.

RESULTS: Osteoclasts in groups 2 and 3 were significantly higher than in the other groups. Groups 3 and 4 showed a similar increase in osteoblastic and fibroblastic activity followed by groups 2 and 1, respectively. The number of capillaries and intensity of inflammatory cells in group 3 was higher than in groups 2, 4 and 1, respectively. There was a significant increase in resorption in group 2. Group 4 showed the least resorption among the groups. Increased very strong RANKL immunoreactivity was observed in group 2 and very strong OPG immunoreactivity was seen in group 4

CONCLUSION: LLLT accelerates the repair process of orthodontically induced root resorption by stimulating osteoclastic, osteoblastic and fibroblastic cell proliferation and activity.

306 INFLUENCE OF MASTICATORY DISORDERS WITH MALOCCLUSION ON GASTRIC EMPTYING***

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AIM: Masticatory function is significantly lower in patients with malocclusion than in those with normal occlusion. Although several studies have suggested that masticatory function influences gastrointestinal digestion, the relationship between malocclusion and gastrointestinal activity has only been occasionally examined. It was hypothesized that insufficient mastication increases the functional burden of the stomach and decelerates gastric emptying. The aim of this study was to investigate the relationship between masticatory function and gastric emptying rates in patients with malocclusion.

SUBJECTS AND METHOD: Eight healthy female volunteers with normal occlusion (control group) and eight female patients with malocclusion (experimental group) underwent a [13C]-acetate breath test using a liquid test meal. Gastric emptying time and maximum excretion time (Tmax) were evaluated. Masticatory function was assessed using chewing-gum (Masticatory Performance Evaluating Gum Xylitol®; Lotte, Saitama, Japan) that changes colour during mastication and a colourimeter. The CIE L*a*b* colour scale was used for colour assessment and the a* values, which represent redness, were used for evaluation. Additionally, the frequency scale for symptoms of gastroesophageal reflux disease (FSSG) was recorded and questionnaires on food intake were completed. The Wilcoxon signed-rank test was used to compare each parameter between the two groups.

RESULTS: Compared with the control group, the Tmax of the experimental group was longer and the a* values were smaller, indicating that the masticatory function of the experimental group was impaired. Moreover, the experimental group generated higher FSSG scores and experienced greater difficulty in chewing compared with the control group.

CONCLUSION: Insufficient masticatory function associated with malocclusion affects gastrointestinal digestive function.

307 LOWER JAW POSITION FOLLOWING SPINAL TREATMENT

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AIM: To demonstrate the changes in lower jaw position by means of modern manual medicine techniques in patients with a functionally disturbed craniomandibular system using a three-dimensional (3D) diagnostic systems: (1) model scan, (2) face scan and (3) spine scanning.

MATERIALS AND METHOD: Using 3D scans of the face, articulator mounted casts and spine, the 3D effects on the face, the lower jaw position and the spinal cord (posture) were investigated in 134 patients who underwent functional treatment before and during orthodontic treatment by means of modern manual medicine techniques. A couple of new measurement criteria are introduced. All data were calculated with the Statistical Package for Social Sciences, (SPSS Inc., Chicago, Illinois, USA).

RESULTS: There were significant changes in the surface of the face: (1) frontal bone (P = 0.0001), (2) cheeks (P = 0.01) and (3) chin (P = 0.0001). The position of the lower jaw was significantly changed by manual medicine techniques (P = 0.0000). The evidence of spinal changes during treatment of the craniomandibular system was high.

CONCLUSION: Orthodontic and orthopaedic treatment of the craniomandibular system has effects on the whole body, as metric aspects of the face, spine and posture. It is recommended to take into account that common use of manual medicine techniques should be used in these cases to optimize the treatment outcome.

308 GOOD REPRODUCIBILITY OF THE CERVICAL VERTEBRAL MATURATION METHOD

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AIM: The cervical vertebral maturation (CVM) method is based on the ability of clinicians to identify the morphology of the cervical vertebrae (C2 to C4) in order to determine their maturation stage and therefore the peak of mandibular growth. The purpose of this study was to evaluate the reproducibility of this method.

MATERIALS AND METHOD: One hundred cephalometric radiographs were equally distributed by gender and age from 7 to 16 years. The cephalometric radiographs were cropped to the size of the C2-C4 area. Ten orthodontic postgraduate students, trained in the CVM method, evaluated the morphology of C2 to C4 twice with a 3 week interval. Inter- and intraobserver reproducibility was tested using Kendall's coefficient of concordance and the percentage of correlation, respectively.

RESULTS: The first and the second measurements of the cephalometric radiographs showed a concordance of 0.85 and 0.86, respectively (average 0.85). Iintraobserver agreement was 54 to 93 per cent; average 69 per cent.

CONCLUSION: The reproducibility of the CVM method proved statistically good in interobserver and moderate in the intraobserver agreement.

309 PRE-SURGICAL ORTHOPAEDIC TREATMENT FOR CLEFT LIP AND PALATE PATIENTS DURING INFANCY: A SYSTEMATIC REVIEW AND META-ANALYSIS

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AIM: To systematically access current evidence on the effectiveness of pre-surgical infant orthopaedics (PSIO) in cleft lip and palate (CLP) patients.

MATERIALS AND METHOD: Search strategy, study selection, quality analysis, data extraction and data synthesis were based on the PRISMA statement and were conducted by two independent investigators. Several electronic databases were

searched in order to identify potentially relevant studies and the reference lists of the retrieved articles were hand assessed. When possible, overall pooled estimates with 95 per cent confidence intervals were obtained using the random effects model. Quality analysis, publication bias and heterogeneity evaluation of the included papers was also assessed.

RESULTS: Initially, 1449 papers were retrieved. After applying the pre-defined inclusion and exclusion criteria, 24 studies were found eligible for inclusion in the qualitative synthesis, whereas 10 of them were included in the quantitative synthesis (meta-analysis). A lack of high-validity studies with regard to active plates or presurgical nasoalveolar moulding appliances was noted. Quantitative analysis of the data of the included studies showed, in CLP patients following PSIO treatment a slight, significant increase only on the maxillary dental arch form, as measured by the MTC (5) variable; however, this was evident only for 2 out of 4 time points assessed. Thus, this positive effect should be interpreted with caution. No other beneficial effect of PSIO was found with regard to sagittal development of the maxilla, maxillary arch depth and width, facial aesthetics, occlusion, collapse or contact status, as well as feeding, speech development, cost-effectiveness and maternal satisfaction. CONCLUSION: The limited evidence derived from this study does not seem to

CONCLUSION: The limited evidence derived from this study does not seem to support the short- or long-term effectiveness of PSIO in CLP patients.

311 THE EFFECTS OF SYMPHYSEAL DISTRACTION ON RETROGLOSSAL AIRWAY DIMENSION AND HYOID POSITION

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AIM: To evaluate the effects of mandibular symphseal distraction (MSD) on retroglossal airway dimension and hyoid bone position.

MATERIALS AND METHOD: Lateral cephalometric radiographs of four male and seven female patients (mean age: 17.24 ± 2.8 years). Records were taken before treatment (T1) and after levelling and alignment of the lower anterior teeth (T2). MSD was carried out with a custom-made bone-borne distractor. A paired *t*-test was used to compare cephalometric variables at T1 and T2.

RESULTS: Lateral cephalometric analysis showed that retroglossal airway dimension, head posture, upper and lower incisor inclination and the position of point B did not change significantly. Only hyoid bone-mandibular plane distance significantly decreased (P = 0.041).

CONCLUSION: MSD alone does not significantly affect retroglossal airway dimension.

312 CHANGES IN THE DENTITION FOLLOWING 10-YEAR USE OF A MANDIBULAR PROTRUDING DEVICE

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AIM: This 10-year prospective study focused on changes in the dentition following use of a mandibular protruding device (MPD) in the treatment of obstructive sleep apnoea (OSA)/snoring.

SUBJECTS AND METHOD: At the 10-year follow-up all subjects, except three that were deceased (n = 74), were invited to participate and 66 accepted the invitation. Impressions, fabrication of dental casts and jaw registration indices were made at baseline and follow-up. Analyses focused on Angle classification and lateral open

bite. The frontal relationship and arch width changes were measured with a digital calliper.

RESULTS: Dental casts of 63 subjects (50 males, 13 females) were available for analysis (43 MPD-users, 20 MPD-ceased users). The MPD users showed a reduced overjet (-1.8 mm; P < 0.001), overbite (-1.5 mm; P < 0.001), and maxillary intercanine width (-0.4 mm; P < 0.001). The perpendicular distance between the mandibular molars and incisors increased (+0.3 mm; P < 0.01). MPD-ceased users retained their initial values except for a decrease in overbite (-0.6 mm; P < 0.01). In the group of MPD-users an increased number of mesio-occlusion and lateral open bites were found. The consistency of measurements showed no systematic measurement errors; intraclass correlation coefficient ranged between 0.93-0.99.

CONCLUSION: Long-term use of an MPD may cause changes in the dentition, especially in decreasing the overjet and overbite. A general feature was an anterior drift of the mandibular teeth. The small alterations seen in the MPD-ceased users may indicate that the MPD-related changes are reversible.

313 RELATIONSHIP BETWEEN FREQUENCY OF MALOCCLUSIONS AND ORTHODONTIC TREATMENT NEED

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AIM: To find an interrelationship between the frequency of malocclusion and orthodontic treatment need.

SUBJECTS AND METHOD: Two hundred and three 18-year-old Polish students (104 males, 99 females) were examined in order to assess the frequency of malocclusions and orthodontic treatment need. Two different orthodontic classifications were used: the Polish classification by Orlik-Grzybowska and the classification of Ackerman and Proffit to establish the incidence of occlusal anomalies. The Dental Health Component of the Index of Orthodontic Treatment Need (DHC IOTN) was used to evaluate orthodontic treatment need. Multiple regression analysis was applied in an attempt to design a mathematical model that could illustrate DHC IOTN dependent on particular malocclusions. Statistical analysis was conducted with Statistica PL version 9.

RESULTS: The frequency of malocclusions assessed with the classifications of Orlik-Grzybowska and Ackerman and Proffit were approximately 77 and 75.4 per cent, respectively. Orthodontic treatment was required in 20.9 per cent of the students (DHC 4 or 5). A statistically significant influence of crossbite and distoclusion on the DHC was observed (P = 0.0013 and P = 0.0085, respectively). A mathematical model with explanatory variation of IOTN DHC depending on particular malocclusions was created: IOTN DHC = $2.29 + 0.63 \times A\&P$ crossbite + $0.72 \times OG$ scissor bite + $0.22 \times OG$ distoclusion ± 0.82 . R² = 0.28

Where: A&P crossbite is the crossbite frequency according to the classification of Ackerman and Proffit; OG scissor bite is the scissor bite frequency according to the classification of Orlik-Grzybowska and OG distoclusion is the distoclusion frequency according to the classification of Orlik-Grzybowska. The model could explain nearly 30 per cent of DHC variability.

CONCLUSION: Malocclusions are a common problem among 18-year-old Polish students. Almost one-fifth of the age group required orthodontic treatment. In nearly 30 per cent of cases it was possible to estimate orthodontic treatment need on the basis of the occurrence of a particular malocclusion.

314EVALUATION OF FACIAL MORPHOLOGY IN CHILDREN AGED 5 TO6 YEARS WITH A CLASS III MALOCCLUSION

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AIM: To evaluate facial morphology in Class III and non-Class III children using three-dimensional (3D) laser imaging.

SUBJECTS AND METHOD: Two groups of children, 25 Class III children (9 males, 16 females; mean age 5.7 ± 0.6 years) and 46 non-Class III children (21 males, 25 females; mean age 5.6 ± 0.8 years). A Class III malocclusion was clinically diagnosed according to the anterior crossbite and Class III molar relationship. 3D facial images were obtained and group comparisons were evaluated (face height, facial convexity, mandibular position and facial surface morphology). Differences between the Class III and non-Class III parameters were evaluated using analysis of variance (ANOVA). Qualitative analysis was performed using colour deviation maps. RESULTS: Class III children had less mid-face prominence and a concave facial profile when compared with non-Class III children (P = 0.002 and P = 0.018). The position of point pg in the *z*-axis just failed to reach statistical significance when comparing the two groups (P = 0.051). Vertical analysis showed no statistical significance between the two groups when evaluating middle (n-sn) and lower (sn-pg) face height. Coincidence of the Class III faces to normal templates, with a tolerance set as 0.5 mm, was low (30% upper face, 24% mid-face, 25% lower face).

CONCLUSION: Facial soft tissue characteristics of Class III children in the primary dentition differ significantly from those of non-Class III children. Class III primary dentition children had a less developed mid-face region compared with the non-Class III children. Therefore, orthopaedic traction of the upper jaw should arguably be considered as the treatment protocol of a Class III malocclusion in the primary dentition.

315 TREATMENT DURATION OF ANTERIOR CROWDING ACCORDING TO MATURATION STAGES OF THE LOWER CANINES AND PREMOLARS J Krotova, N Pankratova, L Persin, N Maksimov, J Rodionova, Department of Orthodontics and Children's Prosthetics, Moscow State Medical-Dentistry University, Russia

AIM: Improvement of diagnostic methods in patients with anterior crowding and evaluation of orthodontic treatment duration according to the maturation stages of the roots of the lower teeth.

SUBJECTS AND METHOD: Twenty 9-15 year old patients before and after orthodontic treatment of anterior crowding combined with lateral physiological occlusion. The patients were divided into two groups according to their age: 9-11 and 12-15 years. Within the groups the extent of dental narrowing was determined. The formation stages of the lower canine and premolar roots were studied on panoramic radiographs.

RESULTS: All patients had a lateral physiological occlusion and anterior crowding due to narrowing of the dental arches. In group 1 the patients had F-G formation stages of the lower canines and premolars with possible bone tissue growth (65-85%). The 12-15 year old patients had the same stages, but possible growth was 25-65 per cent. Root formation stages showed a regular arrangement in the two groups: F-stage in group 1 was registered in 72.2 per cent and stage G in 27.8 per cent of cases. The 12-15 year old patients had an opposite relationship: stage F in 28 per cent and stage G in 72 per cent of cases. This indicates stable and regular growth of the canine roots in patients with anterior crowding. The period of permanent canine root formation

follow one and other in patients with physiological occlusion even when combined with anterior crowding of different stages of intensity. Narrowing of the dental arches in group 1 was 2-3 degrees and in group 2, 1-2 degrees. The average duration of orthodontic treatment, which was carried out conventionally using fixed appliances, was 12-13 months in group 1 and 15-18 months in group 2.

CONCLUSION: The extent of dental arch narrowing and lower canine and premolar root formation stages influences orthodontic treatment duration. The duration of orthodontic treatment in group 1 was, on average, 4.1 ± 0.3 months less than in group 2.

316 POST-RETENTION DEVELOPMENT OF UPPER ANTERIOR CROWDING RELATED TO THE DENTAL ARCH

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AIM: Assessment of post-retention changes of interproximal contact points in the upper anterior segment as related to arch form in order to include malpositions that evade scoring with the irregularity index.

SUBJECTS AND METHOD: Thirty-four subjects successfully treated without pericision or over treatment with moderate to severe pre-treatment crowding, retained with a removable Hawley retainer. Photographs of plaster models pre-treatment (13 years), post-treatment and long-term (32 years) were analyzed. Retention lasted 3-5 years; the mean post-retention time was 19 years and at least 3 years. The irregularity of contact points was assessed in a Viewbox program as deviation from their ideal position on an individualized arch represented by a smoothed curve running through the average contact points. This served for quantification of in- and outward deviations larger than 0.3 mm.

RESULTS: The lateral incisors showed the largest pre-treatment deviations (up to 8.5 mm) mostly in a palatal direction. The central incisors and canines were mostly dislocated in a labial direction. Stability was found in less than 50 per cent of all corrected contact points. Originally buccally positioned contact points showed more extensive and more frequent relapse. Ongoing post-treatment movement was found for 37 per cent of the originally buccally positioned distal contact points of the central incisors and for 25 per cent of the originally palatally positioned contact points of the lateral incisors. About 50 per cent of the originally correct contact points, mostly those of the canines, unchanged during treatment, showed spontaneous post-treatment changes. Only contact points mesial to tooth 23 and distal to tooth 11 showed a correlation between original deviation and relapse. Pre-treatment and long-term symmetry was rare. Long-term correlations between contact point deviations decreased.

CONCLUSION: This novel method of tooth irregularity assessment provides more insight into contact point development and is useful for future research.

317 *IN VITRO* BIOCOMPATIBILITY EVALUATION OF ZIRCONIUM IMPLANTS

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AIM: Dental implants have become an important part of modern dentistry; however their great variety means making the right choice becomes a difficult task. To

improve osseointegration, different possibilities of dental implant surface modifications, e.g. alterations of surface chemistry and roughness have been developed. The objective of this *in vitro* study was to evaluate the biocompatibility of newly created zirconium implant surfaces in comparison with commercially available zirconium and titanium implants.

MATERIALS AND METHOD: Cell viability and proliferation of mouse fibroblast cells (L929) were measured after 21 days using the CellTiter-Glo® and CytoTox-Gloä assay (Promega, Germany) and correlated with surface structures.

RESULTS: In the presence of new ceramic implants with a surface called 'MDS' (blasted/etched)' and 'blasted', cell viability was increased 1.29 and 1.26 fold compared with untreated cells, whereas cell viability was unchanged in the presence of reference implants and new ceramic implants with a surface called 'etched'. The findings of cell viability correlate with results of cell cytotoxicity assay. The etched implants showed a surface with high roughness and heterogeneity, whereas the MDS and blasted implants showed a similar very rough-textured homogenous surface.

CONCLUSION: The biocompatibility of the two new ceramic implants was significantly better in comparison with the tested reference ceramic and titanium implants. This good biocompatibility may be attributed to the homogenous surfaces of these implants that might hasten osseointegration.

318 RELATIONSHIP BETWEEN MANDIBULAR ANTERIOR CROWDING AND SAGITTAL CRANIOFACIAL MORPHOLOGY

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AIM: To investigate the relationship between sagittal craniofacial morphology and mandibular anterior crowding.

MATERIALS AND METHOD: Pre-treatment records of 45 skeletal Class I (mean age: 17.07 ± 2.93 years), 34 skeletal Class II (mean age: 16.68 ± 2.58 years) and 33 skeletal Class III (mean age: 15.52 ± 2.97 years) subjects. SNA, SNB and ANB angles were measured from cephalometric films to classify the patients according to their skeletal pattern. Little's Irregularity Index was used to evaluate anterior crowding and all measurements were achieved on dental casts with a digital calliper. Group differences were assessed with ANOVA.

RESULTS: Statistically significant differences were found among Little's values between Class II and Class I cases and between Class II and Class III patients. Little's index values of Class II patients (5.52 ± 3.14) were greater than both Class I (4.24 ± 2.66) and Class III (4.32 ± 2.61) patients.

CONCLUSION: As the Class II group had the greatest Little's index values compared with Class I and Class III cases, mandibular anterior retention duration and protocols must be carefully evaluated especially in Class II patients.

319 RIDGE PRESERVATION – A NEW APPROACH TO AVOID GINGIVAL CLEFTS FOLLOWING EXTRACTION TREATMENT?

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AIM: To explore, in a split mouth designed study, the influence of extraction socket augmentation with NanoBone® (NB) on the incidence and dimensional degree of gingival clefts (GC).

SUBJECTS AND METHOD: Ten orthodontic patients requiring symmetric premolar extractions offering a total of 28 extractions. The study plan provided one extraction

site to be augmented with NB, the other served as the control. After wound healing, space closure was performed by applying a force of 0.2 N using NiTi coil springs on 17×25 inch stainless steel wires. During the study period, until and after accomplished space closure, the occurrence and severity of GC was determined by measuring their horizontal and vertical dimensions. Furthermore probing depths of the adjacent teeth mesial and distal of the extraction, their vitality, as well as the progress of space closure were documented. In addition radiographs were taken. Statistical analysis was carried out with the Wilcoxon matched pairs test.

RESULTS: The vertical and horizontal dimensions of GC were significantly (P < 0.05) reduced at NB augmented extraction sites. Space closure failed in none of the patients. In two cases in the lower jaw however the velocity of space closure was reduced compared with the control side. Probing depths mesial and distal to the extractions were reduced on the NB side. All teeth observed were vital. Some radiographs displayed hypercalcifications on the test side. Minor apical root resorption was found in two patients on the NB side as well as well as on the control side.

CONCLUSION: Ridge preservation with NB could be a useful method to reduce the severity of gingival clefts, although a larger number of patients would be needed to confirm the results. On the other hand, as the long-term effects have not yet been evaluated, this approach still cannot be recommended as a standard procedure for every extraction case. More research on safety and indications is required.

320 EFFECT OF THERMOCYCLING AND CHLORHEXIDINE ON SHEAR BOND STRENGTH OF ORTHODONTIC ADHESIVES – AN *IN VITRO* STUDY A Labib¹, A Abulnaga², ¹Department of Orthodontics, Cairo University, Egypt and ²Department of Restorative Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia

AIM: To determine whether the use of chlorhexidine mouth rinse and thermal cycling have an effect on the shear bond strength (SBS) of two different adhesive materials. MATERIALS AND METHOD: Sixty extracted sound human premolars were randomly divided into equal two groups according to the material used to bond the orthodontic brackets [Adper Prompt L-Pop Self-Etch Adhesive (AP) with Filtek Z350 Flowable Restorative, and Ketac N100 nano-ionomer primer (KN) with Ketac N100 light-curing nano-ionomer restorative, 3M/Espe]. Orthodontic brackets (Nu-Edge LN Kit) were bonded to the labial enamel surfaces. Each group was subdivided into three subgroups (n = 10); 1) Control, 2) The specimens were subjected to thermocycling (5- 55° C) with 1 minute dwell time for 1000 cycles, and 3) The specimens were immersed in 20 ml of 0.2 per cent chlorhexidine digluconate [(CHX), Colgate Periogard] for 12 hours and then subjected to the thermocycling procedure as in group 2. The teeth were then placed in a Lloyd universal testing machine at a crosshead speed of 0.5 mm/minute and the shear forces to remove the brackets were recorded. Data were statistically analyzed using two-way ANOVA and Tukey's *post-hoc* test (P < 0.05).

RESULTS: The mean SBS of KN (22.5 MPa) showed statistically significantly higher values than AP (17 MPa). There was no significant difference in the mean SBS values between the control subgroup (21.1 MPa) and thermocycling (20.2 MPa), whereas, exposure to both chlorhexidine and thermocycling showed the statistically significantly lowest mean SBS (17.9 MPa).

CONCLUSION: Under test conditions, using chlorhexidine mouth rinse for a long duration would compromise the bonding of the orthodontic brackets, whereas, thermal cycling had no effect on the SBS of both tested adhesive systems.

321 ORAL AND DENTAL HYGIENE PROTOCOL FOR PATIENTS TREATED WITH INTERCEPTIVE ORTHODONTICS

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AIM: To create an oral hygiene intervention protocol for children treated with interceptive orthodontics for specialists and an informative brochure for the child's parents.

SUBJECTS AND METHOD: As a starting point, a thorough review of the literature was made by consulting medical databases such as the Cochrane Library and PubMed. Articles were selected from 2000 to 2010. The treatment process normally used at the Orthodontic Department, University of Brescia was also analyzed.

RESULTS: Maintaining oral hygiene in patients with interceptive orthodontic appliances is an important and indispensable factor that facilitates the recovery of malocclusion and improves the quality of life during treatment.

CONCLUSION: The dental hygienist, within the dental team, may achieve the best results. The protocol created considers every aspect and situation from the point of view of dental hygienists, dentists, otolaryngologists and paediatricians. This has resulted in the creation of a brochure that is a reminder and a guide for parents, where information is available (educational comics and educational plays) and they can find answers to maintain excellent oral hygiene at home.

322 CRANIAL BASE GROWTH DURING ADOLESCENCE ASSESSED THROUGH CONE-BEAM COMPUTERIZED TOMOGRAPHS

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AIM: To assess growth of the middle/posterior cranial base during adolescence based on landmarks located on serial three-dimensional cone beam computed tomographic (CBCT) images.

MATERIALS AND METHOD: CBCT scans from 62 adolescents (11 to 17 years) at baseline and at 12 months were used. Eleven landmarks in the cranial base were identified. Landmark distances were analyzed with respect to the differences between the two time points. R was used to obtain discrete curves by rearranging and connecting each set of coordinates. The curves were aligned via Procrustes transformation and examined for group dimorphism and longitudinal change.

RESULTS: Growth changes in the cranial base were within 1 mm, except for 2.25 mm between the right and left auditory external meatus. There were few differences between the age groups in relation to the peak growth period.

CONCLUSION: Cranial base growth was minimal over the observation period. There were no differences in terms of the amount and pattern of growth.

323 ASSESSMENT OF DENTAL AGE AND DEVELOPMENT IN SINGAPORE CHINESE CHILDREN USING DEMIRJIAN'S METHOD Y C Lai, Orthodontics, National Dental Centre Singapore, Singapore

AIM: To assess the accuracy and precision of Demirjian's method when applied to Singapore Chinese children and to compare their dental maturity to French-Canadian children.

MATERIALS AND METHOD: Three hundred and twenty seven dental pantomograms were collected. The study sample consisted of 156 Chinese girls and 171 Chinese boys between the ages of 3 to 17 years. Dental age was determined using Demirjian's method.

RESULTS: Intra-examiner error was found to be very low (6.2%) and within one stage. Most of the errors occurred at identification of Stages G and H. Demirjian's method consistently overestimated the chronological age in both girls and boys. The median differences between dental age and chronological age ranged from 0.19 to 1.72 years in girls and -0.01 to 1.52 years in boys.

CONCLUSION: Demirjian's method had high precision but consistently overestimated chronological age when applied to Singapore Chinese children. Dental development was completed by the age of 14 years in girls while boys achieved full maturity only at 16 years of age.

324 COMPARISON BETWEEN TWO VERTICAL TUBES FOR AUXILIARY ARCHES

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AIM: To determine the resistance of two vertical tubes until rupture consequent to stress fatigue supported by mechanical tests.

MATERIALS AND METHOD: The number of cycles were calculated of opening and closing clips welded to the molar bands of vertical lingual tubes and the universal vertical hinge PD system until rupture consequent to the stress fatigue supported by the steel of the lingual clips.

RESULTS: Mechanical testing showed a number of limitations due to the average number of opening and closing cycles of the universal vertical hinge PD system that is 7.7. The new vertical lingual tube realized with selective laser sintering (SLS) had a higher degree of resilience of the clips of the vertical tube by increasing the number activations of the clips.

CONCLUSION: The realization with SLS of the new vertical lingual tube improved the technical performance in terms of durability and safety compared with the previous system, with greater patient comfort and more convenient management by the clinician.

325 A PREDICTIVE MATHEMATICAL EQUATION OF PAIN PRODUCED BY DENTAL ARCHWIRES AS A FUNCTION OF TIME

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AIM: To compare pain in orthodontically treated patients during the initial stages of treatment depending on the archwire used, steel and nickel-titanium (NiTi), and to find a predictive mathematical equation to predict pain over hours at the time of initial placement of the archwire

SUBJECTS AND METHOD: One hundred and ten patients divided according to the type of archwire worn, 49 with steel arches and 61 with NiTi. The patients filled out a survey related to pain, specifying the amount of pain (from nothing to severe) they experienced (1 to 10 days) and the time of day in which they felt it (morning, afternoon, night or several times).

RESULTS: Stainless steel and NiTi archwires produce different results in terms of pain. The level of pain was lower in patients treated with NiTi than with stainless steel archwires. The level of pain was determined by the mathematical equation, level of pain = $a * T-3 + c * \exp(-b * T)$.

326 ASSOCIATIONS BETWEEN LEVELS OF PGE₂ IN GINGIVAL CREVICULAR FLUID AND PERCEIVED INTENSITY OF PAIN

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AIM: To study the experience of pain during orthodontic treatment and the possible associations with the gingival crevicular fluid (GCF) composition changes at the level of prostaglandin-E₂ (PGE₂).

SUBJECTS AND METHOD: Forty patients were selected. Discomfort or pain was evaluated using a visual analogue scale. GFC was collected after isolation of the sites from saliva with a Periopaper strip inserted 1 mm into the sulcus and left in place for 30 seconds. The strip was placed in a microcentrifuge tube and immediately frozen at -70° C until analysis.

RESULTS: When the initial value for PGE_2 was high those values remained high during the following week. High levels of PGE_2 were also related to higher levels of pain during the week and during the 6th and 8th day.

CONCLUSION: Chemical markers have some correlations with patient reported subjective pain but they seem to be related more to the accumulation of pain during treatment than at a given time

327 COMPARISON OF STRESS AND DISPLACEMENT IN MAXILLARY PROTRACTION WITH MINIPLATES PLACED AT THE INFRAZYGOMATIC CREST AND LATERAL NASAL WALL

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AIM: To compare the pattern and amount of stress and displacement between maxillary protraction with a miniplate placed at the infrazygomatic crest (MP-IZ) and lateral nasal wall (MP-LN).

MATERIALS AND METHOD: Three-dimensional finite element models of the skull and curvilinear type miniplate were constructed using Mimics and SolidWorks Simulation programs. After a protraction force (500 g/side) was applied to the distal end of the miniplate with a 30 degree downward and forward vector to the maxillary occlusal plane, stress distribution in the circum-maxillary sutures and displacement of the surface landmarks were analyzed using the ANSYS program.

RESULTS: There was a difference in maximum stress distribution area according to the position of the miniplates: infrazygomatic crest and middle part of the maxilla in MP-IZ and paranasal area adjacent to the piriform aperture in MP-LN. Stress values of the fronto-nasal, fronto-maxillary, zygomatico-maxillary, and pterygo-maxillary sutures were higher in MP-IZ than MP-LN. The site of the miniplates produced a difference in the major displacement area: the infrazygomatic crest, maxillary dentition, anterior maxilla, and upper part of maxillary tuberosity in MP-IZ and the lateral nasal wall, maxillary dentition, anterior maxilla, and lower part of maxillary tuberosity in MP-LN. MP-LN showed forward, downward, and outward displacement of ANS, point A, and prosthion. However, MP-IZ exhibited a forward and upward displacement of ANS, point A and prosthion, the outward displacement of the zygomatic process of the maxilla and the maxillary process of the zygomatic bone.

CONCLUSION: The site of miniplate installation should be considered to obtain the correct stress and displacement in different types of maxillary hypoplasia.

328 CHEWING VERSUS SLEEP BRUXISM: DOES THE JAW CONTRACT AT THE SAME PACE?

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AIM: Disruption of the central pattern generator has been implicated in the pathophysiology of sleep bruxism (SB). The gold standard for assessing SB is polysomnography but this is expensive and requires a specialized clinic setting. Portable electromyography (EMG) recorders can be used for detection of rhythmic masticatory muscle activity (RMMA) in the natural environment. The aim of this study was to compare human RMMA in a natural environmental setting, including SB and chewing. It was hypothesized that there is a correlation between chewing pace and the pace of RMMA during sleep among sleep bruxers.

SUBJECTS AND METHOD: EMG surface activity was recorded unilaterally from the masseter in 13 volunteers, who had reported recurrent episodes of SB. Recordings were carried out for approximately 12 hours, and taken over two days in a natural environmental setting, always including dinnertime and the entire sleeping period. The time-frequency properties of RMMA episodes were automatically extracted offline using a previously validated algorithm.

RESULTS: Although all participants had reported moderate to severe SB, the number of SB episodes detected were not significantly correlated with self-reported awareness and severity of SB. The chewing pace differed to that of SB – the average chewing frequency was 1.5 ± 0.4 Hz; the average frequency for SB episodes was 1.1 ± 0.3 Hz and they were not significantly correlated (P > 0.05). The mean total duration of SB activity was < 8 minute over a complete sleep period and the mean duration of SB episodes was 5.6 ± 3.1 seconds.

CONCLUSION: Sleep RMMA episodes are generally short-lasting and unrelated to self-awareness of SB. The chewing pace of sleep bruxers is not correlated with that of sleep RMMA. There is possibly a separate pace-generating mechanism for SB that is independent from that of chewing.

329 RELATIONSHIP BETWEEN MANDIBULAR DIMENSIONS AND CERVICAL VERTEBRAL MATURATION STAGES IN NORMAL OCCLUSIONS***

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AIM: Biological indicators for the evaluation of mandibular growth have been widely used in the last decades. In previous studies, skeletal maturation and, in particular, the cervical vertebral maturation (CVM) have been shown to be one of most reliable indicators. The morphological changes of the vertebral bodies of the second, third and fourth cervical vertebrae (C2, C3 and C4) are classified as stages of skeletal maturation, which correspond to a growth phase in each individual. Therefore, they can be used to evaluate mandibular growth.

MATERIALS AND METHOD: Lateral head films of 370 individuals with normal occlusions were analysed and correlated with mandibular growth with the CVM stages (6 in total).

RESULTS: In each age group, females reached higher stages of maturation than males. Regarding mandibular dimensions, a significant increase of Co-Gn and Goi-Gn was observed between stages 3 and 4. On the other hand, Goi-Gn length increased constantly from stages 2 to 6.

CONCLUSION: These findings indicate that orthopaedic and/or functional treatment can also eventually be started during later CVM stages (stage 5), especially in males. Therefore, patients in the later CVM stages may also benefit from such treatment.
330 A DENTAL PANTOMOGRAPHIC STUDY OF HYPODONTIA IN THE PERMANENT TEETH OF NORTHEASTERN ROMANIANS

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AIM: To determine the frequency and distribution of congenitally absent permanent teeth, except third molars, and their relationship with the persistence of primary teeth or the size of the remaining free space, by gender and age, in young patients in northeastern Romania.

MATERIALS AND METHOD: One hundred and seven dental pantomograms (DPTs) of 107 subjects with hypodontia (except third molars), selected from 587 subjects (240 males, 347 females), aged between 5-28 years, taken during 1991-2010. All DPTs were taken with the same device, Strato-X. Statistical analyses were performed using the Statistical Package for Social Sciences, version 17.0 for Windows (SPSS Inc., Chicago, Illinois, USA).

RESULTS: In total there were 173 congenitally absent permanent teeth (42.8% mandibular second premolars, 39.3% maxillary lateral incisors, 6.9% mandibular central incisors, 6.4% maxillary second premolars, 2.9% mandibular second molars, 1.1% mandibular first molars and 0.6% maxillary first premolars). In patients with these types of hypodontia 53.2 per cent had retained primary teeth, 44.5 per cent after their normal retention age and 46.8 per cent remnant free spaces, which were measured (retained, reduced or closed) for each hypodontia. ANOVA linear regression showed statistically significant correlations between gender and congenitally missing teeth (P = 0.02) and hypodontia 15 (P = 0.05) and between age and the retention of primary teeth and the space (P = 0.00).

CONCLUSION: The high frequency of congenitally absent permanent teeth is not specific only to the studied population. The high frequency of persisting primary teeth implies conservation of dental arch length and vertical occlusal imbalance. The different space sizes results in chewing, phonetic and aesthetic disorders, depending on the location of the hypodontia.

331 DIAGNOSIS AND MANAGEMENT OF IMPACTED TEETH

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AIM: To determine the frequency, distribution and patterns of impacted teeth, except third molars.

SUBJECTS AND METHOD: Sixty-seven patients (29 males, 38 females), randomly selected with impacted teeth (except third molars), aged between 6 and 37 years, who attended during 1991-2010. The diagnosis of impacted teeth was established by clinical and radiographic analysis (dental pantomogram, and anterior occlusal radiograph). Statistical analyses were performed using the Statistical Package for Social Sciences, version 17.0 for Windows (SPSS Inc., Chicago, Illinois, USA).

RESULTS: A single impacted tooth was present in 83.6 per cent of the subjects and two impacted teeth in 16.4 per cent. The most frequent patterns of impaction were: tooth 11 (23.4%), 13 (20.9%), 23 (16.4%), 13-23 (10.4%), 21 (10.4%) and 33 (4.5%). The studied 78 impacted teeth were: canines (56.4%), incisors (33.3%) and maxillary and mandibular premolars (10.3%). Diagnosis of dental impaction was established by intraosseous development, severity and tooth axis direction and the relationship to the dental arch. The treatment was 80.6 per cent surgical-orthodontic (discovery of impacted teeth and traction of dental arch) and surgery only 19.4 per cent (enucleation of unerupted teeth). Linear regression ANOVA showed statistically significant correlations between age and evolutionary diagnosis (P = 0.02), the severity diagnosis

(P = 0.00), impactions located in the upper left (P = 0.04) and upper right (P = 0.05) quadrants.

CONCLUSION: Diagnosis of impacted teeth raises difficulties in establishing the type of treatment. Treatment of impacted teeth was applied according to the complex, clinical and radiographic diagnosis.

332 ACCURACY OF SPACE ANALYSIS IN THREE-DIMENSIONAL DIGITAL AND PLASTER MODELS***

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AIM: To examine the accuracy of Moyers' probability tables in predicting the size of unerupted canines and premolars of the maxillary and mandibular quadrants on digital and plaster models.

MATERIALS AND METHOD: Measurement of tooth widths at their greatest mesiodistal dimension was performed on 30 sets of plaster cast of patients in the permanent dentition, randomly selected, with digital callipers and in the corresponding three-dimensional (3D) digital model using O3d dedicated software (Widialabs, Brazil). The sum of the mesiodistal diameters of the mandibular permanent incisors was used to estimate canine and premolar size, as proposed by Moyers using the 75 per cent of probability, and compared with the actual size of those teeth. Replicate measurements 1 week apart were undertaken to calculate the method error. Pearson's correlation test, Dahlberg's formula, *t*-test and variance analysis were used to analyze the data.

RESULTS: Statistical analysis showed excellent intra-examiner agreement for O3d system measurements (r = 0.91) and calliper measurements (r = 0.95). Estimation of the sum of the canine and premolar sizes using Moyers analysis at the 75 per cent of probability level were on average 2.4 mm greater on the digital image and 2.2 mm on the plaster models than the sun of the actual size of these teeth.

CONCLUSION: The accuracy of the Moyers space analysis on 3D digital models was acceptable and reproducible when compared with traditional plaster study model analyses. The Moyers table of probability (75%) overestimates the sum of the canine and premolar sizes on both digital and plaster models.

333 SOFT PROFILE CHANGES INDUCED BY CHINCUP THERAPY IN PATIENTS IN THE EARLY MIXED DENTITION

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AIM: To evaluate retrospectively the short-term effects on the soft tissue profile of chincup therapy in a sample of patients in the early mixed dentition.

SUBJECTS AND METHOD: Thirty-one patients (15 boys, 16 girls, with a mean age at the beginning of treatment of 6 years ± 1) who exhibited an anterior crossbite with an average overjet of -1.66 mm. All patients had been treated with a chincup until a positive overjet was achieved. When the overbite was more than 1 mm a biteplate was used. In order to evaluate the treatment effects on the patients' profiles, the lateral pre-treatment photographs (T1) and the photographs taken 30 months later (T2) were analyzed. One ratio and three angular measurements [nasolabial angle, soft tissue profile including nose angle (NNP) and soft tissue profile excluding nose angle (NAP)] were selected for analysis to eliminate bias stemming from differences in photograph magnification that occur with linear measurements. Ratio was calculated by dividing the perpendicular distance from the most anterior point of the lower lip to soft sN-soft Pog by the same distance to the upper lip. The data were statistically analyzed using a Student's *t*-test.

RESULTS: Two parameters, NNP and NAP, showed a statistically significant reduction at T2 (P < 0.05), resulting in an increase in facial convexity. The nasolabial angle and the relative lower lip protrusion showed no significant difference at T2.

CONCLUSION: Patients treated with a chincup, with or without a bite plane during the early mixed dentition, showed favourable clinical outcomes with an improvement in their facial profiles. Long-term studies are required to confirm the stability of these changes.

334 CORRELATION BETWEEN MANDIBULAR ASYMMETRY AND THE FUNCTIONAL CONDITION OF DENTOFACIAL MUSCLES

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AIM: To determine the relationship between the functional status of the masseter, temporal and digastric muscles and mandibular asymmetry.

MATERIALS AND METHOD: Cone-beam computed tomography (CBCT) images of 30 patients with distal occlusion aged 12-15 years. Dental midline deviation was detected in 64 per cent. The CBCT images were evaluated for possible asymmetry in the size of the mandibular rami and condyles; length, width and height of the condylar heads; the distance from the inferior side of the condyles to the incisal point. Electromyography was undertaken to define the functional condition of the muscles.

RESULTS: Comparison of the mean values of the right and left side parameters were not statistically significant (P > 0.01). Asymmetry of the mandibular rami and condyles, different positions of the condyles, irregular locations and various forms of the right and the left condyle for each patient were revealed. Electromyographic data showed uncoordinated muscle activity. Correlations between the functional status of the muscles and mandibular asymmetry were analyzed.

CONCLUSION: Measurements evaluated for each patient showed statistically significant difference between the right and left sides. Data analysis confirmed correlations between mandibular asymmetry and the functional condition of the muscles. Patients with distal occlusion have asymmetry compensation owing to the form and size of condyle on the opposite side.

335 ANALYSIS OF OCCLUSION IN CHILDREN WITH PSYCHOMOTOR RETARDATION UNDERGOING ORTHODONTIC TREATMENT

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AIM: To analyze occlusal alterations in patients with psychomotor retardation.

MATERIALS AND METHOD: A retrospective comparative study of 40 handicapped patients undergoing orthodontic treatment was compared with a group of 40 healthy subjects. Their ages ranged from 6 to 18 years. Exclusion criteria were syndromes, craniofacial deformities, cleft lip and palate, chromosomal abnormalities. A standardized form was completed for each patient to obtain comparative data. Abnormalities of growth and dental anomalies were studied by cephalometry and panoramic radiography. Changes in the vertical, sagittal and transverse dimensions, the presence of oral habits and pharmacological treatment were also analysed using plaster models and the clinical history. For comparison inter- and intragroup statistical test were performed; Student's *t*- and chi-square with a significance of P < 0.5

RESULTS: The mean age of the sample was 13.5 years of whom 62.5 per cent were male and 37.5 per cent female. The parameters of growth were within normal limits. Sixty per cent had abnormal sagittal anomalies and 60 per cent presented with transverse anomalies. Dental anomalies were 42.5 per cent (15% dental agenesis, 22.5% ectopia, P < 0.05). Oral habits were also observed (40% were oral breathers, P < 0.00). Thirty per cent of the children were under pharmacological treatment.

CONCLUSION: Children with psychomotor retardation have growth within normal limits but with more dental anomalies and oral habits when compared with a control group.

336 A RETROSPECTIVE 4-YEAR FOLLOW-UP OF ACTIVATOR TREATMENT IN GENERAL PRACTICE.

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AIM: A retrospective long-term follow-up of combined headgear activator treatment in general practice. The aim was to evaluate Class II division 1 malocclusion treatment success and to assess the need for later treatment with fixed appliance.

MATERIALS AND METHOD: All activator treatments, initiated by consulting orthodontists during 2006-2007, were retrospectively analyzed. Out of 214 patients 24 were excluded due to missing data. Dental records of 190 patients (95 boys, 95 girls; median age 11 years; range 8-16 years) were included. The records contained Angle classification, overjet, overbite, lip incompetence and gingival contact. The outcome 'success' was defined as treatment completion, evaluated by a consulting orthodontist. Later treatment with fixed appliance was registered.

RESULTS: All 190 patients had been diagnosed with a Class II division 1 malocclusion and of them 127 (67%) also had lip incompetence and/or gingival contact before treatment. Treatment completion was recorded for 117 patients (62%), of which 25 (21%) received later fixed appliance. Treatment discontinuation was registered for 73 patients (38%) and a significant higher proportion of them (40 patients; 55%; P < 0.001) received later treatment with fixed appliance.

CONCLUSION: Treatment with a combined headgear activator in Class II division 1 malocclusions can be effective in general practice and may reduce the need for treatment with fixed appliance.

337 OCCLUSAL FEATURES OF CHILDREN WITH ADENOID HYPERTROPHY COMPARED WITH A CONTROL GROUP

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AIM: To investigate the association between overbite (OB), overjet (OJ), distal occlusion, crossbite and adenoid hypertrophy.

SUBJECTS AND METHOD: Fifty-six Polish children aged between 2 and 13 years (medium age 5.95) with adenoid hypertrophy who had undergone an adenectomy. The control group was matched for age, gender and number; none of the children had: adenoid hypertrophy, adenotomy or orthodontic treatment in their anamnestic history. Evaluation of anamnestic history, clinical examination, and dental cast measurements were undertaken. Group means were compared and statistical analysis was performed.

RESULTS: Children who had undergone an adenectomy had a larger OJ (P = 0.00104) and deeper OB (P = 0.03664) compared with the control group. A crossbite occurred significantly more often in children from the study than from the control group (P = 0.02346). Children with adenoid hypertrophy were four times more likely

to develop distal occlusion (OR 4.18, P = 0.003), and three times more likely to develop a crossbite (OR 3.37, P = 0.046) than children from control group.

CONCLUSION: Occlusal features of children with adenoid hypertrophy differ from values for the control group, suggesting that adenoid hypertrophy influences occlusion. This influence is probably not direct but caused by mouth breathing which results in nasal breathing.

338 GENETICS IN ORTHODONTICS: MYTHS OR REALITY?*** A Lucchese, Dental School, University of Ferrara, Italy

AIM: To investigate the genetic variables that confer susceptibility to skeletal malocclusions, for use in diagnosis and in treatment planning to provide new approaches to uncover the genetic aetiology of this phenotype and to select the ideal response to treatment.

SUBJECTS AND METHOD: Genomic DNA was obtained from 108 families, including mothers and fathers (age, 35-65 years; average, 50 years) and sons or son (age 6-35 years; average, 15.5 years). Subjects with congenital disorders or general disease were excluded. None had received orthodontic or orthopaedic treatment. All patients gave written informed consent to participate before DNA samples were taken; three samples for DNA were collected for each subject. Polymerase chain reaction amplifications were performed according to a standard protocol. Single nucleotide polymorphisms were selected to investigate candidate genes. Pre-designed TaqMan assays were used for genotyping.

RESULTS: No candidate gene was identified. However some factors of susceptibility were found that might influence the response of patients to orthodontic treatment.

339 ARE THE GOLDEN PROPORTIONS OF ANTERIOR TEETH STILL A GUIDE IN SEARCHING FOR THE IDEAL SMILE?

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AIM: To investigate the dimensions and display of the anterior teeth in a group of subjects to verify if the Golden proportions are still a current guide in rebuilding an ideal smile, and how they change before and after orthodontic treatment.

MATERIALS AND METHOD: The pre- and post-treatment photographs of 400 patients were evaluated in order to measure the mesiodistal diameters of the six anterior teeth. For each measurement, proportions with the lateral incisors were performed to verify concordance with the Golden proportions. A relationship with skeletal pattern was also investigated.

RESULTS: The Golden proportion, as described by Levin, is still current. However, the ratio of the canine in the investigated sample was more representative. Pre- and post-treatment measurements showed a statistical significance when the irregularity index was high.

CONCLUSION: The Golden proportions of the anterior teeth are still a useful guide in defining the ideal smile

340 USE OF ULTRASOUND IN THE DIAGNOSIS OF TONGUE MORPHOLOGY AND FUNCTION

J Lysy, A Thurzo, B Suchancova, S Pintesova, 1st Department of Dentistry and Maxillofacial Surgery, Medical Faculty, Comenius University, and Department of Orthodontics, St. Elisabeth Oncology Institute, Bratislava, Slovakia AIM: To determine the accuracy and clinical usefulness of sonography in the diagnosis of the tongue in the rest position and functional disorders.

SUBJECTS AND METHOD: An ultrasound examination of the tongue rest position in the sagittal and transverse planes and tongue function in M-mode focused on the mesial and middle thirds was carried out. Fixation of the probe was manual, mobile according to the method of Stone. A convex probe and the ultrasound diagnostic unit Siemens Sonoline G60S ultrasound imaging system were used. The findings were compared with those of the clinical examination and three-dimensional cone beam computed tomographic (3D CBCT) high resolution records from the i-CAT CBCT diagnostic unit and lateral cephalometric radiographic images.

RESULTS: All anatomical structures of the tongue were identifiable in the rest position on ultrasound. A convex or concave tongue rest position could be definitively identified in the transverse sectional view. The relationship of the tongue in the rest position to structures of the soft and hard palate could also be definitively identified in the sagittal sectional view. These findings correspond to the 3D CBCT and lateral cephalometric results. Movements of the tongue during swallowing could be identified on functional examination. Functional disorders associated with a lingual fraenum could be definitively identified on clinical examination.

CONCLUSION: Due to the non-invasiveness of ultrasound and its relative availability, it can be used as an additional method in the diagnosis of tongue rest position and functional disorders as well as to monitor changes after therapeutic interventions. Ultrasonography is beneficial in diagnosis.

341 THREE-DIMENSIONAL PLANNING OF LINGUAL ORTHODONTIC TREATMENT USING CONE BEAM COMPUTED TOMOGRAPHY

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AIM: To illustrate features and advantages of complete three-dimensional (3D) planning using cone beam computed tomography (CBCT) for lingual orthodontic treatment.

SUBJECTS AND METHOD: Sixteen patients, aged between 18 and 45 years, were selected for lingual orthodontics that required set-up of the malocclusion to prepare the indirect bonding of the brackets. New generation CBCT for dentistry allowed visualization and analysis of the jaws, teeth and soft tissues of the patient, after a single exposure.

RESULTS: The same digital data, processed by dedicated software, allowed solid casts of the dental arches of the patients to be obtained, using CAD-CAM technology and stereolithographic machines, without traditional impressions or laser scanning. With the same system it was also possible to generate set-up models, simulating not only the movements of the crowns but also of the roots, with respect to the real bone limits of the patient. For every patient on the digital set-up the lingual brackets were virtually positioned in order to make a customized transfer system.

CONCLUSION: The new possibilities offered by CBCT allow full and accurate 3D planning for orthodontic treatment, from diagnosis to indirect bonding, which is important especially in lingual orthodontics, using a single radiographic exposure.

342 MOLAR AND PREMOLAR INTRUSION WITH TEMPORARY ANCHORAGE DEVICES

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AIM: The use of temporary anchorage devices (TADs) for intrusion of molars offers the possibility to achieve clinical results otherwise impossible, speed treatment sequences and neutralize the side effects of alternative mechanics. The low surgical impact generated by these devices makes them useful for segmental treatment even in young people. The aim of this research was to analyse an intrusive mechanic that use miniscrews.

SUBJECTS AND METHOD: Fifteen patients between 45 and 62 years of age who required intrusion of the upper or lower molars or premolars. Before positioning of the miniscrew a superficial and a local anaesthesia were used to improve patient comfort. The intrusive force was delivered by an elastic chain connected to two miniscrews, one positioned palatally and the other buccally. The miniscrew was positioned 4-5 mm from the gingival margin. The direction of insertion had a variable inclination. The head of the miniscrews served as a reference point to evaluate the speed of intrusion.

RESULTS: Intrusion speed with miniscrews was on average higher than expected. In all cases the period of observation was 6 months and all patients completed intrusion in that period. There was no case with a lost miniscrew; thus at the end of the experimental period no effects on intrusion. No patient showed an inflammatory reaction around the head of the miniscrew during treatment or lack of stability of the TADs themselves or discomfort. Pain was referred during miniscrew insertion in three cases that was easily controlled with use of additional injection of mepivacaine. In 13 patients the intrusion caused some form of gingival hypertrophy that disappeared after treatment. None of the teeth showed a lack of vitality during or after intrusion

CONCLUSION: Intrusive mechanics were effective and no clinical complications arose. Miniscrews were well tolerated by patients during therapy.

343 CONSERVATIVE RECOVERY OF MOLAR TEETH WITH THE USE OF TEMPORARY ANCHORAGE DEVICES

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AIM: Impaction of the lower first and second molars is not a common problem, but it is a challenging one. The correction of impacted mandibular molars could be achieved using temporary anchorage devices (TADs). This technique is especially useful when a segmental approach is desired for both aesthetic and treatment need.

SUBJECTS AND METHOD: Twenty-six retained teeth in 20 patients with an age range of 12 to 44 year. All were treated with miniscrews near the impacted teeth to reposition dislodged ones. The duration of therapy, complications encountered, age and gender of the patients were registered. When a mini-implant became loose immediate repositioning was carried out. Before positioning of the miniscrew, superficial and a local anaesthesia were used to improve patient comfort.

RESULTS: All 26 teeth were successfully treated. In only case was the miniscrew was lost during treatment but this was immediately replaced with no consequences on treatment. The average treatment time was 6 months combining distal movement and uprighting. Two miniscrews showed an inflammatory reaction around the head during treatment but neither lack of stability of the TADs themselves nor discomfort for the patients was observed. Pain was reported during insertion of the miniscrews in two cases but this was controlled with use of additional mepivacaine injections. In all 26 cases movement caused some form of gingival hypertrophy but this disappeared after the end of treatment. None of the teeth treated showed a lack of vitality during or after the procedure.

CONCLUSION: The use of miniscrews allows, in many cases, simplification of the treatment plan, using sectional arches. Use of a non-cooperative treatment strategy resulted in more predictable and acceptable treatment for the patients.

344 MANDIBULAR ASYMMETRY IN CLASS II DIVISION 2 AND CLASS III MALOCCLUSIONS IN THE MIXED DENTITION

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AIM: To investigate the effects of two occlusion types on mandibular asymmetry in children in the mixed dentition.

MATERIALS AND METHOD: Mandibular asymmetry measurements were performed on panoramic radiographs of 146 children (77 with a Class II division 2 malocclusion and 69 with a Class III malocclusion) using the Habets method. Regarding gender, there were 61 boys and 85 girls (34 boys and 43 girls were Class II division 2 and 27 boys and 42 girls Class III). Two-way ANCOVA was used to determine the effect of gender and the type of malocclusion controlling for dental age (Demirjian) as covariate.

RESULTS: Dental Class and a combination of the type of malocclusion and gender have a significant effect on the total mandibular asymmetry index. Dental Class accounted for 4 per cent and a combination of Class and gender for 3.4 per cent of variability of mandibular asymmetry. Dental age had no statistically significant effect on the total asymmetry index. Boys in the Class III malocclusion group had a higher total asymmetry index value than girls in the same group (P = 0.045; n2 = 5.9%) and boys with a Class II division 2 malocclusion (P = 0.008; n2 = 5.9%). There were no statistically significant differences in condylar height asymmetry indices and ramus height asymmetry indices between the type of malocclusion and gender.

CONCLUSION: The total mandibular asymmetry values were significantly more pronounced in the Class III than in the Class II division 2 malocclusion group, especially in boys in the mixed dentition, independent of dental age. However, they account for low variability of mandibular asymmetry.

345 CLINICAL VARIABLES AFFECTING THE RATE OF ORTHODONTIC ALIGNMENT

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AIM: To retrospectively evaluate the clinical variables affecting the rate of orthodontic alignment of the maxillary and mandibular incisors.

MATERIALS AND METHOD: The records of 28 patients (12 males, 16 females) with maxillary and mandibular incisor proximal contact displacements were randomly selected and retrospectively reviewed. Utilizing the pre-treatment study models, the most severely displaced incisor in the maxilla and mandible were identified. The largest proximal contact point displacement (CPD) of the displaced incisor was measured and the amount of space required (SR) to allow for alignment was determined by subtracting the mesiodistal width of the displaced incisor and interproximal distance of the immediate adjacent teeth. All measurements were recorded utilizing a digital calliper (Mitutoyo Corporation) by the same examiner. All patients were treated by the same orthodontist and bonded with 0.022×0.028 inch slot interactive self-ligating appliances (In-Ovation System, Dentsply GAC Int.). The same alignment archwire type and sequence, 0.014 and 0.018 inches round austenitic nickel titanium wires (TruFlexTM, Ortho Technology) were utilized for all patients. The electronic dental notes (Exact, Spark Dental) were reviewed to determine the

number of days passed (DP) before the initial aligning archwire was replaced by the next aligning archwire. Multiple regression was utilized to analyze the influence of the pre-treatment CPD and SR on DP.

RESULTS: In the mandible, the influence on DP duration from the amount of SR was 27.4 days [95% confidence interval (CI) 19.4-35.5; P < 0.001] and from the severity of the CPD of the displaced incisor was 10.6 days (95% CI 3.0–18.1; P = 0.008. In the maxilla, the influence from SR and CPD was 11.3 days (95% CI 4.4–18.2; P = 0.002) and 12.1 days (95% CI 8.1–16.1; P < 0.001).

CONCLUSION: Assessment of SR for alignment is necessary to determine the rate of alignment in the mandible.

346 COMPARISON OF HEALTH MANAGEMENT SYSTEMS OF CLEFT PALATE PATIENTS

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AIM: In the years 2000-2002 the Ministry of Health ran a national programme of medical care of cleft palate (CP) children. The standards of treatment were in accordance with the EUROCLEFT recommendations. For the year 2003 the National Health Found became responsible for this objective. The aim of this study was to compare the orthodontic and surgical care systems of CP patients in 2000-2002 and 2003-2010.

MATERIALS AND METHOD: The data of the Cleft Palate Treatment Programme in 2002 and reports of the National Health Found concerning 2010 were compared to assess the quality of treatment of children and adolescents with a cleft of the lip and/or palate.

RESULTS: In 2002 treatment of CP patients was realized in 10 multidisciplinary orthodontic-surgical centres. In 2010, 14 independent orthodontic and 11 surgical centres delivered the services. In 2002, 2210 of children aged 0-18 years were covered by orthodontic and 813 by surgical treatment. In 2010, 3280 of children were treated by orthodontists and 1300 by surgeons. After taking over the realization of the cleft programme by the National Health Found the common standards of treatment, close cooperation of centres and monitoring of the results of treatment was discontinued.

CONCLUSION: The taking over the CP programme by the National Health Found resulted in an increasing of number of medical procedures but the standards of medical care recommended by EUROCLEFT were not adhered to in many cases.

347 EVALUATION OF TWO COMMONLY USED RAT MODELS FOR EXPERIMENTAL TOOTH MOVEMENT

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AIM: To compare tissue reactions evoked by two rat models for experimental tooth movement, an elastic band model and a coil spring model. They were also compared with a periodontic model using a cervical silk ligature.

MATERIALS AND METHOD: In 36 rats the following conditions were allocated by permutation using a split mouth design: (1) an orthodontic elastic band between the maxillary first and second molar, (2) a 10 cN NiTi coil spring for mesial movement of the three maxillary molars, (3) a silk ligature around the cervix of the upper second molar, and (4) no intervention. After 1, 3, and 5 days, groups of 12 rats were killed, processed and sectioned. Haematoxylin and eosin staining was used for general tissue

survey and to evaluate continuity of the epithelium and the transseptal fibre system. Immunostaining for ED1, cathepsin K, and MMP9 was performed for grading of the number of macrophage-lineage cells, osteoclasts and their precursors. Finally, the cementoenamel junction bone distance was used as a measure for bone loss in the interdental septum.

RESULTS: A time-dependent increase in the inflammatory infiltration of the interdental papilla was found with the elastic band and the ligature, but not with the spring model. The disruption of the epithelium of the interdental papilla, and the transseptal fibres was less with the spring model than with the other two. All three models showed a time-dependent resorption of the interdental bony septum. However, this was more pronounced with the elastic band and the ligature, than with the spring model. Cathepsin K+ and MMP9+ cells numbers were higher with the elastic band and the ligature, than with the spring model.

CONCLUSION: The elastic band model induces periodontal effects that resemble very much those induced by ligatures. The coil spring model, in contrast, results in minimal interference with the periodontal tissues and is therefore preferred for experimental tooth movement studies.

348 AVERAGE PROPORTIONS OF BUCCAL CORRIDORS IN A POPULATION

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AIM: To measure the characteristics of the buccal corridors of social smiles in a 20 to 50 year old population. Surface, dimensions and proportions to the whole surface of the smile limited by the upper and lower lip were evaluated.

MATERIALS AND METHOD: Three hundred three-dimensional (3D) photographs (Di3D face scanner) of the face with a social smile expression. Various scans of the social smile were created for each subject and the most average was chosen by a professional committee consisting of three bodies. The scans were analyzed in the native software environment Di3D software.

RESULTS: The buccal corridor surface, displayed on a social smile, was understood as the surface limited by the intersection of sagittal plane defined by the most lateral buccal surface of the distal maxillary posterior teeth visible (especially the premolars) and the surface of the smile laterally limited by the inside of the cheek bordered by the lips. The average surface percentage for the whole smile surface limited by the lips was 15 per cent and the average horizontal length (sum of both) in relation to the horizontal length (linear distance of social smile from angle to angle) 17 per cent of the whole distance.

CONCLUSION: Minimum or excessive buccal corridors should be included in orthodontic diagnosis and treatment planning. Buccal corridor values that differ significantly from acceptable limits should be considered. Buccal corridor aesthetics should be researched not only on two-dimensional (2D) photographs but also on 3D face scans. However the results do not seem to indicate there will be a significant difference from the aesthetic studies undertaken on 2D data.

349 SMART BRACKET TECHNOLOGY IN THE STUDY OF LINGUAL APPLIANCES WITH AND WITHOUT BRACKETS

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Bracket based lingual appliances (BBLA) are largely adopted in orthodontics. Recently novel bracketless lingual appliances (BLLA) have been introduced. Nevertheless knowledge of their mechanics is missing. This presentation will attempt to characterize the force system transferred to a tooth by BLLA with respect to BBLA.

A smart-under-bracket-load-cell (SUBLC) is built. The SUBLC is a thin layer $(2.5 \times 2 \times 0.5 \text{ mm})$ of metal-based composite with an integrated microelectronic chip equipped with multiple piezoresistive stress sensors. A canine retraction mechanic is simulated on two identical resin-based typodonts of the lower arch and *in vivo*, adopting BBLA and BLLA, respectively. A 0.016×0.016 inch stainless steel wire is modelled with a vertical U loop between the canine and first premolar. The wire in the BBLA typodont passively fits in the slots of the brackets bonded on teeth 44-45-46 and in the BLLA typodont passively on the lingual surface of these teeth where it is bonded with composite resin. During the experiments the U loop is activated 1 mm and the wire is fitted in the brackets on 43 in the BBLA typodont and bonded to the lingual surface of 43 in the BLLA typodont. The force systems transmitted to the canine are measured by SUBLC. Five tests were performed for each appliance configuration on resin-based typodont and *in vivo*.

For both configurations the value of the mesiodistal component of the force system was statistically significantly higher than those in the other directions. No statistically significantly difference was observed in the mesiodistal component of the force systems between the two tested configurations. The mechanic of canine retraction with the use of BLLA is equivalent to that of canine retraction with the use of BBLA.

350 LENGTH OF THE MANDIBULAR RAMUS AND THE CONDYLAR PROCESS: A COMPARISON OF MEASUREMENTS

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AIM: To compare different imaging procedures [cone beam computed tomography (CBCT), computed tomography (CT), magnetic resonance imaging (MRI) and lateral cephalometry (LC)] for assessment of mandibular ramus length and the condylar process (CP). These measurements were chosen as they reflect mandibular growth, which is crucial especially in the treatment and follow-up of patients with juvenile idiopathic arthritis (JIA). MRI does not expose patients to ionizing radiation and is routinely used in JIA patients. The hypothesis tested was that MRI is at least as precise and shows good agreement with other radiographic procedures.

MATERIALS AND METHOD: Sixteen measurements from eight intact cadaver heads were obtained on CBCT, CT, MRI and analogue LC. Ramus height (RH) was measured parallel to the posterior border of the ramus and through the most cranial point of the condyle. The height of CP was assessed by constructing a projection of the most caudal point of the mandibular incisor onto the ramus height line. Each distance was measured twice by two independent observers. Coefficient of variation (CV) was used to investigate the precision and Bland-Altman (BA) plots assessed agreement of procedures. Intraclass correlation was used to assess inter- and intraobserver reliability.

RESULTS: MRI data showed very high precision [mean CV for RH: 1.2% (SD 0.7%) and for CP: 3.4% (SD 2.0%)], being as precise as CT and more precise than the other procedures ($P \le 0.006$). MRI measurements were smaller than values obtained by other procedures (BA: highest mean difference for RH: -3.4 mm and CP: -1.9 mm).

CONCLUSION: MRI is as precise as CT and can therefore be used to assess mandibular growth. MRI measurements are generally smaller, which might be due to different representations of the tissues inherent to the imaging methods. Therefore the landmarks, especially the condylar, might be identified at different positions. This has to be taken into consideration when comparing MRI measurements to data and reference values based on CBCT, CT or LC.

351 EFFECTS OF FIXED HYBRID APPLIANCES ON OCCLUSION, TEMPOROMANDIBULAR JOINT STATUS AND DENTOFACIAL MUSCLES M Markova, L Polma, L Persin, Department of Orthodontics, Moscow State University of Medicine and Dentistry, Russia

AIM: To undertake a complex examination of the temporomandibular joints (TMJs), dentofacial muscles and occlusion in patients with distal occlusion before and after treatment using a fixed Herbst hybrid appliance, a Twin Force double lock bite corrector and a Sabbagh universal spring (SUS) II.

MATERIALS AND METHOD: Data from magnetic resonance images (MRI) of the TMJs, electromyographic studies, lateral cephalograms and dental casts of 37 patients with distal occlusion aged 12-15 years before and after orthodontic treatment. The subjects were divided by the presence of a high or low growth potential [according to the stages of formation of the cervical vertebrae (Baccetti, 2005)], as well as the position of the upper incisors.

RESULTS: Before treatment all measurements were decreased $\langle SNB (77^{\circ} \text{ or less}) \rangle$, there was a reduced growth rate of the mandible, violations of the articular disc (on MRI) were observed in 40.5 per cent of patients, all subjects showed infringement of the electromyographic (EMG) indices. Post-treatment there was a significant increase in the indicators responsible for the longitudinal dimensions of the mandible: Co-Gn, Ar-Pg, Go-Pg' (P < 0.001) in the high growth potential group. In all groups there was an increase of the inclination of the lower incisors, distalization of the upper molars and mesialization of the lower molars. MRI of the TMJs showed improvement in 38.1 per cent of patients of the articular disc position and restored symmetry of the disc position in 20 per cent. Deterioration of TMJ structures was not observed in any patient. In 32.4 per cent there was a significant improvement in EMG parameters. There was also a significant increase in airway dimensions in all groups (P < 0.01).

CONCLUSION: Orthodontic treatment using the Twin Force and SUS II appliances create a positive effect on the dental system. However, in treatment planning it is important to estimate the favourable moment to commence therapy (stage CS2, CS3 cervical vertebrae formation).

352 BIOMECHANICS OF MAXILLARY MOLAR INTRUSION

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AIM: Microscrews effectively can be used for intrusion of upper molars with a reduced treatment time and better control of the magnitude of forces without the need of patient compliance. This study aimed to review the biomechanics described in the literature for upper molar intrusion with skeletal anchorage by microscrews.

MATERIALS AND METHOD: PubMed was searched using the following keywords: miniscrews orthodontics, orthodontic mini-implants, miniscrews anchorage, anchorage mini-implants, miniscrews intrusion. The language limit was activated (English, Spanish). Items directly related to the intrusion of upper molars with skeletal anchorage were chosen and some often cited reference articles were also included. The biomechanics of the attachment systems used was studied. The forces produced by the different attachment systems were analysed.

RESULTS: Published articles, mostly simple case reports, reported different methods for intruding upper molars with microscrews for extruded molars, due to the lack of antagonist and subsequent prosthetic rehabilitation, for treatment of anterior open bite and occlusal plane canting because of unilateral extrusion. The different biomechanical options of the micro-implants were analyzed (palatal in the middle palatal area or between the roots/vestibular). These options considered were: connecting directly to elastomeric wire on the buccal and lingual sides of the molars, with a chain or NiTi coil from each miniscrews through the occlusal side of the molar, a micro-implant for vestibular and BTP, sectional arch, brackets with lingual tip, constriction arch, or a closed coil spring.

CONCLUSION: The use of micro-implants as anchorage for molar intrusion with different mechanisms shortens treatment time and improves outcomes in this type of movement. To choose the correct technique it is essential know the side effects of the forces applied. It is critical to avoid vestibular tipping.

353 INFLUENCE OF CONTRACEPTION OR HORMONAL THERAPY DURING MENOPAUSE ON DENTAL MOVEMENT.

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AIM: Due to the increasing demand for orthodontic treatment by adult patients, it is essential to know how different drugs can affect tooth movement for correct treatment planning. The aim of this study was to analyze how different contraceptives and hormonal therapy affect dental movement.

MATERIALS AND METHOD: A PubMed search was made using the following keywords: progesterone dental movement, oestrogen dental movement, contraceptives tooth movement, contraceptives on tooth movement, bisphosphonates orthodontic, menopause orthodontic. The language limit was activated (English, Spanish) and in the end all searches were combined. Items found were studied by analyzing how each type of therapy influenced the tooth movement. The different types of contraceptives were also analysed to determine their components.

RESULTS: There are many chemical contraceptives but all include progesterone; oestrogen is also commonly included. Both progesterone and oestrogen decrease bone reabsorption in the early stages although the effect of oestrogen is the most studied. Ovariectomy and changes during the menopause facilitate tooth movement. Bisphosphonates inhibit tooth movement; it can help in the retention of previous treatment. Calcium in combination with PGE₂ stimulates tooth movement

CONCLUSION: It is important to know whether patients use contraceptives or are following a therapy to mitigate the side effects of the menopause, and the composition of the different drugs due to the rate of tooth movement. Although both progesterone and oestrogen affect the process of reabsorption and bone apposition they do it differently. Oestrogen promotes bone formation and inhibits alveolar reabsorption while progesterone is involved in bone formation. Hormonal changes occurring during menopause favour tooth movement. Some drugs used during the menopause such as calcium associated with PGE_2 favours tooth movement, while others such as bisphosphonates slow it.

354 A NEW METHOD OF HEAD POSITIONING FOR ORTHODONTIC DIAGNOSIS BASED ON THREE-DIMENSIONAL CONE BEAM COMPUTED TOMOGRAPHY AND STEREOPHOTOGRAMMETRY

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AIM: Facial balance and skeletal harmony are essential in orthodontic treatment, and symmetry is an important factor in facial and skeletal diagnosis. Conventionally, head position is standardized by ear rods to examine facial symmetry; however, the relationship of the right and left ears may not always be symmetrical, and therefore should not be used as a landmark in facial symmetry. The aim of this study was to evaluate a new method of head positioning for orthodontic diagnosis based on three-dimensional cone beam computed tomography (3D-CBCT) and stereophotogrammetry, and to compare it with the conventional method.

MATERIALS AND METHOD: 3D-CBCT images and stereophotogrammetry were obtained of 20 Japanese adult patients without jaw deformity, and a pair of both images was superimposed using 3D-CT imaging software. First, the reference planes were determined based on the eyes, and facial asymmetry was evaluated using the superimposed images as follows: 1) The image was split at the midline; 2) The left side was replaced with the mirror image of the right side; 3) The differences between the original face and the two right sides were projected into colour maps on the stereophotogrammetric data; 4) The vertical and horizontal positions of the right and left external acoustic foramens were examined. Facial asymmetry was visualized by superimposition of 3D-CBCT and stereophotogrammetry, and was evaluated from the reference based on the eyes.

RESULTS: There was a difference between the right and left external acoustic foramina in their vertical, horizontal and sagittal relationships.

CONCLUSION: Facial asymmetry could not be accurately evaluated by conventional methods standardized by ear rods. On the other hand, the novel method of head positioning using 3D-CBCT and stereophotogrammetry helped to precisely determine facial symmetry for a more accurate orthodontic diagnosis.

355 THE CONTRIBUTION OF THE CHEEKS IN MASTICATION

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AIM: To investigate the contribution of the cheeks in the process of bolus formation. SUBJECTS AND METHOD: A wax cheek guard was placed into either the left or right buccal sulcus to disrupt the action of the cheeks. Eighteen volunteers who participated were asked to chew two pieces of a two-colour gum with the cheek guard in place and two pieces without, for 30 strokes, unilaterally on the same side as the cheek guard. The chewed bolus was placed into a plastic bag, the length was measured and the bolus was then flattened. Samples of the flattened boluses, one chewed with and one chewed without the cheek guard in place were evaluated by five judges, who were asked to identify the most mixed.

RESULTS: The length of the bolus was increased by 36 per cent with the use of a wax cheek guard in comparison with the gum masticated without a guard. The mixture rate was 50 per cent lower with the use of cheek guard due to obstruction of cheek activity during mastication. Even after 30 masticatory cycles the mixture might not be completed as a result of the obstruction of cheek function. This may be due to the functional disturbance of the buccinator or distraction of the bolus folding between the masseter and the modiolus.

CONCLUSION: Inhibition of the action of the cheeks that contributes to bolus manipulation during mastication reduces the amount of mixing and elongates bolus length.

356 INFLUENCE OF GENETIC VARIABILITY IN ORTHODONTIC INFLAMMATION

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AIM: Gingival health is usually compromised during orthodontic treatment. Nevertheless, substantial variability is found among patients in its clinical appearance and severity. Orthodontics commonly induces a local change in the ecosystem by altering the composition of oral plaque facilitating development of an inflammatory process. Interleukin (IL) is one inflammatory and immunological mediator increased in the crevicular fluid during inflammation. The objective of this observational prospective study was to examine the association of genetic variability and clinical indicators of inflammation such as bleeding and gingival inflammation during orthodontic treatment.

MATERIALS AND METHOD: Fluid samples were collected with a swab of the yugal mucose by frotis before and 3 and 6 months after treatment. Bleeding was checked by periodontal probing. The samples were processed in a laboratory by DNA extraction, amplification and subsequent hybridization

RESULTS: A highly significant association was found in the comparative analysis of homozygous subjects [2/2(TT)] for the IL-1B gene, resulting in an increased predisposition to gingival bleeding as related to an inflammatory process [OR: 1.66; minimum 1.24, maximum 2.23; P = 0.04; confidence interval (CI) 95%] when analyzing changes in the first six months. While no association was found for homozygous or heterozygous subjects for the most frequent alleles for the IL-1A and IL-1B gene (P > 0.05), subjects who were homozygous [2/2(TT)] for the minor allele of the IL-1A gene were more likely to be affected by bleeding at both 3 and 6 months compared with the start of treatment (OR: 3.2; minimum 1.9, maximum 5.3; P = 0.02; CI 95%) and (OR: 3.2; minimum 1.91, maximum 5.35; P = 0.002; CI 95%), respectively

CONCLUSION: Genetic variations in the IL-1 gene cluster mediate predisposition to gingival inflammation in orthodontic patients.

357 ORTHODONTIC TOOTH MOVEMENT IN TYPE 2 DIABETES – HISTOMORPHOMETRIC ANALYSIS

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AIM: Osteoblasts and osteoclasts, the cells involved in bone remodelling, are under the influence of systemic factors. Type 2 diabetes mellitus, which presents with chronic hyperglycaemia, is considered to affect bone metabolism. Therefore, the aim of the present study was to examine histomorphometric characteristics in Goto-Kakizaki (GK) rats, a type 2 diabetes animal model, during orthodontic tooth movement.

MATERIALS AND METHOD: Male rats were divided into four groups: Wistar control group (n = 8), GK control group (n = 8), Wistar appliance group (n = 8) and GK appliance group (n = 8). Animals on the last two groups were fitted with a superelastic closed coil spring placed between the first and second molars and the incisors in the upper jaw. The appliance was replaced weekly. Tooth movement was measured on days 0, 7, 14, 21, 28, 35 and 42, respectively. On day 42 all animals were sacrificed and tissue samples of the maxilla containing all three molars were prepared using haematoxylin and eosin. Alveolar bone, osteoclast and osteoblast areas in all four groups were determined using a point counting method.

RESULTS: The physiologic distal drift of the molars was greater in GK rats than in Wistar rats (P < 0.05). No statistically significant difference was observed in tooth

movement between both appliance groups. The alveolar bone area was decreased in the GK control group compared with the Wistar control group (P < 0.05), but no difference was observed when the two appliance groups were compared. Osteoclast area was greater in both appliance groups compared with the control groups (P < 0.01). Osteoblast area was greater in the Wistar appliance group than in GK appliance group (P < 0.01).

CONCLUSION: The alveolar bone area in GK rats is less than in Wistar rats. However, the difference diminishes during orthodontic tooth movement. The results suggest that particularly the response of osteoblasts is compromised during tooth movement in patients with diabetes.

358 MODERN COMPLEMENTARY EXAMINATIONS IN ORTHODONTIC DIAGNOSIS

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AIM: To emphasize the importance of dental pantomographs, cephalometric radiographs, cone beam computed tomographs, axiographic records, two- and threedimensional visual treatment objectives, cast mounting and set-ups in correct diagnosis.

SUBJECTS AND METHOD: Ten consecutive new patients were asked to complete a questionnaire consisting of 10 multiple choice questions regarding their malocclusion, their understanding of the condition and the necessity for treatment. The same questionnaire was administered at different time points: during anamnesis, after the first clinical examination and contact with the clinician, and after a second meeting with the orthodontist, when the diagnosis was explained together with the different treatment plans and benefits of each treatment. The obtained data was interpreted using simple descriptive statistics.

RESULTS: At the first time point most patients were concerned by one problem (an aesthetic issue or the presence of a dysfunction) although two of them had already visited another clinician who made the referral to the orthodontist. At the second time point they were more aware of the malocclusion but had not made a decision concerning treatment. At the third time point, after the patients had been informed of the gravity of the problem and the risks and they decided to start treatment.

CONCLUSION: The key to every treatment is good communication with the patient. The same complementary examinations that help the practitioner to set a correct diagnosis can be used to explain to the patient the need for treatment.

359 A NEW FUNCTIONAL APPLIANCE FOR CLASS II GROWING PATIENTS. A PROSPECTIVE CONTROLLED STUDY

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AIM: To evaluate, in a prospective controlled study, the skeletal, dentoalveolar and soft tissue effects of the PUL appliance for treatment of Class II malocclusions.

SUBJECTS AND METHOD: Fifty-six skeletal Class II patients (25 boys, 31 girls). The treated group (TG) consisted of 40 patients consecutively treated with the PUL appliance (mean age: 10.6 ± 1.2 years). The PUL appliance consists of two different components, one for the upper jaw and the second for the lower jaw. These parts are fabricated using a thermoforming material from the dental cast; the appliances are

connected by two telescopic rods incorporating a stainless steel coil spring activated to enhance the mandibular position. The TG was compared with a control group (CG) of 16 untreated Class II subjects (T0 mean age 9.4 ± 1.6 years, T1 mean age 10.6 ± 0.8 years). The patients in both groups had the following features: ANB <5 degrees; overjet >5 mm; a full Class II molar relationship; no missing teeth (extracted or agenesis); prepubertal stage (CS1 or CS2). The mean treatment time for the TG was 11.2 ± 0.3 months. Lateral cephalograms were analyzed at the start of treatment (T0) and end of therapy (T1). Customized cephalometrics examination was used. Cephalogram magnification was normalized. Intraclass correlation coefficients for angular and linear measurements were evaluated (both >0.91). Blinded statistical analysis with a *t*-test for independent data with difference between T1 and T0 was used for the comparison. Significance was tested at P < 0.05.

RESULTS: Statistically significant differences were found between TG and CG for SNA, SNB, ANB, Wits, 1Sup^PP, overjet, CoGn, CoGo, MxMndiff, Pog-OLP, Li-OLP, Mi-OLP, molar relationship and U-lip protraction.

CONCLUSION: The PUL appliance efficiently corrects a Class II relationship and produces significant improvements compared with untreated Class II subjects.

360 TREATMENT EFFECTS OF A NEW FUNCTIONAL APPLIANCE AND A TWIN BLOCK IN CLASS II DIVISION 1 MALOCCLUSIONS

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AIM: To prospectively compare the effect of a new functional appliance (PUL) with a twin-block (TB) treated group.

SUBJECTS AND METHOD: Sixty-three skeletal Class II patients (38 boys, 25 girls). The first group comprised 47 patients consecutively treated with the PUL appliance (mean age at the start of treatment: 10.6 years). The PUL appliance consists of a lower and upper component. These parts are fabricated using a thermoforming material from the dental cast; the appliances are connected by two telescopic rods incorporating a stainless steel coil spring activated to enhance the mandibular position. The second group included 18 patients consecutively treated with the TB appliance (mean age: 9.6 years). Inclusion criteria were: ANB < 5degrees; overjet >5 mm; full Class II molar relationship; no missing teeth (extracted or agenesis); prepubertal stage (CS1 or CS2). The mean treatment time was 12 ± 3 months for the PUL group and 9 ± 4 months for the TB group. Lateral cephalograms were analyzed at the start of treatment (T0) and at the end of the protocol (T1). Customized cephalometric examinations were used. Cephalogram magnification was normalized; Intraclass correlation coefficients for angular and linear measurements were evaluated (both >0.84). Blinded comparison between craniofacial starting forms and T1-T0 changes in each group were performed by means of a Student's *t*-test. The two groups were compared with analysis of variance. Statistical significance was tested at P < 0.05.

RESULTS: The PUL resulted in a statistically significant correction of ANB angle, the maxillomandibular differential (P < 0.001) and Wits. The PUL appliance induced larger retrusion and palatal tipping of the maxillary incisors than the TB.

CONCLUSION: The PUL and the TB appliances produce similar therapeutic modifications in Class II patients. The PUL induced statistically significant changes in skeletal, dentoalveolar and soft tissue components.

361 PERIODONTAL HEALTH STATUS IN PATIENTS UNDERGOING ORTHODONTIC TREATMENT WITH FIXED OR REMOVABLE APPLIANCES

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AIM: To evaluate the microbiological and clinical outcomes occurring during the first three months of orthodontic therapy in adults with fixed appliances and removable aligners.

SUBJECTS AND METHOD: Thirty patients were assessed for Plaque Index (PI), Probing Depth (PD), Bleeding on Probing (BOP) and compliance to oral hygiene before the beginning of orthodontic treatment and after 1 and 3 months. Subgingival microbial samples were also analyzed using real time polymerase chain reaction for periodontal pathogen identification and microbial biofilm mass. Untreated patients were used as a control group. The results were analysed using chi-square, odds ratios, regression analysis and ANOVA.

RESULTS: Only one patient treated with fixed appliances was found positive for periodontopathic anaerobes. Analyses of the correlation showed a statistical relationship between the increase of microbial biofilm mass and the type of orthodontic treatment (P < 0.005), increasing PI (P < 0.000), BOP (P < 0.000) and a strong inverse relationship with patient compliance (P < 0.000). By comparing the microbial biofilm mass obtained in the three different groups with the same PI value, compared with the other groups, removable treatment induced a lower biofilm accumulation. Graphic analysis of the interaction between oral hygiene compliance and orthodontic treatment showed that removable aligners had a positive significant influence on patient compliance and on the final microbial biofilm results. However, some of these patients changed their oral hygiene habits, showing very low microbial biofilm level (< 100 PCR/bacteria) and gingival brushing lesions.

CONCLUSION: Fixed and removable appliances did not increase the risk of periodontal disease in these patients. However, therapy with removable aligners showed less microbial biofilm mass and minimized the negative effects of gingival inflammation, particularly in patients with poor oral hygiene compliance.

362 A NEW APPLIANCE FOR SIMULTANEOUS EXPANSION AND DISTALIZATION – COMPARISON WITH THE HYRAX AND PENDEX APPLIANCES

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AIM: To prospectively assess the safety and efficacy of newly designed appliance for simultaneous expansion of the maxilla and distalization of the upper molars, and a retrospective comparison of the treatment results with the new appliance and with the Haas (maxillary expansion) and Pendex (maxillary molars distalization) appliances.

SUBJECTS AND METHOD: Between 2009 and 2011, 17 patients (6 boys, 11 girls) were prospectively enrolled into the study with the new appliance. Eighty patients (48 boys, 32 girls) treated with the Hyrax and 40 patients (23 boys, 17 girls) treated with the Pendex appliance were also analyzed.

RESULTS: In an average follow-up of 4.2 months, no adverse effects of the new appliance were observed. There were also no statistically significant differences in anterior and posterior maxilla expansion (in comparison with the Hyrax appliance: 2.8 versus 2.7 mm and 3.9 versus 4.1 mm respectively; P > 0.05) and distalization of the upper permanent molars (in comparison with the Pendex appliance: 3.7 versus 3.9 mm; P > 0.05).

CONCLUSION: The new appliance is safe. There were also no statistically significant differences in the treatment results between the newly designed and conventional appliances (Hyrax, Pendex). However, in contrast to the conventional

appliances, it allows achievement of the planned end points simultaneously in a shorter time. Moreover, it eliminates negative effects typical for Pendex appliance treatment, such as: excessive protrusion of the upper incisors, a tendency for crossbite and extrusion of the permanent upper molars.

363 AESTHETIC CHANGE IN PRE- AND POST-TREATMENT SURGERY AND ORTHODONTIC TREATMENT IN LIP PROTRUSION PATIENTS*** S-S Mo¹, M-J Shin², Y-A Kook¹, Department of Dentistry, The Catholic University of Korea, Seoul and ²Private Orthodontic Practice, Seoul, Korea

AIM: The main purpose of orthodontic treatment is to improve function and aesthetics. However, lately it has been more focused on aesthetics. Upper and lower lip protrusion is one of the most common complaints of Korean women. Retraction of upper and lower incisors after extraction of the upper and lower first premolars or anterior segmental osteotomy (ASO) can be used for treatment. In this study, the improvements in aesthetics were evaluated after orthodontic treatment alone or with surgery.

SUBJECTS AND METHOD: Among female patients with lip protrusion, mild crowding (upper: 1.1 ± 1.0 mm, lower: 2.85 ± 1.2 mm), and no distinct deviation of the incisors, five were treated by extraction of four first premolars and orthodontic mini-implants (orthodontic group), while five were treated with a modified ASO (surgical group). One hundred and twenty one people (48 dentists, 73 lay people) were questioned on the facial aesthetics. The participants evaluated the lower face of the given photographs and scored them from 0 to 10. The photographs were classified into frontal, smile and lateral. Sixty photographs were evaluated.

RESULTS: In patients with upper and lower lip protrusion, both the orthodontic and surgical groups showed improvement in aesthetic impact in the frontal, lateral and smile photographs. In the frontal photographs, there were no significant differences in improvement in aesthetics between the orthodontic and surgical groups, however, in the smile photographs, the orthodontic group showed more improvement, and in the lateral photographs, the surgical group showed more improvement.

CONCLUSION: Orthodontic treatment or combined surgical-orthodontic treatment can improve the aesthetics of the lateral, frontal and smile view in the case of upper and lower protrusion. The choice of treatment according to the condition of the patients can assist in achieving better results

364 DENTAL, SKELETAL AND PERIODONTAL CHANGES IN ADULT PATIENTS TREATED WITH A SLOW MAXILLARY EXPANDER

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AIM: To evaluate the efficiency of slow maxillary expansion (SME) in the correction of maxillary transverse deficiency in adult patients, focusing on: arch width, amount of dentoalveolar tipping, clinical crown height and changes in the palatal vault.

SUBJECTS AND METHOD: Sixteen patients (average age 31.6 years) in the permanent dentition. Criteria for inclusion were: non-growing patients and availability of dental models pre- and post-treatment cut distally to the first molars. The following lines and angles were calculated on dental models to evaluate dentoalveolar and periodontal modifications: intermolar width (IMW) and interpremolar width (IPW); alveolar process inclination (API), tipping of the upper first molars (MI) and clinical crown heights of the first molars and premolars (H1.6, H2.6, H1.4, H2.4)).

RESULTS: MI was slightly reduced at the end of treatment (-1 ± 6.7) , and API was increased (2 ± 1.5) . Significant expansion of the upper arch was found, especially in the premolar area (IPW increased 4 ± 1.4 mm and IMW 3 ± 2.3 mm). Clinical crown heights were slightly increased but the result was not clinically significant. H1.6 and H2.6 increased 0.5 ± 1 and 0.5 ± 0.7 mm, respectively and H1.4 and H2.4 increased 0.6 ± 0.8 mm and 0.9 ± 1.2 mm, respectively).

CONCLUSION: SME can be regarded as an efficient device and a helpful alternative in the treatment of transverse maxillary deficiency in adults, giving increased space in the premolar area, minimum molar tipping, expansion of alveolar processes and no clinical negative effects on the periodontium. SME produces slow expansion supported by very light and continuous forces. These forces create direct bone resorption by promoting the remodelling of the alveolar bone associated with the possibility of obtaining controlled molar movement during the expansion. This fact is due to its rigid structure activated by a nickel-titanium spring.

365 INFLUENCE OF FACIAL PATTERN ON THE PERCEPTION OF FACIAL ATTRACTIVENESS

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AIM: To analyse how facial pattern influences perceptions of facial attractiveness among three groups: orthodontists, fine art students, and lay people.

MATERIALS AND METHOD: A photograph of a male profile with a mesofacial pattern in repose was digitally manipulated using Adobe Photoshoph C3 (Adobe Systems Inc., San Jose, California, USA) to create a second image with a brachyfacial pattern and a third with a dolicofacial pattern. The images were assessed by orthodontists (20 males, 20 females), fine art students (20 males, 20 females) and laypersons (20 males, 20 females). Each image was awarded a mark of 1 if it was considered aesthetically unattractive, 2 if it was moderately attractive and 3 when it was thought aesthetically attractive. Data were analysed with Kruskal-Wallis (P < 0.05) and Mann-Whitney tests, applying the Bonferroni correction (P < 0.016).

RESULTS: Significant differences were found in the evaluation of the mesofacial pattern between orthodontists (median = 2.5) and the other two groups (median of orthodontists and lay people = 2; P < 0.016). No significant differences were found between the three groups in their evaluation of the brachyfacial pattern (P > 0.05). Evaluation of the dolicofacial pattern was significantly different (P < 0.016) between orthodontists (median = 1) and laypeople (median = 2).

CONCLUSION: The mesofacial pattern was considered more attractive by orthodontists than the other two groups. All three groups evaluated the brachyfacial pattern equally. The dolicofacial pattern was considered less attractive by orthodontists than by the general population.

366 MODIFICATION OF NASOLABIAL ANGLE IN A MALE AND FEMALE: INFLUENCE ON FACIAL ATTRACTIVENESS

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AIM: To determine if modification of the nasolabial angle in a male is perceived in the same way as in a female by orthodontists, fine art students and lay people.

MATERIALS AND METHOD: Photographs of a male and female profile with a nasolabial angle within accepted parameters of normality (90°) were digitally modified using Adobe Photoshoph C3 (Adobe Systems Inc., San Jose, California, USA) to create a second image of the same subject with a nasolabial angle of 85

degrees and a third with an angle of 95 degrees. The six photographs were evaluated by: orthodontists (20 males, 20 females), fine art students (20 males, 20 females) and laypersons (20 males, 20 females). Each image was awarded a mark of 1 if it was considered aesthetically unattractive, 2 if it was moderately attractive and 3 when it was thought aesthetically attractive. Data were analysed with the Mann-Whitney test (P < 0.05).

RESULTS: Orthodontists did not find significant differences (P > 0.05) in perceived facial aesthetics between the male and female with nasolabial angles of 85 degrees. However, fine art students and laypeople found the female image significantly more attractive (P < 0.05). With a nasolabial angle of 90 degrees, neither orthodontists nor the general public detected significant differences (P > 0.05) between the genders, while fine art students considered the female image more aesthetically attractive (P < 0.05). The three groups found the image of the male with a nasolabial angle of 95 degrees significantly more attractive than the female image (P < 0.05).

CONCLUSION: When the nasolabial angle is modified, orthodontists perceive less difference between the genders when evaluating facial aesthetics. Fine art students perceived the greatest difference between the genders in these terms, while laypersons found less difference but more than orthodontists.

367 DEPRESSION IN PREGNANCY AND RISK OF A CLEFT LIP AND PALATE: A POPULATION BASED CASE CONTROL STUDY

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AIM: A cleft lip and palate (CLP) is a frequent congenital malformation of the head and neck. The first trimester of pregnancy is the most sensitive period in the aetiology of this malformation. If a teratogen factor appears in this early stage, an alteration in embryogenesis takes place. The aim of this study was to investigate the possible association between depression in pregnancy and the risk of CLP.

SUBJECTS AND METHOD: A retrospective case-control study was conducted between October 2009 and April 2011 of 123 CLP children's mothers and 130 matched controls. In both groups the frequency of depression factors in the mother and her age at pregnancy was assessed by completing a self-administered survey with questions concerning age and depression history in pregnancy. In addition, in the CLP group, the incidence of different cleft patterns was analysed. A descriptive analysis was conducted, and chi-square test, odds ratio (OR), Student's *t*- no matched test and Pearson correlation were used to test for differences between groups (P < 0.05).

RESULTS: The most common cleft type was a unilateral complete cleft lip and palate (54.4%) followed by a bilateral complete cleft lip and palate (16.3%). Male patients (60.97%) on the left side (41.46%) were the most affected. The results of age and depression history showed that depressed pregnant women have a greater risk of having children with CLP [OR = 4.286; 95% confidence interval (95%CI), *P* value 1.5-11.9, *P* = 0.003]. The mothers of the cleft children were significantly younger (*P* < 0.05) than the control mothers. The age of depressed pregnant mothers was significantly younger (*P* < 0.05) than that of mothers without depression. An association was found between depression and age of case and control mothers (*P* < 0.05).

CONCLUSION: Depression in pregnancy is a risk factor in CLP. Pregnancy at an early age can result in depression so the risk of having CLP children is increased.

368 A LABORATORY INVESTIGATION OF DUAL-CURED VERSUS CONVENTIONAL GLASS IONOMER CEMENTS FOR BAND CEMENTATION***

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AIM: The success of a fixed dental appliance depends on the metal supports (brackets and bands) being attached securely to the teeth, and remaining there during treatment. There is insufficient evidence to determine which is the most efficient cement for securing orthodontic bands to molar teeth. The aim of this *in vitro* study was provide evidence to assist in clinical decision making.

MATERIALS AND METHOD: Twenty-six sound human third molars divided into two equal groups. One group was banded with Ketac-Cem and the other group with Rely-a-Bond. The porosity and microleakage at the interface band-cement and cementoenamel junction was examined under a scanning electron microscope.

RESULTS: Increased microleakage was observed at the cement-band interface with Ketac-Cem (P < 0.001) and at the enamel-cement interface with Rely-a-Bond (P < 0.001). The glass ionomer cement had a lower number, size and shape of the pores.

CONCLUSION: As there is good adhesion to metals and direct chemical bonding to enamel, there is higher microleakage at the cement band area and not at the bandenamel preventing bacterial penetration.

369 THREE-DIMENSIONAL MEASUREMENTS ON CONE BEAM COMPUTED TOMOGRAPHIC IMAGES

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AIM: To evaluate the reliability of measurements of buccolingual inclination of the teeth as well as arch dimensions in subjects wearing metal fixed appliances performed on cone beam computed tomographic (CBCT) scans.

SUBJECTS AND METHOD: Ten patients wearing metallic fixed appliances were scanned with a CBCT-scanner (Classical iCat) with a voxel size of 0.25 mm. The CBCT scans were exported using the DICOM format into three-dimensional imaging software (Mimics®). Dental buccolingual inclinations, arch length and widths were measured using dental landmarks identified on the multiplanar reconstructions as well as on the volume rendering images. The same examiner identified all landmarks twice with a 2-week interval. Reliability was evaluated by intraclass correlation coefficient and paired *t*-tests (P < 0.05). The error of the method was assessed using Dahlberg's formula.

RESULTS: Excellent reliability (r > 0.9) was found for all linear and angular measurements, except for inclinations of the lower first molars, which only displayed a reliability of r = 0.64. The error of the method was 1.19 degrees (mean = 0.66°) for buccolingual inclinations, 0.68 mm (mean = 0.27 mm) for arch widths, and 0.23 mm (mean = 0.20 mm) for arch lengths.

CONCLUSION: The method used provided highly reliable linear and angular dental measurements even on CBCT images of patients wearing metallic fixed appliances, which therefore can be used for quantitative analyses. On the other hands, caution should be exercised when the measurements are performed on teeth where both metallic brackets and metallic fillings are simultaneously present.

370 STABILITY IN CLASS I SUBJECTS WITH AND WITHOUT EXTRACTIONS AND WITH AND WITHOUT LONG-TERM RETENTION

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AIM: To verify changes in transverse dental arch width and inclination of the incisors at the beginning and end of treatment and at least 6 years post-treatment in subjects with and without extractions and in cases with and without retention.

SUBJECTS AND METHOD: Fifty patients with an Angle Class I (25 with extractions, 25 without extractions, 22 with retention and 28 whose retention ceased after a minimum of 2 years). Measurements were made on plaster models of the intercanine, interpremolar and intermolar width, incisal heights and dental discrepancies in both arches, and the inclinations of the incisors on lateral skull cephalograms before, immediately after, and a minimum of 6 years post-treatment. A descriptive analysis of the results was performed and compared with a *t*-test. Analysis of intra- and intergroup significance for the different stages was undertaken.

RESULTS: All groups were stable with relapse of less than 2 mm (P = 0.008). The upper intercanine width increased in cases with and without extractions (more in the extraction group; P = 0.001). Lower intercanine width did not change significantly. Upper and lower interpremolar width increased steadily (P = 0.000), in cases with and without extractions (more in the extraction group). Intermolar width did not show any significant changes in the upper arch. In the lower arch an increase was noted in the non-extraction group and a decrease in the extraction group.

CONCLUSION: Stability depends primarily on maintaining the arch form. Changes were found in the lower incisor inclination in cases without extractions at the end of treatment (P = 0.001) and remained stable (P = 0.008). No significant changes were found with or without retention (P > 0.05).

372 THE CHRONOLOGICAL AGE OF THE GROWTH SPURT USING THE CERVICAL VERTEBRAL MATURATION METHOD: A RETROSPECTIVE STUDY

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AIM: The efficiency of orthopaedic treatment depends on the use of force regarding the growth spurt. The aim of this study was to determine whether a correlation exists between the average age of the growth spurt and chronological age.

MATERIALS AND METHOD: Lateral cephalometric radiographs of 134 girls aged 9 to 12 years and 212 boys aged 10 to 13 years. Cervical vertebral maturation (CMV) was estimated using the method of Baccetti. The correlation between chronological age and maturity stage was estimated by Spearman rank correlation coefficient.

RESULTS: Moderate correlations were found between cervical vertebral maturation and chronological age: girls r = 0.565, boys r = 0.607 (P < 0.0001).

CONCLUSION: The CVM method appears to be efficient for assessing the pubertal growth spurt. The relatively low value of the correlations between chronological age and CVM stage shows that chronological age is not reliable for assessing skeletal maturity. The approximate growth spurt was estimated at 11 years for girls and 12 years for boys.

373 ORTHOGNATHIC SEVERITY AND TREATMENT OUTCOME IN LEEDS, ENGLAND

D Morris, Z A Alzayad, Department of Orthodontics, Leeds Teaching Hospitals NHS Trust, England AIM: To cephalometrically assess the pre-treatment 'severity' score and the 2-year post-debond 'outcome' score of orthognathic patients and to compare them with the 1999 United Kingdom national results. The aim of this study was to perform a Peer Assessment Rating (PAR) analysis on treated Leeds orthognathic cases and to compare their treatment outcome with previously published results.

MATERIALS AND METHOD: The randomly selected records of 20 orthognathic patients who had undergone surgery during 2004-2006. The lateral cephalograms were digitized blind under ideal conditions by a single operator using Opal v2.2 software. Scores from the seven key cephalometric parameters on the British Orthodontic Society's surgical-orthodontic analysis data sheet were recorded. All the corresponding study casts were PAR scored by a calibrated, independent and experienced assessor. The raw PAR scores were plotted on a PAR nomogram and the mean PAR reduction was calculated.

RESULTS: There were highly significant improvements between the severity and outcome scores in the majority of cases. The mean severity score was 2.6 (SD 1.0) whilst the mean outcome score was 5.5 (SD 0.5). The national standard was exceeded. The mean start PAR score was 40.8 and the mean 2 year post-debond PAR score was 5.1. The mean reduction in PAR score was 88 per cent. All Leeds subjects had been either improved or greatly improved.

CONCLUSION: Overall, the Leeds orthognathic patients were significantly more severe at the start of treatment compared with the national average and had a slightly superior outcome score at 2 years post-debond. The PAR outcome scores showed stable treatment results with high occlusal standards. All orthognathic clinicians should be encouraged to regularly carry out such outcome assessments on their patient caseload.

374 DEVELOPMENT OF A DECISION AID FOR PROSPECTIVE ORTHOGNATHIC PATIENTS

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AIM: To assess the usefulness and readability of current orthognathic patient-related information and to develop and assess the acceptability of a new format of patient information, a decision aid, for patients making treatment choices about surgical-orthodontic treatment.

MATERIALS AND METHOD: A cross-sectional study utilising questionnaires and face-to-face interviews to assess the impact of a newly developed decision aid. The initial sample consisted of patients over 16 years of age (n = 74). Each was asked to complete two questionnaires about their socio-demographics, levels of psychopathology, knowledge, decisional conflict, anxiety, risk perception and expectations. A sub-sample was interviewed individually using a semi-structured protocol with open-ended questions and the transcripts were analysed using a thematic framework. The decision aid pamphlet, presented as a decision tree with attribute tables, included evidence-based information on possible treatment options and their consequences. Qualitative and descriptive statistics were used to investigate factors affecting the acceptability and effectiveness of the decision aid.

RESULTS: Questionnaires were fully completed by 39 patients (52%). The mean age of the patients was 24.3 years (range 16.5-47.2 years) with 67 per cent being female. Uptake of the offered surgical-orthodontic treatment was 92 per cent. Patients considered the decision aid to be more useful and easier to understand than currently available leaflets. Significant variation in their knowledge about the risks and consequences of the available treatment options still existed. Patients found the

value clarification questions to be a different and more valuable alternative to existing resources.

CONCLUSION: All patients felt that the decision aid presented the required information in a more 'patient-friendly' and useful format. Further refinement of the decision aid is required prior to formally integrating it routinely in to the orthognathic clinical care pathway.

375 A COMPARISON OF CONTEMPORARY IMAGING TECHNIQUES FOR THE MEASUREMENT OF TOOTH LENGTH

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AIM: To compare tooth length measurements for all commonly used radiographic imaging modalities in dentistry: periapical films, dental pantomograms (DPT) and cone beam computed tomographs (CBCT).

MATERIALS AND METHOD: Study models containing eight anterior teeth for the upper and lower arch were used to simulate a patient undergoing fixed appliance treatment. Long-cone periapical radiographic images of the upper and lower labial segments were taken at standardised angulations to the occlusal plane of 0, 5, 10, 15 and 20 degrees using conventional and digital images. DPT and CBCT images (two different CBCT machines with four settings for one machine and two for the other) were taken on three separate occasions. The teeth were subsequently removed from the set-up and their length measured with a calliper and ruler and compared with the lengths obtained by the radiographs.

RESULTS: The lengths obtained on DPTs consistently overestimated real lengths by 2 mm or more [average: 2.3 mm; 95% confidence interval (CI): 1.4 to 3.3 mm]. Both periapical radiographs (digital and conventional) performed similarly. Results at 90 degrees best resembled real tooth length (average: -0.14 mm; 95% CI -0.64 to 0.37 mm). Performance progressively deteriorated as the film angulation increased and overestimation occurred (average at 110° : 4.62 mm; 95% CI: 4.32 to 4.92 mm). Even when using the crown to root ratio to calculate the relative tooth length the results were unreliable. All results obtained from CBCTs were similar, and consistently underestimated tooth length by 0.5 to 1 mm, displaying similar measurement errors (average: 0.89 mm; 95% CI: -1.33 to -0.44 mm).

CONCLUSION: None of the radiographic modalities used in this study were able to measure tooth length to a precision better than 0.5 to 1 mm of the original length. Caution is recommended when estimating root resorption using any radiographic imaging technique, taking into account that CBCT performs better than long-cone periapical radiography and DPT in tooth length assessment, DPT being the least accurate.

376 EFFECTS OF THE TWIN BLOCK AND ACTIVATOR-HEADGEAR APPLIANCE IN THE TREATMENT OF CLASS II DIVISION 1 MALOCCLUSIONS

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AIM: To compare the treatment effect of Twin Block (TB) and maxillator (activatorheadgear) appliances on skeletal, dental and soft tissue structures in patients with Class II division 1 malocclusions.

SUBJECTS AND METHOD: All patients with a Class II division 1 malocclusion treated in the period of 2000-2010 with either a maxillator or TB. Of these, 44 had

complete pre- and post-treatment records: 18 were treated with a TB (mean age 11.7 years) and 26 with a maxillator (mean age 10.5 years). Lateral cephalograms and dental casts were evaluated. A paired *t*-test and a two-sided independent samples *t*-test were used for intra- and intergroup analysis, respectively.

RESULTS: TB and maxillator appliance treatment resulted in a significant decrease in overjet, overbite and correction of the Class II molar relationship. Post-treatment cephalometric measurements showed a significant increase of SNB and reduction of ANB angle in both groups. Additionally, in the TB group a significant increase in mandibular length (Co-Pgn) was demonstrated. Both appliances lead to increased retroclination and retrusion of the upper incisors, and proclination and protrusion of the lower incisors. The latter was significantly more prominent in the TB group. Upper and lower lip protrusion was significantly reduced, more so in the TB group. Both groups demonstrated significantly improved convexity of the soft tissue profile (GL-RN/RN-PGs).

CONCLUSION: The maxillator and TB appliances contributed successfully to the correction of a Class II division 1 malocclusion due to improved skeletal, dentoalveolar and soft tissue characteristics. However, the results indicate more enhanced mandibular growth in the TB group.

377 MANDIBULAR PROGNATHISM AND EARLY TREATMENT

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AIM: To investigate skeletal changes in Angle Class III patients in the primary, early and late mixed dentition stages following chin cap therapy.

SUBJECTS AND METHOD: The patients were divided into two groups: early treatment group (ETG; n = 13, 11 females) with mean treatment initiation at 5.5 years of age, and late treatment group (LTG; n = 12, 8 females) with a mean age of 9 years at the beginning of therapy. Lateral cephalometric headfilms before and after treatment (mean age: ETG = 14 years 11 months; LTG = 14 years 10 months) were compared. The controls consisted of untreated, age-matched Class I patients. The influence of time, treatment group, and the time-group interaction was evaluated using analysis of variance with repeated measures separately for each parameter.

RESULTS: The ETG showed significant skeletal improvements post-treatment with a decreased obtuse gonial angle (-9.9°, P < 0.0001), increased articular angle (+5.4°, P < 0.017), SNB angle near Class I values (-0.7°, P = 0.87), and an ANB (+0.5°, P = 0.88) within the range of normal skeletal orthognathy. Anterior face height increased (+20.0 mm, P < 0.0001), nearing that of Class I patients. In the LTG, these changes were less pronounced or absent. Dental compensation was found in both groups but to a greater degree in the LTG.

CONCLUSION: Early chin cap therapy during the primary and early mixed dentition is effective. Because of the orthopaedic effect, the therapy should be a first choice in the treatment of mandibular prognathism. Due to its bite closing impact it is even more important in high-angle Class III cases.

378 RELATIONSHIP BETWEEN ORTHODONTIC EXPERTISE AND PERCEPTION OF TREATMENT NEEDS FOR MANDIBULAR PROTRUSION IN JAPANESE SUBJECTS

T Murakami, N Kawanabe, H Kamioka, T Yamashiro, Department of Orthodontics, Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Japan AIM: To determine whether the Peer Assessment Rating (PAR) index is a useful predicator of the perceived treatment needs of Japanese subjects with mandibular protrusion, and to investigate possible discrepancies in perceived treatment need among orthodontists and dental students with and without experience or knowledge of orthodontic treatment.

SUBJECTS AND METHOD: One hundred and ten laypersons and 32 orthodontists were shown casts of 20 patients with untreated mandibular protrusion and a questionnaire was provided in which they had to describe their perceptions of the patients' orthodontic treatment need using a 10-point visual analogue scale (VAS). The PAR index was used for cast evaluation.

RESULTS: The PAR index value was strongly correlated with VAS score in the mandibular protrusion cases. The VAS score was significantly increased for casts with a PAR index of more than 22 and an overjet of less than 0 mm in both groups. In cases with a PAR index greater than 22, the orthodontists perceived them to have significantly greater treatment need than the dental students. Dental students who had undergone previous orthodontic treatment more accurately recognized the patients' treatment needs in cases involving casts with a PAR index ranging from 22 to 29 and an overjet value ranging from 0 to -2.0 mm than dental students who had not undergone previous orthodontic treatment.

CONCLUSION: The PAR index is a good clinical predictor for assessing perceived treatment need in mandibular protrusion cases. Dental students tend to underestimate the treatment needs of mandibular protrusion cases with high PAR index values and negative overjet values. However, such underestimation among dental students becomes less common as their experience and knowledge of orthodontics increases.

379 EFFECTS OF BISPHOSPHONATE-CLODRONATE ON ORTHODONTIC TOOTH MOVEMENT IN WISTAR RATS

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AIM: To determine the anti-resorptive effect of locally applied bisphosphonateclodronate compared with a saline solution on alveolar bone during orthodontic tooth movement.

MATERIALS AND METHOD: Adult Wistar rats of both genders. The animals were kept in standard laboratory conditions with a natural light mode environment at a room temperature of 25°C. During the experiment water and food were available *ad libatum*. Groups 1 and 2 were treated with bisphosphonate-clodronate at a concentration of 10 mM locally applied at 3 and 7 day intervals, respectively. The animals in the control group were untreated. Measurement of tooth movement was carried out on plaster models of the experimental animals that were scanned in the O3DM laboratory (Poland) and processed with O3DM software. The data (tooth movement measurements) were analysed with a *t*-test. The level of significance was P < 0.05

RESULTS: The anti-resorptive effect of local applied bisphosphonates-clodronate compared with the saline solution on alveolar bone during orthodontic tooth movements in the experimental animals was confirmed clinically on the models.

380 CONDYLAR PATH ANGLE CHANGES IN JUVENILE IDIOPATHIC ARTHRITIS

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AIM: To assess the usability of cone beam computed tomography (CBCT) in the analysis of asymmetric condylar and fossa changes in juvenile idiopathic arthritis (JIA) patients.

SUBJECTS AND METHOD: Sixty-nine children with JIA aged 5-17 years were examined in a cross-sectional study. The patients were examined using CBCTs of both condyles, the height of ramus, and also the angle between the articular eminence and Frankfort horizontal plane (condylar path angle) was measured. Condylar shape was graded using a five-point scale (Billiau *et al.*, 2007) and the correlation with the condylar path angle and ramus height was assessed.

RESULTS: The mean condylar path angle on the right side was 25.1 degrees (SD 7.1) and 27.7 (SD 7.6) for the left. The correlation between right condylar path angle and ramus height was 0.38 (P = 0.001) and for the left 0.53 (P = 0.001). The asymmetry between right and left angle correlated with asymmetry of ramus heights r = 0.52 (P = 0.001). The correlation between asymmetry in condyle shape and condyle path angle was r = 0.58 (P = 0.001) and in asymmetry of condyle shape and ramus height r = 0.24 (P = 0.046).

CONCLUSION: CBCT is a valuable diagnostic tool in the examination of all bony temporomandibular joint (TMJ) components in JIA patients. Condylar path angle is a sensitive indicator of TMJ involvement in JIA.

381 MANDIBULAR SECOND PREMOLAR AGENESIS

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AIM: To test the hypotheses that (1) the distal angulation of an unerupted mandibular second premolar (MnP2) is significantly greater in children with agenesis of its antimere; and (2) delayed tooth formation is significantly more frequent in children with more distally angulated premolars.

MATERIALS AND METHOD: The panoramic radiographs of 38 patients (age range 8-15 years) with unilateral aplasia of MnP2 were retrospectively examined. Contralateral mandibular primary second molars were present for all participants. They were compared with a control sample of 82 patients. Each unerupted MnP2 was traced, and its developmental stage as well as its angulation was registered (measured with the distal angle and the premolar-molar angle). Dental age was evaluated using the Haavikko method. The Student's *t*-test was performed to identify significant differences between the groups. The influence of developmental stage of MnP2 on its angulation in the agenesis group was also analyzed. The significance level for was set at P < 0.05.

RESULTS: There was a 9.5 degree decrease in the distal angle and a 13.2 degree increase in the premolar-molar angle for the unerupted MnP2 in the agenesis group (P < 0.00 and P < 0.000, respectively), compared with MnP2 inclinations in the control sample. The delay in dental age was significantly greater in patients with agenesis (= 2.1 years) compared with the control group (= 1.5 years; P < 0.00). The overall result of tooth inclination in the agenesis sample showed that during developmental changes, the teeth become more upright (P < 0.05)

CONCLUSION: Both hypotheses are retained. Aplasia of MnP2, distally displaced premolars and delayed tooth formation have been shown to be part of a genetically related pattern of dental anomalies.

382 EVALUATION OF EATING HABITS AND MASTICATION CAPABILITIES OF JAPANESE PRE-SCHOOL CHILDREN***

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AIM: It has been reported that learning molar grinding exercises improves mastication and increases tooth diameter. Mastication training is effective for children who cannot perform molar grinding exercises. With reports that mastication exercises are learned before the eruption of the first molar teeth, mastication training was performed on pre-school children. For the measured items, it was considered that the patients' subjective evaluation was necessary, and an evaluation of mastication exercises and mastication capability was added and a survey of food ingestion was conducted.

SUBJECTS AND METHOD: Forty-four kindergarten children were tested at the beginning (T1) and end (T2) of a 3-month training period. Fourteen types of food, with differing physical properties, were assessed for the food ingestion survey. Survey choices were quantified and mastication difficulty and food physicality scores were calculated for use in the mastication capability evaluation. Mastication exercises for five foods were measured, and the subjects were divided into two groups: those with a mastication route wider (W) than the average value, and those with a narrower (N) route. For the mastication capability evaluation, measurements of maximum occlusal force and labial closure force were measured.

RESULTS: Significant differences in mastication were found between the two groups for five foods. Compared with group W, the mastication difficulty score was significantly higher for group N, and there was little variation in taste for those using the grinding exercises. Group N indicated higher food property scores and mastication difficulty for chewier foods than group W. Children who had not undergone grinding exercises had high mastication difficulties and did not absorb high-mastication products well. Mastication capabilities were also low.

CONCLUSION: It is important that proper mastication training and eating guidance is given to children who have trouble with grinding exercises.

383 A METHODOLOGICAL APPROACH TO ASSESSING ALVEOLAR BONE USING CONE-BEAM COMPUTED TOMOGRAPHY

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AIM: To compare the accuracy of cone-beam computed tomography (CBCT) scanning (Pax-Reve3D OS PRO) and conventional two-dimensional (2D) intra-oral periapical (PA) radiography in determining periodontal bone support, and to ascertain if CBCT can adequately replace the use of 2D imaging in quantifying periodontal bone.

MATERIALS AND METHOD: Twenty linear measurements (from the mid-point of the interproximal contact area between the lower left first and second molar to the highest bone level) for both imaging modalities were obtained from a single dry skull for comparison. Care was taken such that the measurements could be obtained from the CBCT image as though taken from a PA radiograph, using a reference plane matched to the angulation of the PA film. Measurements were also obtained without a reference plane to approximate clinical situations. The level of agreement was assessed using the Bland-Altman plot, with clinical equivalence between the two devices of ± 0.5 mm.

RESULTS: The mean difference in measurements between CBCT and PA examinations was -0.76 mm, with a standard deviation (SD) of 0.20 mm for CBCT 1 (with a reference plane), and -0.56 mm with a SD of 0.18 mm for CBCT 2 (without a reference plane). Statistically different readings were obtained for CBCT and PA examinations, but no significant difference in measurements was found between CBCT 1 and CBCT 2. This indicates that with correct positioning, equivalent measurements could be obtained without a reference plane.

CONCLUSION: Both imaging modalities cannot be used interchangeably. However, the results suggest that with an adjustment factor, measurements obtained could be rendered equivalent.

384 A MULTIDISCIPLINARY APPROACH TO REHABILITATION OF PATIENTS WITH UPPER LATERAL INCISOR HYPODONTIA

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AIM: Primary hypodontia leads to considerable problems. First of all, it is an aesthetic problem that is of great concern to patients. In cases of partial missing of teeth, for example the second incisors, spaces and diastemas are present in the jaw. However, this is not the only problem. Occlusal changes develop between the teeth of both jaws, which, in turn, lead to functional disorders. Therefore, treatment of hypodontia aims to restore the dentition and to achieve a high aesthetic, functional and long-term result.

SUBJECTS AND METHOD: Twenty-one patients aged from 18 to 23 years (18 females, 3 males). All had been diagnosed with primary uni- or bilateral upper lateral incisor hypodontia. Five had a neutral occlusion, eight a Class II malocclusion, two a Class II malocclusion with an increased overbite, four a Class III malocclusion and two a crossbite. One method to treat this problem is surgery: implantation is the comprehensive treatment of patients with orthodontic disturbances. The possibility to use implants after orthodontic treatment has been described by Linkow (1970), Hotz (1981) and others. After additional radiographic and anthropometric examinations, it was decided to implement an interdisciplinary treatment approach – to treat the main orthodontic problem according to the developed scheme, forming spaces in the dental arch for the other incisor teeth and carrying out dental implantation at the final stage.

RESULTS: The implementation of the above approach resulted in high aesthetics and a good long-term function. The preparation of healthy teeth and the negative effects on the mucosa caused by wearing removable dentures were avoided.

385 ORAL HEALTH-RELATED QUALITY OF LIFE OF 3-5 YEAR-OLD CHILDREN WITH a CLEFT LIP AND PALATE

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AIM: Long-term treatment of patients with a cleft lip and palate (CLP) can result in a high social burden and may have an influence on the quality of life. The aim of this study was to assess the oral health-related quality of life (OHRQoL) of children aged 3-5 years with a CLP of two centres of competence for oro- and craniofacial malformations independent of the different cleft forms.

SUBJECTS AND METHOD: A total of 90 parents of children with non-syndromic CLP. OHRQoL was assessed using the revised German version of the Early Childhood Oral Health Impact Scale. The classification of a CLP was according to the World Health Organization International Classification of Diseases (ICD-10). In addition, six socio-demographic questions were raised. The descriptive areas for

children and for parents were determined and a correlation between the different cleft forms was explored.

RESULTS: Children with CLP showed a high level of OHRQoL. Both the average values of the descriptive fields for children, and the values of their parents, with isolated cleft lip point to the highest quality of life. The lowest OHRQoL was for patients with an isolated cleft palate.

CONCLUSION: Differences in OHRQoL among 3-5 year old children with a CLP exist in different cleft forms. The results do not correlate with the apparent level of severity of the malformation. OHRQoL of children with an isolated cleft palate is reduced compared with children with a cleft lip and palate. A cleft palate can have a negative impact on language development.

386 NECK AND SHOULDER MUSCLE ACTIVITY DURING DENTISTRY-RELATED POSTURAL TASKS

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AIM: To investigate activity of the sternocleidomastoid and upper trapezius muscles during static postural tasks that aimed to mimic dental work. Because of the high prevalence of musculoskeletal pain in females, it was also hypothesized that the exerted activity differs between genders.

SUBJECTS AND METHOD: Electromyographic (EMG) surface activity was recorded unilaterally from the right sternocleidomastoid and upper trapezius muscle in 17 participants (8 males, 9 females; mean age 22.8 years, SD: 1.7 years), who were instructed to perform postural tasks under computer guidance. EMG activity was expressed as a percentage of the maximum voluntary contraction (%MVC). The intensity of muscle activity was ranked as light (<3% MVC), moderate (3-8% MVC), and substantial (>8% MVC). The effect of gender on muscle activity was tested using a linear mixed statistical model.

RESULTS: Most postural tasks produced light to moderate activity of the sternocleidomastoid and incisor upper trapezius muscles (<8% MVC), but some tasks were associated with marked co-activation of the sternocleidomastoid and upper trapezius muscles such as contralateral trunk and neck rotation (9.9%), head leaning (6.3%) and shoulder shrugging (5.5%). Head leaning yielded moderate to substantial activity of both muscles. The sternocleidomastoid muscle was more active during postural tasks involving head movements. During trunk and arm movements, the sternocleidomastoid muscle was minimally active compared with the trapezius muscle, which had up to 40 per cent more activity than the sternocleidomastoid muscle. Muscle activity did not differ significantly between genders (F = 3.1; P = 0.078). No significant interaction was found between muscle and gender or between postural task and gender (F = 2.0; P = 0.153).

CONCLUSION: Dental work may result in significant contraction levels of both neck and shoulder muscles. The findings provide normative values to be used for further investigation of muscle contractions in a natural work environment.

387 IMPROVEMENTS OF FACIAL AND PROFILE ATTRACTIVENESS AFTER CLASS II MANDIBULAR ADVANCEMENT SURGERY

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AIM: The majority of patients who seek orthognathic surgery are motivated by aesthetic reasons; hence an improved aesthetic result is paramount in the treatment of

these patients. The purpose of the study was to determine the perceived level of improvement in facial attractiveness as assessed by different groups in patients after bilateral sagittal split osteotomy (BSSO).

MATERIALS AND METHOD: The frontal and lateral pre- and post-operative photographs of 10 Caucasian patients who had received BSSO for mandibular advancement were selected. Changes in facial and profile attractiveness were assessed by groups of 10 orthodontists, 10 art students and 10 laypersons. Frontal and lateral pre- and post-operative photographs were randomly distributed throughout two surveys. The raters ranked the attractiveness of each subject in five categories on a 100 mm unmarked visual analogue scale (VAS).

RESULTS: There was an overall improvement in the attractiveness rating in patients who had received BSSO. The lateral post-operative photographs showed an 11.5 per cent improvement among all three groups compared with the pre-operative photographs. The frontal post-operative photographs showed a 7.5 per cent improvement. There were significant differences between the groups (P = 0.005); orthodontists were more generous with their improvement ratings while the art students tended to give a more critical assessment. There were no significant differences between male and female raters (P > 0.05).

CONCLUSION: All three groups found mandibular advancement using BSSO to result in an improved aesthetic outcome. Orthodontists found the greatest improvement and art-students the least.

388 EFFECT OF ADENOIDECTOMY ON DENTOFACIAL DEVELOPMENT IN CHILDREN WITH RECURRENT MIDDLE EAR INFECTION

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AIM: To examine the effect of adenoidectomy on dentofacial development in children who underwent tympanostomy tube insertion, with or without adenoidectomy, due to recurrent episodes of middle ear infection. It was hypothesised that children with tympanostomy tube insertion with adenoidectomy will have more optimal occlusal development of the primary dentition.

SUBJECTS AND METHOD: Children who had several events of acute otitis media during the two first years of life. The children were randomly allocated to one of two treatment groups: tympanostomy tube placement without adenoidectomy (group 1) or tympanostomy tube placement with adenoidectomy (group 2). There were 63 children in group 1 and 74 in group 2. At 5 years the children were re-examined. Group 1 comprised of 41 children (14 females, 27 males, mean age 5.2 years, SD 0.17) and group 2, 59 children (17 females, 42 males, mean age 5.2 years, SD 0.18) At this time clinical orthodontic examination was made including morphological (overjet, overbite, molar relationship, crowding, crossbite) and functional (nose/mouth breathing, lip seal) craniofacial status. The differences between dentofacial characteristics in the two treatment groups were tested with Fisher's exact test.

RESULTS: There were no statistically significant differences between the frequencies of studied morphological or functional parameters between the two different treatment groups.

CONCLUSION: Combining adenoidectomy with tympanostomy tube insertion in the treatment of recurrent middle ear infection does not seem to make any difference in terms of occlusal development compared with tympanostomy tube insertion only.

389 SHORT TERM INFLUENCE OF FIXED ORTHODONTIC THERAPY ON PERIODONTAL PATHOGENS

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AIM: To evaluate, in a prospective longitudinal observational study, the short-term changes occurring in periodontal pathogens following fixed orthodontic placement.

SUBJECTS AND METHOD: Subgingival plaques samples were collected from 32 subjects before (T0) and after 3 (T1) and 6 (T2) months of fixed orthodontic treatment. The presence of five putative periodontopathogen species, *Actinobacillus actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythia*, *Treponema denticola* were detected using polymerase chain reaction. Descriptive analysis was conducted and McNemar's test was used to determine differences between the groups (P < 0.05).

RESULTS: The prevalence of *A. actinomycetemcomitans* significantly increased (P < 0.05) between T1 (0%) and T2 (18.8%). The prevalence of *P. gingivalis* significantly increased (P < 0.05) between T1 (6.3%) and T2 (25%). A decreased prevalence was found in *P. intermedia* and *T. forsythia* but this was not significant (P > 0.05) at T0 versus T1 or T2 and T1 versus T2. *T. denticola* increased in prevalence at T0 (3.1%), T1 (15.6%) and T2 (21.9%) but this was also not significant (P > 0.05).

CONCLUSION: Orthodontic treatment induces changes in the periodontopathogens species of subgingival plaque. During the first six months of orthodontic treatment with fixed appliances increases occurred in prevalence of *A. actinomycetemcomitans* and *P. gingivalis*.

390 MANDIBULAR SKELETAL CHANGES IN CLASS II MALOCCLUSION SUBJECTS TREATED WITH FUNCTIONAL APPLIANCES

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AIM: To perform a literature review to evaluate mandibular skeletal changes in Class II malocclusion subjects at the pubertal peak of skeletal growth treated with functional appliances.

MATERIALS AND METHOD: A survey of articles published up to September 2011 regarding the effects of functional appliances on mandibular growth was performed using several electronic databases: PubMed, Scopus, EBSCOhost and Scirus. The keywords used in the databases were 'Angle Class II', 'malocclusion' and 'functional appliances'. The inclusion criteria were: (1) Functional appliance therapy of Class II malocclusion; (2) Untreated control groups; (3) Patients at the pubertal peak skeletal growth assessed using the cervical vertebral maturation method or hand-wrist radiographs; (4) cephalometric analysis at the start and end of treatment to measure skeletal changes using anatomical points.

RESULTS: After selection according to the inclusion/exclusion criteria, a total of seven articles were selected for final assessment. The quality standards of these articles ranged from low to medium to high. A consistent heterogeneity among studies was found that showed a clinically significant supplementary elongation in total mandibular length (a change greater than 2.1 mm in the treated group compared with the untreated group) as a result of overall active treatment with functional appliances treatment. However, one study did not show statistical differences. The Twin-block appliance showed the highest mandibular length increment followed by the Herbst and MARA.

CONCLUSION: Functional appliance treatment at the pubertal peak skeletal had a statistical effect on mandibular length growth. Further investigation into the effects of functional appliances at this growth peak would be beneficial.

391 CHANGES IN MANDIBULAR INCISOR ALIGNMENT FROM 9 TO 54 YEARS OF AGE

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AIM: To examine changes in irregularity of the mandibular anterior teeth in orthodontically untreated subjects during the age span 9 to 54 years. Additional objectives were to relate these changes to changes in mandibular intercanine width, dental arch length, overjet, and overbite.

MATERIALS AND METHOD: Dental study casts obtained from individuals included in the University of Oslo Craniofacial Growth Archives. One sample (n = 121) comprised subjects with longitudinal records at ages 9, 12, 15, 18, and 21 years. Another sample (n = 35) comprised study casts obtained from individuals at about 23 years of age and then 10, 20, and 30 years later. None of the individuals had received orthodontic treatment during the observation period. Mandibular alignment, assessed using Little's Irregularity Index, intercanine width and dental arch length were measured using a computer program, whereas overjet and overbite was measured manually by digital callipers. Differences between age stages were analysed by paired *t*-tests and independent *t*-tests were used to analyse differences between the genders.

RESULTS: The mean irregularity index score decreased significantly (P < 0.05) from 9 to 12 years and increased (P < 0.001) from 12 to 21 years. A mean increase was also observed from 23 to 54 years, but this change was smaller compared with the earlier stages. Intercanine width and dental arch length decreased during most time periods. Changes in overjet and overbite were small, in particular during the late observation periods. Change in irregularity index score was correlated with a decrease in intercanine width in the period 12 to 21 years (r = 0.26, P < 0.05)

CONCLUSION: Orthodontically untreated dentitions undergo continuous changes. Irregularity of the mandibular anterior teeth increases throughout life, although at a lower rate during the late decades.

392 DESIGNING COMPUTER SOFTWARE FOR EVALUATION AND SELECTION OF THE MOST APPROPRIATE SHAPE FOR ORTHODONTIC ARCHWIRES

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AIM: To program computer software to select the most appropriate shape and size of preformed archwires according to each patient's dental arch, as well as developing software for three-dimensional (3D) acquisition of arches and assessment of its accuracy and preliminary clinical application.

MATERIALS AND METHOD: One hundred and twenty plaster models were generated from 120 set-ups using artificial teeth corresponding to various malocclusions. Two casts were scanned with an optical scanner (3D models) and 100 casts with a conventional scanner [two-dimensional (2D) models]. Three independent examiners measured intercanine and intermolar width as well as arch depth with digital callipers and 3D/2D software on plaster and virtual models, respectively. The best fit for both the molar and canine points was the reference for archwire selection in both methods, which were compared by kappa statistics.

RESULTS: The kappa values for the 2D and 3D software in comparison with manual measurements were 0.91 and 0.837, respectively. Digital measurements of the distances were within 0.1 mm of the reference value.

CONCLUSION: The software accuracy is clinically acceptable. Archwire selection based on arch dimensions calculated by the software has appropriate validity and reliability.

393 EFFECT OF THE NUMBER OF CLINICAL BRACKET POINTS ON THE ACCURACY OF A CURVE FITTED TO DENTAL ARCH FORM

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AIM: Adjustment of an accurate curve to the dental arch form is an important part of orthodontic treatment. The aim of this study was to compare the fitting accuracy of two curves constructed by different numbers of clinical bracket points (CBP) to the dental arch form using 4th degree polynomial function.

MATERIALS AND METHOD: A mathematical formula associated with a polynomial function was used to reconstruct the dental arch forms of 20 adolescents with a normal occlusion. CBP were marked on every tooth present on each maxillary and mandibular model (second molar to second molar) using an orthodontic bracket positioning gauge. A coordinate measuring machine was used to record the coordinates of each CBP (x, y, z). A curve fitting software was then used to obtain the best 4th degree polynomial function and associated curve fitted to all 14 CBPs. Another polynomial 4th degree function and curve was obtained for the same models using CBP only on the central incisors, canines and second molars. Curves for each model were compared using statistical values including correlation coefficient, standard error, sum of residuals and R^2.

RESULTS: The statistical values for two curves fitted to each dental model had insignificant differences. There were no differences between maxillary and mandibular dental arches.

CONCLUSION: Six CBPs were sufficient for proper fitting of 4th degree polynomial function to dental arch forms of both jaws.

394 EFFECT OF NARINGIN ON THE EXPRESSION OF PTHRP AND SOX9 IN EARLY GROWTH AND DEVELOPMENT OF THE SPHENO-OCCIPITAL SYNCHONDROSIS

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AIM: To assess the effect of the flavinoid, naringin, on growth of the sphenooccipital synchondrosis by quantifying the levels of expression of Sox9 and PTHrP in an *in vitro* mouse model.

MATERIALS AND METHOD: Fifty 1-day old BALB/c mice were randomly assigned to experimental or control groups, and each group equally divided into five time frames (6, 24, 48, 72 and 168 hours). The mice were sacrificed with phenobarbitone sodium, and the spheno-occipital synchondroses dissected and cultured in experimental or control BGJb medium. Sections of the specimens underwent immunohistochemical staining for Sox9 and PTHrP, and the amount of expression was quantified using a true-colour RGB computer-assisted image-analysing system with digital imaging.

RESULTS: There was a significant increase in the expression of Sox9 at 6 and 24 hours (P < 0.001) between experimental and control groups, however there was no significant difference between the levels of expression of PTHrP between experimental and control groups at any of the time frames. No significant correlation was between the expression of PTHrP and Sox9.

CONCLUSION: Naringin enhances growth of the spheno-occipital synchondrosis through over expression of Sox9. This is a successful *in vitro* model to study factors regulating the growth of the spheno-occipital synchondrosis.

395 EVALUATION OF ANXIETY LEVELS IN MOTHERS OF INFANTS WITH CLEFT LIP AND PALATE

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AIM: To evaluate the anxiety levels of mothers of infants with a cleft lip and palate (CLP) at the initial visit to the orthodontic clinic, during nasoalveolar moulding therapy and before lip surgery.

MATERIALS AND METHOD: A 10-item questionnaire was distributed to 31 mothers (mean age: 27.6 ± 5.8 years) with a CLP baby before taking impression (T1), after 4 weeks of nasoalveolar moulding therapy (T2) and before lip surgery (T3). At the initial visit the mothers were asked to answer the State-Trait Anxiety Inventory (STAI) to evaluate their anxiety levels. To analyze the data, descriptive statistical methods (mean value, standard deviation) were carried out. Independent *t*-, chi-square and Pearson's correlation tests were used to compare the groups, to test the qualitative data and to determine the correlation of variables, respectively.

RESULTS: The mean anxiety level values decreased between T1 and T2 (P = 0.0001). No significant differences were found between the mean values at T1 and T3 (P = 0.299). A significant positive correlation was evident between STAI and T1 and T3 questionnaire scores (P = 0.006 r = 0.483, r = 0.445 P = 0.012). Neither T1, T2 or T3 questionnaires nor STAI scores were associated with the mother's age, educational status or family history of a CLP.

CONCLUSION: The anxiety levels of mothers with a CLP baby were high at the first appointment, but decreased after having information and observing the results of nasoalveolar therapy. However, the anxiety of the mother can increase again before surgery. Therefore, it may be beneficial in terms of psychological support for the parents to obtain information about surgery and to become acquainted with the surgeon during the first months of nasoalveolar moulding therapy.

396 EFFECTS OF A TEMPORARY ASYMMETRIC OCCLUSAL BLOCK ON UPPER BODY POSTURE

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AIM: To examine whether a unilateral occlusal block using a 1 or 2 mm thick silicone panel, can significantly change the upper part of the body.

SUBJECTS AND METHOD: Thirty-eight adults without significant discomfort in the temporomandibular system or body movement apparatus. Measurement of the upper part of body posture was performed with a three-dimensional back scanner. The 1 or 2 mm thick silicone panel was placed systematically between the left/right premolars. Statistical comparison of the measuring data was carried out between the reference measurement and the provoked lower jaw position.
RESULTS: If the occlusion was changed dextrally (to the right) or sinistrally (to the left) by the silicone panel, rotation in the shoulder area improved (right 1 or 2 mm; P = 0.00; left 1 mm: P = 0.00) in comparison with the habitual starting position. With a dextral occlusal disruption with 1 mm of silicone, pelvic rotation also changed (P = 0.05).

CONCLUSION: A unilateral occlusal block in the premolar region has an influence on upper body rotation in the standing position, particularly in the shoulder area. Thus the results demonstrate functional relationships between chewing and the movement system, which may explain complaints in one of the subsystems influenced by therapeutic measures in an otherwise unaffected system.

397 EFFECTS OF INDIVIDUALLY CONSTRUCTED MOUTHGUARDS ON FUNCTIONAL POSTURE OF THE SPINAL COLUMN DURING FIELD HOCKEY

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AIM: A mouthguard is mainly seen as a preventive method to protect teeth from trauma. The effects on body posture have not been sufficiently explored. The aim of the present study was to determine if wearing a mouthguard during playing field hockey could influence the functional posture of the spinal column while fulfilling specific movements. A comparison of neutral occlusion (normal bite without wearing a mouthguard, while wearing a mouthguard was made.

SUBJECTS AND METHOD: The functional posture of the spinal column was measured in three different positions. Measurements were carried out on 12 field hockey players of a 1. Bundesliga Team with the sonoSens® monitor which works with continuing ultrasonics. The ultrasonic waves communicate between different sensors and collect information on body posture.

RESULTS: Functional differences while wearing a mouthguard were found during flexion, extension, lateral-flexion and torsion, mainly in the thoracic spine. This was observed while standing and during walking as well as when fulfilling specific hockey movements. It results in uprighting and derotation of body posture compared with the neutral occlusion.

CONCLUSION: A mouthguard not only has a protective function, but when individually constructed in centric jaw relation, is able to influence the functional posture of the spinal column of field hockey players.

398 COMPUTED TOMOGRAPHIC ANALYSIS OF GROWTH AND DEVELOPMENT AROUND THE ARTICULAR TUBERCLE AND ARTICULAR POSTERIOR TUBERCLE

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AIM: To conduct image analysis of the articular tubercle of the area surrounding the mandibular fossa and of the sagittal section of the articular tubercle employing computed tomographic (CT) images according to age.

MATERIALS AND METHOD: Ten skull bones for each Hellman's dental stage. Images of these bones were acquired with CT imaging equipment in the Frankfort plane and at a parallel angle. Acquisition conditions were as follows: X-ray tube voltage, 130 Kv; tube current, 63 mA in bone mode; scanning time, 20 seconds; slice interval, 2 mm, WW3000 and WL480. Images were transferred to high-speed threedimensional for image analysis. Subsequently, based on images of the thinnest point of the mandibular fossa and of images 2 mm toward the inside and 2 mm toward the outside of this point, the longitudinal distance, horizontal distance, area of the articular tubercle and articular posterior tubercle were measured.

RESULTS: Growth rates in the longitudinal and horizontal distance and of the area of the articular and posterior tubercles of the thinnest point of the mandibular fossa peaked from Stage IA to Stage IC. From Stage IC to Stage IVC, a moderate increasing trend was observed; from Stage IVC to Stage VA, growth rates declined.

CONCLUSION: Comparisons regarding the extent of growth between the sections 2 mm on the inner and outer sides of the thinnest point of the mandibular fossa and each of the other items revealed no significant differences in a 4 mm range as a combination of the two areas. No meaningful changes were observed in growth based on occlusion in the central part of the glenoid fossa.

399 TANAKA AND JOHNSTON SPACE ANALYSIS OF THREE-DIMENSIONAL DIGITAL IMAGES AND PLASTER MODELS

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AIM: To determine the accuracy of three-dimensional digital images for predicting the size of canines and premolars according to Tanaka and Johnston mixed dentition space analysis.

MATERIALS AND METHOD: Plaster models of 30 pre-orthodontic patients in the permanent dentition phase were randomly selected and digital images of each one were obtained by non-destructive laser scanning. Tooth widths were measured on the digital images using O3d dedicated software (Widialabs, Brazil) and on the plaster models using digital callipers. The sum of the mesiodistal diameters of the mandibular permanent incisors was used to estimate canine and premolar sizes applying the Tanaka and Johnston regression equation and compared with the actual size of those teeth. Replicate measurements 1 week apart were undertaken to calculate the method error. Pearson's correlation test, Dahlberg's formula, *t*-test and variance analysis were used to analyze the data.

RESULTS: Statistical analysis showed excellent intra-examiner agreement for the O3Dd (r = 0.96 to 0.99) and calliper (r = 0.87 to 0.99) measurements. The difference of the first and second tooth width measurements was above 0.20 and 0.06 mm for O3d and calliper, respectively. Tooth size measurements were greater on the digital image, 0.20 to 0.54 mm for canines and 0.67 to 0.92 mm for premolars. Estimation of the sum of the canines and premolars sizes using Tanaka and Johnston regression analysis revealed significantly greater values than the sum of the actual size of those teeth with both methods: digital (upper teeth 1.11 mm, lower teeth 0.72 mm) or calliper (upper teeth 3.35 mm, lower teeth 2.84 mm) measurements.

CONCLUSION: Digital images showed systematic greater values of tooth sizes. The Tanaka and Johnston regression equation overestimates the canine and premolars sizes on digital and plaster models. Digital image analysis showed greater predicted values than plaster models.

400 CEPHALOMETRIC ANALYSIS BY MEANS OF CONE BEAM COMPUTERISED TOMOGRAPHY AND CONVENTIONAL LATERAL CEPHALOMETRIC RADIOGRAPHS

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AIM: To compare cephalometric measurements obtained from three-dimensional (3D) reconstructed images generated by means of cone beam computerized tomography (CBCT) with measurements obtained in two dimensions (2D) from conventional lateral cephalometric radiographs (LCR).

MATERIALS AND METHOD: Five dry human skulls were selected. Three images were taken, one lateral cephalogram using CBCT (ProMax 3D Planmeca Oy, Helsinki, Finland) and two LCRs (PM 2002 CC Proline-Planmeca; Helsinki, Finland), one magnified (1:1.1) and the other non-magnified (1:1). The cephalometric images of each skull were evaluated using the Nemotec Dental Studio NX program (Software Nemotec SL, Madrid, Spain). Nineteen measurements were obtained, 11 angular and eight linear, from each of the three types of cephalometric image. If data followed a normal distribution, they were analyzed using one-way ANOVA (P < 0.05); when not distributed normally, using the Kruskal-Wallis test (P < 0.05) and Mann-Whitney, applying the Bonferroni correction (P < 0.016).

RESULTS: No significant differences were found between angular measurements (P < 0.05). For linear measurements only one significant difference was found between the magnified LCR anterior cranial base measurement and the non-magnified LCR (P < 0.016).

CONCLUSION: There are no significant differences for angular and linear measurements from LCRs and CBCTs. Therefore, measurements performed on CBCT cephalometric radiographs are comparable with those from conventional cephalometric radiographs. The only significant difference was between measurements of the anterior cranial base taken from the magnified LCR and the non-magnified LCR.

401 RELIABILITY OF CEPHALOMETRIC MEASUREMENTS FROM THREE-DIMENSIONAL RECONSTRUCTED IMAGES AND CONVENTIONAL TWO-DIMENSIONAL IMAGES

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AIM: To evaluate the dimensional accuracy of cephalometric images in three dimensions (3D) produced using cone beam computerized tomography (CBCT) and others in two dimensions (2D) taken by means of conventional lateral cephalometric radiographs (LCR).

MATERIALS AND METHOD: Five dry skulls were used. Twelve craniometric points were selected and a metal sphere with a diameter of 1 mm was placed at each point. Images of the skulls were taken in 3D using CBCT (ProMax 3D Planmeca Oy, Helsinki, Finland), with image-capture conditions of 96 kV and 6 mA, and in 2D using LCR (PM 2002 CC Proline-Planmeca, Helsinki, Finland) at 120 kVp and 3.8 mA. From cranial points selected, a total of 15 linear measurements were performed on each skull. Measurements were made digitally using the Nemotec Dental Studio NX program (Software Nemotec SL, Madrid, Spain) and also manually, directly from the dry skull itself, using a calliper. If data followed a normal distribution, they were analyzed using one-way ANOVA (P < 0.05) and the Scheffé test (P < 0.05); when not distributed normally, data were analyzed using the Kruskal Wallis test (P < 0.05).

RESULTS: Significant differences were found between measurements taken manually and those from CBCT and LCR images for nine of the 15 linear measurements. There were no significant differences between measurements taken from CBCT images and those from LCR.

CONCLUSION: Nine of the 15 cephalometric measurements, whether measured from 3D (CBCT) or a 2D radiograph (LCR), showed a low level of accuracy compared with direct anthropomorphic measurements.

402 CONDYLAR CHANGES IN JUVENILE IDIOPATHIC ARTHRITIS PATIENTS WITH ASYMMETRICALLY AFFECTED TEMPOROMANDIBULAR JOINTS TREATED WITH A DISTRACTION SPLINT

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AIM: To compare the three-dimensional (3D) morphological and positional changes of mandibular condyles in juvenile idiopathic arthritis (JIA) patients with unilateral temporomandibular joint (TMJ) treated for 2 years with a distraction splint to those occurring in age-matched subjects without JIA treated with fixed appliances.

SUBJECTS AND METHOD: Group A: JIA patients (n = 16, 9 females, 7 males, mean age 11.9 years) treated with a distraction splint for unilateral TMJ involvement. Group B: Healthy orthodontic patients with no TMJ pathology (n = 11, 8 females, 3 males, mean age 11.7 years) treated with conventional fixed appliances. Both groups were scanned with cone-beam computed tomography at the start (T0) and after 2 years of treatment (T1). The 3D virtual model of the mandibles at T0 and T1 were superimposed on stable structures. Linear measurements of condylar width and height and transverse, vertical and sagittal position of the condyle were performed, in addition to volumetric measurements. The change in the position of gonion and condylion indicated the growth vectors in three dimensions. Comparison within the JIA group (affected non-affected TMJ, T0 and T1) was performed using Wilcoxon's paired test. A Mann-Whitney test was used to compare the affected condyles of the JIA group and the condyles in the control group. A significance level of 5 per cent was chosen.

RESULTS: All values increased over time in both groups and condyles. In the JIAgroup condylar volume, the height of the ramus and condyle increased less on the affected than non-affected side. The affected ramus rotated more medially. Affected and non-affected condyles in the JIA-group showed more posterior and less vertical growth and displayed large interindividual variability as compared with healthy controls.

CONCLUSION: In JIA patients, the asymmetry does not worsen during distraction splint therapy, but is characterized by wide variability. The 3D technology demonstrated a medial rotation of the affected ramus not detectable on two-dimensional images.

403 CHANGES IN AIRWAY DIMENSIONS AND HYOID POSITION FOLLOWING FIXED FUNCTIONAL THERAPY.

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AIM: To retrospectively examine the effects of fixed mandibular protraction appliances used during the post-peak growth period on the dimensions of the pharyngeal airway.

MATERIALS AND METHOD: One hundred and twenty lateral cephalometric films obtained from 60 Class II patients (43 girls, 17 boys) presenting mandibular retrognathism. Each group consisted of 15 children who received treatment with either a Jasper Jumper, Forsus fatigue resitant device, or Sus2. The control group also consisted of 15 children who did not receive any orthodontic treatment. Lateral cephalometric films were taken in the natural head position at the start and end of

appliance treatment. Sagittal airway, skeletal and dental parameters were measured using the Dolphin Imaging software program. Statistical calculations were carried out with NCSS software for Windows.

RESULTS: When the pre- and post-treatment measurements were compared, Class II correction was achieved in all study groups through dentoalveolar changes. No difference was observed between the study groups with respect to airway changes. A slight increase in airway dimensions was found at the oropharynx in the study groups. CONCLUSION: Similar prospective studies are needed in mature patients and with three-dimensional images.

404 INVESTIGATION OF THE RELATIONSHIPS OF CEPHALOMETRIC MEASUREMENTS BY CLUSTER ANALYSIS

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AIM: To investigate the relationship between various cephalometric measurements and craniofacial features by the means of cluster analysis.

MATERIALS AND METHOD: Eighty measurements were performed on pretreatment lateral cephalograms of 203 adults (157 girls, 46 boys) and these measurements were evaluated by cluster analysis. Fifteen cephalograms were randomly selected, retraced and digitized 2 weeks later to determine the method error. RESULTS: Twenty-six measurements found to be interchangeable with another measurement by cluster analysis were eliminated in the first tree diagram. A second diagram was constructed for the remaining 54 measurements. Observation of the tree diagram established by the cluster analysis revealed that there were fundamentally four groupings that were independent from the anatomical feature observed.

CONCLUSION: Cluster analysis offers a new and consistent methodology for the evaluation of the relationships between cephalometric craniofacial features.

405 THE RELATIONSHIP OF UPPER AND LOWER INCISOR CEPHALOMETRIC MEASUREMENTS

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AIM: To define the relationship of cephalometric measurements of upper and lower incisor positions.

MATERIALS AND METHOD: Pre-treatment cephalograms of 203 individuals were traced and digitized. SNA, SNB, ANB, GoGnSN, SN, NSAr, MX1-NA, Mx1-NA angle, Mx1toA-IFH, Mx1 to APo MX1 to FH, MX1-SN, Md1 to APo, Md1 Inclination, MD1-NB, IMPA, Md1-NB angle, FMIA, incisor-occl.plane, MD1-SN-7 and MD1-N-PG measurements were performed and the relationships between the measurements were evaluated by correlation analysis.

RESULTS: For lower incisor measurements, statistically significant high correlation coefficients were found between all measurements except for IMPA and incisor-Occl.Plane. For upper incisor position, correlation coefficients showed high agreement between all measurements. When the agreement between the upper and lower incisor parameters were evaluated, it was observed that Mx1 to APo measurement showed the best agreement with the lower incisor position indicators.

CONCLUSION: Agreement of cephalometric measurements depends mostly on the closeness of the landmarks used for evaluation. The results for cephalometric measurements for a specific craniofacial feature must be verified using measurements that utilise independent anatomical landmarks for the same feature.

406 EVALUATION OF INFLAMMATORY RESPONSE AND OXIDATIVE STRESS DURING RAPID MAXILLARY EXPANSION

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AIM: There has been widespread use of palatal suture opening to expand a constricted maxilla orthopaedically and to gain space for a crowded dentition. However, there is still lack of knowledge about the biochemical response of periodontal tissues during this treatment. The aim of this study was to investigate the inflammatory response and oxidative stress during rapid maxillary expansion (RME).

SUBJECTS AND METHOD: Fourteen patients who required RME. Each patient received periodontal prophylaxis and instructions in home care, including rinsing with chlorhexidine. Two weeks after periodontal prophylaxis, a modified hyrax appliance was placed. The jackscrew was activated twice daily for two weeks. Gingival crevicular fluid (GCF) samples were collected before and after periodontal prophylaxis and during passive use of the appliance, active orthodontic treatment, and retention. Fluid samples were collected with filter paper strips and analyzed by ELISA for total antioxidant status (TAS), total oxidant status (TOS), IL-1ß and nitric oxide (NO). Repeated measures ANOVA was used to evaluate the differences by time.

RESULTS: Interaction in terms of the amount of GCF was not statistically significant. However, there were statistically significant differences between the mesiobuccal and mesiopalatal sides and times. Gender was not found important in terms of the amount of GCF. There was no statistical difference regarding TAS and NO values, whereas the difference in the mean values of TOS during time was significant (P < 0.05). IL-1 β values in terms of time and gender interaction was significant (P < 0.01).

CONCLUSION: This investigation corroborates previous findings that an inflammatory process occurs during application of mechanical force to teeth.

407 REAL-TIME CELL ANALYSIS OF ORTHODONTIC CEMENTS ON GINGIVAL FIBROBLASTS

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AIM: To evaluate the cytotoxicity of four different orthodontic cements on human gingival fibroblasts.

MATERIALS AND METHOD: Forty cylindrical specimens (5 × 2 mm) were divided into four equal groups. The specimens were prepared with different orthodontic cements; GC Fuji Ortho Band LC (GC), Meron (Voco), Ultra Band Lok (Reliance) and 3M Unitek Multi Cure (3M Unitek). Gingival fibroblasts were isolated from human gingival connective tissue of systemically healthy individuals. The materials were incubated in DMEM culture medium for 72 hours according to ISO 10993-5 standards (surface area-to volume ratio of the specimen to cell-culture medium; 3 cm²/ml). Gingival fibroblasts were maintained with Dulbecco modified Eagle medium containing 10 per cent foetal bovine serum. A real-time cell analyzer (RT-CES, xcelligence) was used to evaluate cell survival. After seeding 200 μ L of the cell suspensions into the wells (5.000 cells/well) of the E-plate 96, gingival fibroblasts were treated with bioactive components released by tested cements and were monitored every 15 minutes for a period for 88 hours. One-way analysis of variance (ANOVA) and Tukey-Kramer multiple comparison tests were used for assessment of cell proliferation.

RESULTS: There were significant difference between the cell indices of the control and study groups at 24 and 48 hours. All tested materials showed statistically significant cytotoxicity at 24 and 48 hours (P < 0.001).

CONCLUSION: All tested materials exhibited severe cytotoxic effects on human gingival fibroblasts.

408 GENOTOXIC EFFECTS OF BANDING PROCEDURES WITH DIFFERENT ORTHODONTIC CEMENTS ON HUMAN ORAL MUCOSA CELLS F Ozturk¹, S Yüksel², E Toy¹, E L Kurtoglu², B Küçük¹, Departments of ¹Orthodontics and ²Medical Biology and Genetics, Inonu University, Malatya, Turkey

AIM: To assess the genotoxic and cytotoxic effects of banding with five different orthodontic cements on human oral buccal epithelium cells.

SUBJECTS AND METHOD: Fifty healthy volunteers (mean age 14.54 \pm 2.37 years) randomly divided into five equal groups. Preformed stainless steel molar bands (3M Unitek) were cemented to the upper and lower first molars with five different orthodontic cements (Durelon, GC Fuji Ortho Band LC Paste Pak, Meron, Ultra Band Lok and 3M Unitek Multi Cure) in each group. The genotoxic effects of banding for one month were evaluated using the micronucleus test. To monitor cytotoxic effects, binucleated cells (BN), karyolysi and karyorrhexis (KR) were also evaluated.

RESULTS: When degenerative nuclear alterations between different time points within groups were compared, statistically significant differences were found. Analysis of micronuclei in buccal epithelial cells revealed a significant increase in chromosomal damage in all groups (P < 0.01). Statistically significant differences were found in the number of BN in Meron, Ultra Band Lok, Durelon, and 3M Multi Cure groups (P < 0.01). Banding with GC Fuji and Durelon significantly elevated KL frequencies (P < 0.05). Durelon had a significant effect on KR (P < 0.01).

CONCLUSION: Band cementation with conventional glass ionomer cements showed the least genotoxic effects. Banding with polycarboxylate cement showed the highest cytotoxic effects on human oral buccal epithelium cells.

409 CHARACTERISTICS OF DISTOMOLAR TEETH: A RETROSPECTIVE STUDY

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AIM: To retrospectively evaluate the frequency, location and shape of distomolar teeth and to find a possible relationship with age and gender.

MATERIALS AND METHOD: Panoramic radiographs of 494 patients (221 males, 273 females) referred between 2005 and 2011. Supernumerary teeth that were distal to the third molar were diagnosed as distomolar teeth. Special care was taken to include only those patients who had not undergone any extractions in the third molar regions.

RESULTS: The presence of distomolars was observed in 1.2 per cent of the patients. In total, eight distomolar teeth were diagnosed in six patients. Two (25%) distomolar teeth were in females and six (75%) in males. Distomolars were found primarily in the maxillary left (n = 4, 50% of distomolars) and right (n = 3, 37.5% of distomolars) quadrants. There were two rootless coronal forms (25%) and six normal or microdont distomolar (75%) teeth. In two patients, the distomolar teeth were bilaterally located while in four they were unilateral.

CONCLUSION: Distomolars occur more frequently in the maxilla and are often impacted. A higher male expression was found.

410 PRO-INFLAMMATORY CYTOKINES IN GINGIVAL FLUID OF ORTHODONTIC TRACTIONED TEETH***

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AIM: Dental displacement is obtained by bone resorption and apposition, resulting from an inflammatory process localized at this level. Lymphocytes produce a large number of peptides with some functions on bone. These peptides have been described as cytokines. Among these are interleukin (IL)- α and 8, which are the main proinflammatory cytokines. The objective of this study was the assessment of IL- α and IL-8 levels in the gingival fluid of orthodontic tractioned teeth at different periods of time compared with teeth on which no orthodontic force is applied.

SUBJECTS AND METHOD: Fifteen girls and 15 boys (9 to 12 years of age) in the, early mixed dentition, who exhibited orthodontic tooth movement (buccally erupted canine) of a single tooth (test group). The opposing teeth from the antagonistic arch were considered as the controls. Gingival fluid was sampled before treatment, 1 hour after the start of orthodontic force, and 1 and 7 days from force application. The levels of IL- α and IL-8 in the gingival fluid were determined by ELISA.

RESULTS: The levels of the two pro-inflammatory interleukins in the gingival fluid of the tractioned tooth were significantly higher (P < 0.01) on day 1 compared with the control tooth. At day 7, only the level of IL-8 in the experimental tooth was significantly higher compared with the control tooth. No interleukins were found in the controls.

CONCLUSION: The levels of IL- α and IL-8 in the gingival fluid increase as dental movement takes place, due to a localized inflammatory process, as a response to mechanical stress. This is non-invasive method to control the level of tissue inflammation during orthodontic treatment.

411 SAGITTAL AND VERTICAL SKELETAL ANALYSIS IN THE BRONZE AGE AND MEDIEVAL SERBIAN SKELETAL REMAINS

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AIM: To analyze and compare sagittal and vertical jaw relationship on skeletal material from two archaeological sites: an early Bronze Age graveyard at Mokrin and a medieval Vinca, and to determine differences from modern cephalometric standards. MATERIALS AND METHOD: Ten lateral cephalometric radiographs from the Mokrin site and 15 from the Vinca. All radiographs were traced manually. Reference points and planes were used according to the Schwarz, Steiner, Björk and Jarabak. An independent samples *t*-test was used to compare measurements.

RESULTS: There were no statistically significant differences between the examined groups. In the sagittal plane SNA in both groups showed maxillary prognathism, ANB was also slightly increased, which indicated a skeletal Class II. In the vertical plane the angle between SN and the maxillary line, SN-MeGo angle and the sum of the posterior angles were also decreased, suggesting upward rotation of the jaw bases and an horizontal growth pattern.

CONCLUSION: Even though the period between the investigated groups was approximately 3000 years, it is too small to show greater skeletal differences among them. However in comparison with the contemporary population, there are differences in the vertical plane. The horizontal growth pattern could be explained by the use of less refined food in the past and different lifestyles, especially in the prehistoric Bronze Age.

412 TEMPORARY ANCHORAGE SUPPORTED ASYMMETRIC SPACE CLOSURE MECHANICS IN MONOLATERAL AGENESIS

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AIM: To illustrate the use of temporary anchorage devices (TADs) in asymmetric space closure due to monolateral agenesis of the lower second premolar with retention of the second primary molar (E).

SUBJECTS AND METHOD: Eleven patients presenting monolateral agenesis of the lower second premolar (in some cases multiple agenesis), a Class I occlusion on the side opposite to the agenesis and no need for profile reduction. The treatment plan was to extract the E molar in the lower arch and to mesialize the first and second molars. To optimize the occlusion the upper second premolar (or the E molar in case of multiple agenesis) was extracted. To enhance the asymmetric anterior anchorage, a TAD (Spider Pin 1.3×8 mm) was inserted in the inter-radicular space between the canine and the first premolar. Cephalometric radiographs were taken at the beginning (T1) and end (T2) of treatment.

RESULTS: Despite the unusual asymmetric extractions, all patients finished with a correct Class I occlusion and space closure. Superimposition of the T1 and T2 cephalometric tracings showed a correct incisor position with profile maintenance.

CONCLUSION: The described mechanics are reliable and effective when asymmetric space closure is required due to agenesis or absence of one lower premolar, when the profile needs to be maintained and a correct occlusal relationship exists on the opposite side.

413 MORPHOLOGICAL COVARIATION AMONG THE SHAPES OF SYMPHYSIS, MANDIBLE AND CRANIOFACIAL COMPLEX.

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AIM: To evaluate sexual dimorphism of the shapes of the symphysis, mandible and craniofacial complex, as depicted on lateral cephalograms, and to estimate their covariation.

MATERIALS AND METHOD: Pre-treatment lateral cephalograms of 80 patients (40 males, 40 females, age range: 11-14 years), representing a skeletally heterogeneous orthodontic population. Patients with agenesis or syndromes were excluded from the study. A total of 57 landmarks were placed on three areas; the symphysis (3 fixed and 18 sliding semi-landmarks), the mandible (2 fixed and 19 sliding semi-landmarks) and the craniofacial complex (15 fixed cephalometric landmarks). All digitized points were processed using Procrustes superimposition and principal component analysis. Permutation tests were applied to assess sexual dimorphism. Two-block partial least squares (PLS) analysis was used to evaluate covariation among shapes.

RESULTS: No shape differences between the genders was noted for any of the three shapes studied; symphysis (P = 0.23), mandible (P = 0.21) and craniofacial complex (P = 0.62). Two-block PLS analysis performed on the total sample of 80 patients revealed non-significant covariation between symphysis and mandible (r-squared = 4%).

CONCLUSION: Sexual dimorphism does not seem to exist among the shapes of symphysis, mandible and craniofacial complex for the age period studied. Mandibular outline shape from articulare to menton may be determined by different genetic and/or functional factors than the shape of the symphysis.

414 FINITE ELEMENT ANALYSIS OF THE EFFECTIVENESS OF A LEVER ARM IN LINGUAL SLIDING MECHANICS

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AIM: To conduct a three-dimensional finite element (3D FEM) analysis of individual tooth displacement and stress distribution when a posterior retraction force of 200 g is applied at different positions of the retraction hook on the transpalatal arch (TPA) of a molar, and over different lengths of the lever arm on the maxillary anterior teeth in lingual orthodontics.

MATERIALS AND METHOD: A 3D FEM model, including the entire upper dentition, periodontal ligaments, and alveolar bones, was constructed on the basis of a sample (Nissan Dental Products, Kyoto, Japan) survey of Asian adults. Individual movement of the incisal edge and root apex was estimated along the x-, y-, and z-coordinates to analyze tooth displacement and von Mises stress distribution.

RESULTS: When the length of the lever arm was 15 and 20 mm, the incisal edge and root apex of the anterior teeth were displaced lingually, with a maximum lingual displacement at a lever arm length of 20 mm. When the posterior retraction hook was on the root apex, the molars showed distal displacement. When the length of the lever arm was 20 mm, anterior extrusion was reduced and the crown of the canine displaced toward the buccal side, in which case, the retraction hook was on the edge, rather than at the centre, of the TPA.

CONCLUSION: When the six anterior teeth are retracted posteriorly, lateral displacement of the canine and lingual displacement of the incisal edge and root apex of the anterior teeth occurs without extrusion of the anterior segment when the length of the lever arm is longer, and the posterior retraction hook is in the midpalatal area.

415 CALCIUM PHOSPHATE ORTHODONTIC ADHESIVES: ARE THEY A CLINICAL REALITY?

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AIM: To compare experimental tri-calcium phosphate (TCP) composites against commercially available amorphous calcium phosphate composite (Aegis Ortho) and other commercially used orthodontic adhesives including a composite (Transbond XT) and resin-modified glass ionomer cement (Fuji Ortho LC).

MATERIALS AND METHOD: Four hundred and twenty previously extracted premolar teeth were randomly allocated to one of 14 test groups and uncoated Victory series premolar brackets were bonded using: Transbond XT, Fuji Ortho LC, Aegis Ortho and experimental composites containing 0, 1, 5 and 10 per cent TCP. Bond strength was measured following wet and dry storage of the specimens that were then analysed to determine the mechanism of bond failure and to assess the adhesive remnant index (ARI) score. Discs of the experimental TCP composite and Aegis Ortho were then stored in an aqueous solution to determine the calcium ion release from the materials using an ion-selective electrode.

RESULTS: Kruskal-Wallis and Mann-Whitney statistical analysis showed that Transbond XT produced the greatest bond strength (12.30-15.29 MPa; P < 0.05). Fuji Ortho LC dry (11.76-9.55 MPa) and Aegis Ortho (11.89-10.08 MPa) produced clinically acceptable bond strengths. The experimental TCP composites produced statistically lower (P < 0.05) but clinically acceptable bond strengths following dry storage (8.84-8.07 MPa) that significantly reduced following aqueous storage (2.26-1.46 MPa; P < 0.05). This was found to be due to an increase in cohesive bond failure (P < 0.05). TCP experimental composite released significantly greater concentrations [8.92×10^{-4} (+ 1.86×10^{-4}) M] of calcium ions compared with Aegis Ortho [1.19×10^{-4} (+ 0.45×10^{-4}) M] (P < 0.05).

CONCLUSION: All orthodontic adhesives suffer from hydrolytic degradation that affects their bond strength. The addition of a leachable calcium phosphate to composite comes at the cost of reducing the mechanical integrity of the composite which leads to reduced bond strength and an increase in cohesive bond failure.

416 AN AUDIT OF THE BASIC PERIODONTAL EXAMINATION AS PART OF THE ROUTINE ORTHODONTIC EXAMINATION

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AIM: To audit patient notes to see if the basic periodontal examination (BPE) had been recorded. This would allow identification of new orthodontic patients with poor oral hygiene and gingivitis that may otherwise be missed, to make more appropriate referrals to the hygienist and therapist and to monitor periodontal condition before, during and after treatment.

MATERIALS AND METHOD: Notes of 90 consecutive patients over 20 years of age seen in new patient clinics were obtained starting from January 2010 to June 2010. The notes were examined for several data, including: age of the patient; presence of recorded BPE scores; any referrals to hygienist, therapist or other clinicians in the periodontology department and level of clinician (senior house officer, registrar, consultant, etc).

RESULTS: The majority of the adult patients examined in the audit were aged between 20 and 39 years with over half between 20 and 29 years. BPE scores were recorded for five out of 90 patients. Referrals for addressing the periodontal condition were made for eight patients; five to the general dental practitioner and three to the periodontology department in the dental hospital. Three referrals were made in the absence of BPE scores. The majority of patients were seen by trainees and consultants. The level of oral hygiene was recorded for all patients

CONCLUSION: Documentation of BPE fell significantly short of the gold standard. An improvement of the recording of BPE scores for adults aged over 20 years is required.

417 TORQUE CONTROL DURING INSERTION AND REMOVAL OF MINI-IMPLANTS***

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AIM: Mini-implants are commonly used in subjects with high anchorage needs. Too high insertion torques may result in fracture of mini-implants. Therefore, control of maximum insertion torque is crucial to prevent mini-implant fractures. Depending on the implant type, insertion torques vary between 11 to 64 Ncm. The aim of this study was to evaluate the accuracy and effectiveness of different drivers and surgical units with torque limitation.

MATERIALS AND METHOD: Six different drivers and one surgical unit with adjustable torque limitation were tested in two different scenarios: the first when inserting mini-implants where the torque gradually increases and the second the situation during removal of the mini-implants or while inserting in areas with high bone density where the torque has its peak at the beginning of the movement. A strain gauge force sensor was coupled to the driver and the peak torque values were recorded. In both set ups each driver was tested at 5, 10, 15, 20, 25, 30, 35, 40, 45, and 50 Ncm where appropriate. Each measurement was repeated eight times.

RESULTS: The accuracy of torque limitation of four of the six drivers was sufficient. Generally, mechanical torque limitation devices performed better than electronically controlled units. Especially during removal of the implants, maximum allowed torque values were exceeded by drivers with electronic torque control.

CONCLUSION: It could be shown, in most cases, that drivers or surgical units with torque limitation were sufficiently accurate for clinical use. Therefore, they can be recommended to prevent implant fractures. However, in some situations, such as implant removal, torque limitation was found to be not effective in all cases.

418 ANALYSIS OF VARIATIONS IN THE CRANIAL BASE AND THEIR IMPACT ON THE MORPHOLOGICAL CHARACTERISTICS OF MALOCCLUSION

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AIM: Immediate connections of the cranial base with the nasomaxillary complex and the changes that occur during the development phase can significantly affect growth, the extent and development of different parts of the face, their size, shape, position and mutual relationships. The aim of this study was to clarify the relationship between the form and size of the cranial base and morphological variations of the maxillofacial complex.

MATERIALS AND METHOD: Pre-treatment lateral cephalograms of 90 patients. On the basis of clinical examination and morphological analysis, these were placed into three groups: Class I, Class II and Class III malocclusion. Three linear and two angular cranial base dimensions as well as nine angular and four linear measurements of the facial skeleton were analyzed.

RESULTS: The cranial base angle in Class I normocclusion ranged from 129.1 to 131.3 degrees. Cranial base angle in Class I and Class II malocclusions showed no statistically significant difference, while in Class III the angle significantly decreased. With a Class III malocclusion the length of the lower jaw and posterior facial height was significantly higher than in the Class I control group. The length of the upper jaw in Class II malocclusion subjects was higher than in Class I, while the length of the lower jaw was similar.

CONCLUSION: A significantly smaller angle of the cranial base may be responsible for a Class III malocclusion. The length of the lower jaw is longer in Class III, and the length of the upper jaw longer in Class II malocclusion subjects.

419 PARENTAL PERCEPTIONS OF ORTHODONTIC TREATMENT IN DISABLED CHILDREN COMPARED WITH A NON-DISABLED GROUP

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AIM: To know the motivation levels and expectations of parents with disabled children undergoing orthodontic treatment (OT) and also to evaluate these parents' reports about its social influence, adverse effects, and satisfaction level with OT results.

SUBJECTS AND METHOD: The parents of 63 patients with physical, mental, sensory and/or cognitive disabilities (disabled patients; DP) undergoing OT completed a 31-item questionnaire related to their children attitudes and adaptation, benefits

perceived, adverse effects and satisfaction level after OT. The control group (CG) included 63 patients without disabilities undergoing OT.

RESULTS: The main medical diagnoses were Down syndrome and learning disabilities in the DP group. Ninety-two per cent of parents with disabled children were motivated during OT compared with 60 per cent of CG parents (P < 0.005). Oral hygiene procedures were increased in the DP group during OT. Adaptation of the DP children to OT when they wore removable appliances took more time than in the CG (73 versus 94%, P < 0.005), while fixed appliances did not show statistical differences between the groups. The percentage of parents who considered that OT positively affected social acceptance was significantly higher in the DP group (77%) than in the CG (55%). Oral lesions occurred in both groups, but DP children showed a greater increase of salivary secretion and/or nausea (21 versus 4.8%, P < 0.005). Although the majority of parents were satisfied with the results of OT, the expectations of DP parents were 42 versus 9.5 per cent of CG parents (P < 0.005).

CONCLUSION: There is a high level of motivation for OT from parents and DP. The adaptation of DPs to fixed appliances was better than to removable appliances, inspite of increasing the difficulty for good dental hygiene and causing oral lesions. A high improvement in quality of life of DP undergoing orthodontic treatment was detected. All parents would repeat OT and would recommend it for other DPs.

420 SEARCHING FOR THE AETIOLOGY OF CONDYLAR DYSMORPHIC DEVELOPMENT

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AIM: Condylar deformity of the temporomandibular joint (TMJ) is a well-known condition causing mandibular growth deviation. The condition is known as idiopathic condylar resorption or progressive condylar osteolysis. Stability of the TMJ, i.e. no changes in joint components causing a shift in mandibular position, is questionable and post-treatment relapse is a considerable risk. Little is known on the aetiology causing condylar growth deficiency and elucidation of the pathology is necessary. Studies on synovial fluid evaluation may lead to a better understanding of the aetiology behind this condition. Yet, it is crucial that no side effect occurs from such a procedure. The aim of this study was to evaluate safety issues in relation to a synovial sampling technique.

SUBJECTS AND METHOD: Twenty healthy, adult volunteers were examined for TMJ dysfunction and mandibular movements before and after a sample of synovial fluid was taken using the push-pull technique (Alstergren *et al.*, 1999). The study is part of a larger investigation related to synovial sampling in patients with mandibular growth deviations and TMJ pathologies. Samples were taken from both TMJs and cone beam computed tomographic (CBCT) scanning was carried out to reveal the needle position in the upper joint compartment.

RESULTS: All volunteers reported limited TMJ pain after sampling (mean 13.0 on a visual analogue 0-100). Pain disappeared in all participants after 1-2 days maximum. Objectively, mouth opening capacity and laterotrusion were not affected by the procedure. CBCT scanning showed a variety in needle position.

CONCLUSION: The synovial fluid sampling technique is safe resulting in only minor transient symptoms. This technique is therefore applicable in studies on TMJ pathology responsible for dentofacial growth abnormalities in growing individuals.

421 QUANTIFICATION OF THE ACID ETCHED ENAMEL PATTERN OF BRACKETS BONDED *IN VIVO*

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AIM: To quantify the proportion of type 1 and 2 acid etch enamel patterns of brackets bonded *in vivo*.

SUBJECTS AND METHOD: Patients planned for extraction orthodontic therapy had their full dentition acid etched and bonded with brackets by light cured liquid resin and Transbond XT composite paste according to the manufacturer's instructions. Thirty-eight premolars were removed for therapeutic reason directly after bonding of the full braces. They were decalcified in 20 per cent formic acid, leaving behind only the cured liquid and composite resins on the brackets. The liquid resin surfaces of the 38 bondings were examined under a scanning electron microscope (SEM), with grids of 10×10 boxes best fitting each specimen on the SEM screen. At each grid intersection, the specimen was examined at $\times 500$ magnification to determine the type of bonding pattern. The percentages of type 1 and 2 patterns found at the grid intersections of these 38 brackets were recorded and the descriptive statistics were calculated in Sigmaplot 11.0. Standard deviation (SD) to number of specimens were plotted to confirm the reproducibility of the data obtained.

RESULTS: The average coverage of each bracket by type 1 or 2 pattern was 8 per cent (SD 11.8%, median 3.8%). There were 13 brackets (34% of all brackets) with complete absence of types 1 and 2 patterns. Sixteen brackets (42% of all brackets) had less than 10 per cent of type 1 and 2 patterns. No brackets had more than 40 per cent coverage of type 1 and 2 bonding patterns.

CONCLUSION: In an *in vivo* environment, the proportion of the acid etched enamel patterns on orthodontic bracket bases, related to their mechanical interlocking to human enamel, is small and highly variable and may even be non-existent.

422 A MOLECULAR STUDY OF THE MASSETER MUSCLE IN SUBJECTS WITH A UNILATERAL POSTERIOR CROSSBITE

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AIM: It has been shown that subjects with a unilateral posterior crossbite (UPC) exhibit different mandibular kinematics during mastication when chewing on the affected side, resulting in an increased frequency of reverse chewing cycles. Integrins are a family of cell surface membrane proteins that mediate the interaction of cells with each other; these proteins also link the extracellular matrix (ECM) to the cytoskeletal actin and provide a bidirectional signalling between the ECM and the cytoplasm. The aim to this work was to analyze, by immunohistochemical techniques, biopsies of human masseter muscles of surgical patients with severe Class III malocclusions with a UPC.

MATERIALS AND METHOD: Biopsies were obtained, under general anaesthesia, from the superficial and anterior portion of both masseters of patients undergoing orthognathic surgery. In the immunohistochemical analysis, the expression of the major integrin specific in the muscular tissue: α 7B, β 1D, α 7A and β 1A were studied. With specific software, the pixel intensity of 100 fibres was analysed for each reaction and a mean and standard deviation for single fibres were obtained.

RESULTS: The amount of integrins appeared significantly lower, in the right masseter, than that detected in left counterpart; furthermore, α 7A and β 1A isoforms, compared with α 7B and β 1D isoforms, respectively, were significantly predominant in both masseters.

CONCLUSION: Based on the results, it is possible to hypothesize that the decreased masseter activity on the crossbite side can be strongly related to integrin behaviour. The data provides the first suggestion that integrins in masseter muscle play a key role in regulating muscular activity, allowing the optimization of the contractile forces of this muscle.

423 NATURAL HEAD POSITION AND INTRACRANIAL PLANES V Pie de Hierro Laka, Department of Orthodontics, University of the Basque Country/Euskal Herriko Unibertsitatea, Bilbao, Spain

AIM: To evaluate the reproducibility of natural head position (NHP) using four different photographic methods to reorientate lateral radiographs to NHP, and to determine the grade of coincidence in diagnosis of the three planes studied (Frankfort plane, sella-nasion line and horizontal plane).

SUBJECTS AND METHOD: Standing NHP was studied in a group of 51 patients with unselected occlusions, 36 females and 15 males. NHP was registered four times (first time, 10 minutes later and after 1 week and 1 month). It was firstly performed with the help of a mirror as an external visual reference, secondly with correction by the operator when a significant deviation of posture was observed, thirdly with an air level on glabella and lastly with the level over a SAM facebow (right lateral arm). The reproducibility and method agreement was measured using different statistical analyses. Bland-Altman graphical representation was used to evaluate method agreement.

RESULTS: The reproducibility of NHP was good and similar to others investigations (Dahlberg's coefficient less than 1.8). The method corrected by the operator showed the best reproducibility (Dahlberg's coefficient less than 1.6) and method agreement (Bland-Altman graphical). There was poor coincidence between the three planes studied (Wilcoxon test); Frankfort plane presented less coincidence. The horizontal and sella-nasion lines presented high degrees of coincidence in diagnosis of maxillary position, indicating a retrognathic tendency of the sample.

CONCLUSION: NHP is a good and reliable method in orthodontic diagnosis but the information from classical planes should not be discarded. Frankfort plane showed the best results in variability but the poorest results in diagnosis coincidence with other lines of reference.

424 CEPHALOMETRIC EVALUATION OF MELAS PATIENTS WITH THE m.3243A>G MUTATION IN MITOCHONDRIAL DNA

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AIM: Mitochondrial encephalopathy, lactic acidosis and stroke-like episodes (MELAS) is a maternally inherited mitochondrial diseases caused by mutations in the mitochondrial DNA (mtDNA). It is most commonly caused by the m.3243A>G mutation. The mutation is biochemically characterized by a decreased capacity to produce adenosine triphosphate in the cell. Clinically MELAS is characterized by considerable phenotypic variability and multiorgan involvement. It often manifests in organs with high aerobic energy metabolism such as the nervous system, muscle and heart. Many patients also have short stature. The aim of this study was to find out whether the craniofacial morphology of m.3243A>G MELAS patients differs from that in an unaffected normal population.

SUBJECTS AND METHOD: Twenty-three patients (6 males, 17 females) harbouring m.3243A>G were radiologically examined. The median age was 47 years

(range 23-68 years). None of the patients had had any orthodontic treatment. The control group consisted of age- and gender-matched healthy adults with normal craniofacial structures.

RESULTS: Dimensions describing maxillary length and anterior cranial base, as well as mandibular length and facial axis, were significantly larger in the subjects than in the controls.

CONCLUSION: Patients with m.3243A>G differed significantly from the controls, mainly in midfacial skeletal structures. Mandibular growth was also increased. This increased growth could be explained by an increased rate of endochondral bone growth, which it is suggested is caused by changes in mitochondrial energy metabolism of bone.

425 EFFECT OF MOISTURE ON DENTAL ENAMEL IN THE INTERACTION OF TWO ORTHODONTIC BONDING SYSTEMS

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AIM: To assess, by means of scanning electron microscopy (SEM), the remaining adhesive interface after debonding orthodontic attachments bonded to bovine teeth with the use of hydrophilic and hydrophobic primers under different dental substrate moisture conditions.

MATERIALS AND METHOD: Twenty mandibular incisors were divided into four equal groups. In group I bracket bonding was performed using Transbond MIP hydrophilic primer and Transbond XT adhesive paste applied to moist substrate, and in group II a bonding system was used comprising Transbond XT hydrophobic primer and adhesive paste to moist substrate. Brackets were bonded to the specimens in groups III and IV using the same adhesive systems but on dry dental enamel. The images were qualitatively evaluated by SEM.

RESULTS: The absence of moisture in etched enamel enabled better interaction between bonding materials and adamantine structures. The hydrophobic primer achieved the worst micromechanical interlocking results when applied to a moist dental structure, while the hydrophilic system proved versatile, accomplishing acceptable results in moist conditions and excellent interaction in the absence of contamination.

CONCLUSION: The best condition for the application of primers to dental enamel occurs in the absence of moisture.

426 THE RELATIONSHIP BETWEEN DENTAL CROWDING, TOOTH SIZE AND ARCH DIMENSIONS

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AIM: To evaluate the relationship between dental crowding and tooth size and arch dimensions.

SUBJECTS AND METHOD: Fifty-six pairs of dental casts (28 males, 28 females) with normal occlusion, ranging in age from 16 to 20 years .A second group consisting of 65 pairs of dental casts (12 males, 53 females) with a Class I malocclusion ranging in age from 16 to 26 years. Mean and standard deviations of the following parameters were used to compare the two groups: mesiodistal tooth diameters, buccal and lingual dental arch widths, dental arch perimeters and dental arch length.

RESULTS: The size of the teeth was generally larger in the crowded group than in the uncrowded group. The width of the dental arch was smaller in the crowded group.

No significant differences were found between the groups for dental arch perimeters and dental arch length.

CONCLUSION: In the crowded group, dental crowding was caused both by large teeth and small dental arch widths, especially in the maxilla.

427 CORRECTION OF A CLASS II MALOCCLUSION WITH A NON-COMPLIANCE DEVICE – 8 YEAR FOLLOW-UP

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AIM: The Eureka spring is an intermaxillary non-compliance device for the correction of Class II malocclusions. The aim of this study was to analyse the dentoalveolar and skeletal effects directly after removal of the Eureka spring and 8 years after treatment completion.

SUBJECTS AND METHOD: Twelve patients (7 females, 5 males, mean age 12.7 years) were treated with fixed orthodontic appliances and the Eureka spring for correction of a Class II malocclusion between 01/2001 and 02/2002. Lateral cephalograms were taken before (T0, n = 12), directly after removal (T1, n = 12) and 8 years after treatment (T2, n = 4). Cephalometric analysis was performed by two observers with a modified Pancherz analysis (Onyx-Ceph 3TM, Image Instruments). Statistical analysis was performed using the Statistical Package for Social Sciences (version 17, SPSS Inc., Chicago, Illinois, USA). Interobserver agreement was evaluated.

RESULTS: The correction of the Class II with the Eureka spring was obtained after 5.5 months on average. The following variables showed statistically significant differences (P < 0.05) between T0 and T1: Co (d = -1.27 mm) and Ar (d = -2.38 mm) showed negative differences, B (d = +6.82 mm), M6s (d = +2.27 mm), M6i (d = +7.62 mm), Is (d =+2.38 mm), Ii (d = +6.45 mm) and Pog (d = +7.54 mm) positive differences. Dentoalveolar and skeletal maxillary effects were similar (A +1.45 mm, M6s +2.27 mm, Is +2.38 mm). In the mandible, skeletal differences predominated (B +6.82 mm, M6i +7.62 mm, Ii +6.45 mm, Pog +7.54 mm). Differences between T0 and T2 showed similar results compared with those between T0 and T1. Interobsever agreement was given at a level of ±2 mm.

CONCLUSION: These results confirm the findings of other studies on the therapeutic effect of fixed non-compliance devices for the correction of a Class II. Due to the explorative nature of this study, the data were not corrected for normal growth (Bolton standards). Differences between T0 and T2 showed similar values between T0 and T1, due to the number of cases (n = 4) without statistical significance. The absolute amounts of differences seem high compared with other studies, but decreased at T2.

428 MOYERS' PROBABILITY TABLES FOR THE SPANISH POPULATION A Planells Andrés, R Vila Dorca, J Sentís Vilalta, J Duran Von Arx, J M Ustrell Torrent, Department of Orthodontics, University of Barcelona, Spain

AIM: To evaluate the appropriate confidence index from Moyers' probability tables for the Spanish population due to the difference in tooth size according to ethnicity and gender.

MATERIALS AND METHOD: One hundred pre-treatment models of 50 males and 50 females in the permanent dentition. Measurements were made using a digital calliper with an accuracy of 0.1 mm of the mesiodistal widths of the mandibular permanent incisors, canines and upper and lower premolars. The actual tooth

measurements were compared after correlation analysis with the expected values in Moyers' probability tables.

RESULTS: With the collected data, several tables and histograms showing changes in the graph of the normal distribution were created.

CONCLUSION: There is a need to personalize the tables according to the population studied.

429 TRANSALVEOLAR TRANSPLANTATION OF SEVERELY IMPACTED DEVELOPING PREMOLARS

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AIM: To present a novel surgical approach to upright severely impacted developing premolars that were otherwise scheduled for extraction.

SUBJECTS AND METHOD: Four upper and five lower impacted second premolars were consecutively transplanted (from ectopic to normal position) between 2004 and 2011. The age of patients at the time of surgery ranged from 11 years 5 months to 17 years (mean: 13 years 9 months). Initial inclination of all impacted premolars was more than 65 degrees in relation to a neighbouring premolar. Five premolars were inclined between 90 and 180 degrees. All teeth were located below half of the root length of the neighbouring first molar. Orthodontic extrusion was estimated as not possible and space closure was contraindicated due to occlusal relationships. In the maxilla, surgical access was gained from the palate while in the mandible the buccal flap was raised. Bone covering impacted teeth was gently removed and premolars were surgically uprighted. Non-rigid fixation was applied for 7-10 days after surgery. The observation time ranged from 6 to 83 months (mean: 42 months). Clinical examination of transplanted and contralateral control teeth included recording of: pocket depth, clinical attachment level, mobility, electric pulp testing and width of keratinized gingiva. Standardized radiographs were used to evaluate: root development, pulp obliteration and the presence of pathology.

RESULTS: All transplanted premolars were present at the time of the examination. Except for one, all transplants spontaneously erupted into occlusion. Clinical and radiological evaluation did not reveal significant differences between transplanted and control premolars.

CONCLUSION: Transalveolar transplantation of developing premolars is a predictable technique to correct severely impacted premolars in patients in whom orthodontic extrusion and space closure are unfavourable.

430 MINI-IMPLANTS: BIBLIOGRAPHIC REVIEW OF *IN VIVO* CLINICAL STUDIES

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AIM: To answer the most frequent questions concerning orthodontic mini-implants, and to achieve a high level of evidence based on *in vivo* studies focusing on: 1) the survival rates of the mini-implants under different conditions; 2) osseointegration levels with different materials and surfaces; 3) capacity and timing of load; 4) advantages or disadvantages of drilling before implant placement.

MATERIALS AND METHOD: A Medline search was undertaken using the terms: 'mini', 'implant', 'screw' and 'orthodontic', in an isolated and combined way. Inclusion criteria were: published articles in journals indexed in the Journal Citation Report; publication year between 2000 and 2011. All the studies had to report histological analysis as optical or electron microscopy immunofluorescence. Twentyfour articles that fulfilled the selection criteria were then studied and the results compared in relation to: mini-implant osseointegration; elaboration material; miniimplant surface; load capacity; load duration; placement technique and survival.

RESULTS: All studies analyzed had a survival rate between 75 and 89.89 per cent. All used titanium mini-implants or alloys with a high level of titanium and all showed a high osseointegration coefficient [bone to implant contact (BIC) between 85.7 and 13.13%]. A textured surfaced achieved better levels of BIC with the surface. The mini-implant capacity of the load was not determined. There seems to be agreement that immediate loading of mini-implants favours dynamic bone remodelling as long as primary stability is high, without increasing the failure rate. All results showed that no drilling is required before mini-implant placement, obtaining better values of BIC and primary stability in low bone density.

431 AN INTERDISCIPLINARY APPROACH TO ORTHODONTIC DIAGNOSIS: SYNERGY BETWEEN ORTHODONTIC AND MYOFUNCTIONAL THERAPY

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AIM: To test the efficacy of close cooperation between orthodontists and myofunctional therapists, finding clinical guidelines concerning the timing of intervention and therapeutic possibilities of intervention.

SUBJECTS AND METHOD: Three hundred and sixty patients, aged from 4 to 16 years, underwent a preliminary clinical examination performed by a group of orthodontists. A more complex evaluation was then performed by a multidisciplinary team comprising an expert orthodontist, a myofunctional therapist and an otorhinolaryngologist. The association between malocclusions and myofunctional alterations was performed with the chi-square test (P < 0.05).

RESULTS: Myofunctional parameters were significantly affected by malocclusions such as an open bite and dentoskeletal Class II malocclusion.

CONCLUSION: Regular collaboration between myofunctional therapists and orthodontists is required since treatment planning may lead to better and more rapid resolution of the malocclusion. It would be useful for a schedule to be completed at 6 years of age to identify oral habits and resolve them before more complex skeletal changes occur.

432 A CLINICAL STUDY OF CONDYLAR POSITION OF THREE BIOTYPOLOGIAL FACIAL GROUPS

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AIM: Orthodontic diagnosis and treatment related to the orthopaedic position of centric relation (CR) requires a comprehensive study of the condylar position (Roth, 1981; Cordray, 2006). According to the craniofacial architecture, a hyperdivergent facial type seems to be more prone to condyle displacement than other facial groups. Therefore, the hypothesis tested was that in hyperdivergent subjects the centric slide (CS) is more frequent and wider. This work intended to investigate and compare CS in a hyperdivergent, a hypodivergent and an intermediate group.

MATERIALS AND METHOD: The displacement from CR to centric occlusion, namely CS, was assessed in the vertical (ΔZ) and sagittal (ΔX) planes with a mandibular position indicator (MPI®) on mounted models in a semi-adjustable

articulator (SAM \circledast 2P). The cases were selected from a sample of 742 orthodontic patients submitted to sequential criteria that allowed identification of an asymptomatic orthodontic population that had surpassed the growth peak. They were divided into three groups of 36, according to cephalometric criteria (Girardot, 2001). The groups were studied and then compared statistically using a Student's *t*-test with a level of significance of 0.05.

RESULTS: CS was more common and generally wider in the hyperdivergent group, being likely to occur in a lower posterior aspect in the hyperdivergent and intermediate groups and lower anteriorly in the hypodivergent group. In all groups it was possible to verify that vertical displacement was wider than sagittal, with the vertical displacement being significantly higher in the hyperdivergent subjects (P = 0.003).

CONCLUSION: Although condylar displacement is more frequent in hyperdivergent subjects, the findings reinforce the need for mounting the models on an articulator in CR and performing evaluation of condylar position as a protocol in any orthodontic case. These procedures supply relevant and mandatory information on the orthodontic decision.

433 AN ELASTOPOSITIONER CORRECTOR FOR PREVENTION AND EARLY TREATMENT OF MYOFUNCTIONAL DISORDERS IN CHILDREN N Popova, O Arsenina, A Popova, Department of Orthodontics, Central Scientific Research Institute of Dentistry and Oral and Maxillofacial Surgery, Moscow, Russia

AIM: Early diagnosis and timely preventative measures, early correction of the developing skeletal, dentofacial and myofunctional imbalance.

SUBJECTS AND METHOD: Comprehensive diagnosis and treatment of children (200 in the mixed dentition and 250 with distal occlusion of the primary teeth). The following methods were used: anthropometric analysis of the facial proportions, plaster models analysis, analysis of the data from radiographic studies and electromyography of the masticatory muscles. Therapeutic and preventive measures included the use of an elastopositioner corrector.

RESULTS: Use of the corrector optimized eruption of the permanent teeth, jaw growth, the formation of physiological occlusion of permanent teeth, muscle function, the maxillofacial complex and articulation. It was found that when using the corrector for 6 months, 76 per cent of the patients improved muscle coordination during contraction of the dentition. Analysis of the results of treatment showed a positive trend change. Eighty per cent of the children managed to achieve good morphological, functional and aesthetic results and 15 per cent satisfactory results, while in 5 per cent the result was unsatisfactory due to interruption of treatment.

CONCLUSION: Standard elastopositioners, individually matched by size, increases the effectiveness of treatment for children aged 7-12 years with anomalies of dentition during the period of tooth replacement, normalizes the shape and size of the dentoalveolar arches, the depth of overjet, occlusal contacts, the position of the permanent teeth, improves the aesthetics of the face, helps to normalize the function of masticatory muscles in order to prevent the formation of complex anomalies, their aggravation during growth and development.

434 MYOFUNCTIONAL DISORDERS IN PATIENTS WITH DISTAL OCCLUSION AND TEMPOROMANDIBULAR JOINT DYSFUNCTION

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AIM: To substantiate the appropriateness of a complex diagnostic criteria and an algorithm for selecting orthodontic interventions in patients with distal occlusion and temporomandibular joint (TMJ) dysfunction for the purpose of correcting the developing skeletal, dentoalveolar and muscular imbalance.

SUBJECTS AND METHOD: Forty patients (age 17-30 years) with distal occlusion and TMJ dysfunction. The following methods of examination were used in accordance with standard protocols: electromyography of the masticatory muscles, stabilometry and computerized dental occlusion analysis using a T-scan system.

RESULTS: Before treatment, all muscles, especially the temporal, showed bioelectric activity (BEA) in all patients at rest. During occlusion, all patients showed discoordination of masticatory muscle contractions. BEA of temporal muscles prevailed over BEA of masseter muscles. Changes in voluntary chewing were noted. Lack of rhythmicity, adynamia of chewing periods and alternate right-sided/left-sided chewing were revealed. Computerized clinical monitoring of the occlusion using a T-scan revealed the presence of occlusal disorders in patients with distal occlusion and TMJ dysfunction. Throughout occlusion, alternate right/left-sided prevalence of aggregate occlusal forces was noted; this data confirmed the presence of an unbalanced occlusion. Evaluation of motor strategy, with the use of stabilometry, based on analysis of the energy expended for maintaining or changing the posture (Grokhovsky and Kubryak) revealed an increase in the mechanical work connected to transfer of a pressure centre within the supporting plane.

CONCLUSION: Analysis of the results of functional examinations made it possible to produce an objective opinion on the disorders existing in patients with distal occlusion and TMJ dysfunction, necessary for planning complex treatment interventions.

435 ANGULAR PHOTOGRAMMETRIC ANALYSIS OF THE SOFT TISSUE FACIAL PROFILE.

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AIM: To determine angular cephalometric values of the soft tissue facial profile of a group of young adults through photometric analysis, and to determine differences between males and females and between the ages analyzed.

SUBJECTS AND METHOD: Seventy-five students (17 males, 58 females) between 18 and 23 years of age who had not undergone orthodontic treatment. They were selected for analysis according to a set of criteria. All photographs were taken in the natural head position and analyzed digitally with Nemoceph®.

RESULTS: Application of the Student's *t*-test showed sexual dimorphism in most parameters of the labial, nasal, and chin areas. Many differences were found for several angles: nasofrontal, vertical nasal, nasolabial, cervicomental and facial convexity including the nose. Between the ages analyzed, the results showed differences in the angle of the middle facial third.

CONCLUSION: Sexual differences were observed in five of the measurements and also between the ages analyzed. The mean values obtained from this sample can be used for comparison with the records of subjects with the same characteristics and following the same photogrammetric technique.

436 LINEAR PHOTOGRAMMETRIC ANALYSIS OF THE SOFT TISSUE FACIAL PROFILE.

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AIM: To determine the linear cephalometric values of the soft tissue facial profile of a group of young adults through photometric analysis and to find out the differences between males and females and between the ages analyzed.

SUBJECTS AND METHOD: Seventy-five dental students (17 males, 58 females) aged between 18 and 23 years who had not undergone orthodontic treatment. They were selected for analysis according to a predefined set of criteria. All photographs were taken in the natural head position and analyzed digitally with Nemoceph®. Statistical analysis was undertaken using the Student's *t*-test.

RESULTS: Sexual dimorphism was observed in most parameters of the labial, nasal, and chin areas. Significant differences were found between males and females related to middle and lower face length, face depth, nasal length, nasal prominence, height of the tip of the nose, nasal and subnasal depth, length of upper and lower lip, height and prominence of the chin. Over the ages analyzed, there were differences between the values of the upper and middle facial lengths and nasal length.

CONCLUSION: Males have larger faces in general, with greater face heights; longer nasal, labial, and chin lengths; larger nasal, labial, and chin prominences; and a greater nasal and facial depth in the tragus point.

437 THREE-DIMENSIONAL EVALUATION OF CHILDREN'S FACIAL MORPHOLOGY DURING PREPUBERTAL GROWTH***

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AIM: To assess soft tissue characteristics of the face in children without malocclusion during prepubertal growth.

SUBJECTS AND METHOD: Twenty-eight children (16 boys, 12 girls, aged 5.95 ± 0.34 years), without malocclusion. Surface facial images were obtained using a threedimensional (3D) surface laser scanning system. 3D average facial templates for boys and girls were constructed annually and were compared for differences qualitatively and quantitatively. The Mann-Whitney *U*-test was used to determine differences between the two groups at each time point, while the Friedman test was used to test differences within each group during the observed period of time. The results were considered significant at P < 0.05.

RESULTS: The average boy's facial template was larger than the average girl's facial template at all time points. Some variables that described the size of the face in the lateral (facial width) and vertical (facial and nasal length) directions were significantly larger in boys (P < 0.05). The average values of most variables that describe facial morphology changed over time, some significantly (P < 0.05). Surface changes in both groups were generally directed downward and forward. Boys showed a constant change throughout the observation period of five years, while girls showed the biggest changes between the ages of 7 and 8 years.

CONCLUSION: Boys had larger faces than girls at all time points. The surface of the average boys' and girls' face between the ages of 5 and 10 years changed significantly, however they each had different growth patterns.

428 REAL-TIME IMAGING OF THE TEMPOROMANDIBULAR JOINT USING RADIAL MAGNETIC RESONANCE IMAGING

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AIM: Most of the painful processes in the temporomandibular joint (TMJ) occur or are intensified under masticatory loading of the joint. Among all imaging techniques, magnetic resonance imaging (MRI) has great advantages over other techniques in its ability to depict soft tissue changes of the TMJ. Therefore the aim of this study was to develop and evaluate a fast dynamic MRI technique for measurement of the TMJ.

MATERIALS AND METHOD: Radial MRIs were used for rapid image acquisition to depict the motion of the TMJ. Radial MRI was performed on eight adult patients with different craniomandibular diseases and seven healthy patients. Firstly, patients with a known diagnosis were measured to test the radial MRI and to compare it with conventional techniques. Secondly, patients with obscure symptoms and signs were examined to test the ability of the new technique to yield additional diagnostic information. The patients were examined on a 1.5 T whole body MRI scanner (Siemens® Avanto Magnetom) using two four-channel multiarray coils.

RESULTS: A total of 15 informed and consenting patients were examined and 64 datasets were obtained. All measurements were well tolerated. The average time demand of a standard dynamic TMJ measurement was roughly 5 to 10 minutes. Seven patients showed no anatomic or functional abnormalities under all examined load states. In eight cases the diagnosis was reflected by the obtained results. In one case abnormalities, which previously could not be detected using standard diagnostic routines, were discovered.

CONCLUSION: Radial MRI provides invaluable information to the clinician as it allows monitoring of the TMJ under conditions that are hidden to current technologies. Radial MRI, performed with the proposed method, revealed the reasons behind painful symptoms experienced by one patient, where extensive classic diagnostics had not yielded conclusive results.

439 DIFFERENCES BETWEEN DENTAL AND CHRONOLOGICAL AGE

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AIM: To compare dental age, according to Demirjian, and the chronological age of patients who had undergone dental treatment in the last 10 years.

SUBJECTS AND METHOD: Two evaluators recorded the data of 313 dental patients of both genders with, at least an initial panoramic radiograph, and the age, gender and name. Dental age was assessed according to Demirjian's tooth development stage. The Statistical Package for Social Sciences, version 17.0 for Windows (SPSS Inc., Chicago, Illinois, USA) was used to perform a Wilcoxon test for paired differences and Pearson's chi-squared test to evaluate the difference in severity and gender.

RESULTS: The mean chronological age of the sample was 124.3 ± 31.7 months, significantly higher than dental age 116.9 ± 31.7 (P < 0.001). There was a statistically significant association between the severity of the difference and gender: In males the difference was moderate (10-20%) between chronological and dental age; while in females the differences tended to be slight (5-10%).

CONCLUSION: There is both a significant difference between dental and chronological age and also between the difference shown by males (moderate) and females (slight).

440 HOW SAFE ARE ARCHWIRES?

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AIM: Preformed orthodontic wires are currently conditioned in sealed individual bags in order to avoid cross-contamination. Instructions on wrappers generally recommend additional autoclave sterilization for added protection, pre-packaging sterilization not being mentioned. The aim of this study was qualitative and quantitative evaluation of bacterial contamination of such individually conditioned archwires.

MATERIALS AND METHOD: Ten stainless steel archwires (Ormco) and 10 copper Ni-Ti $\$ archwires (Ormco). Five archwires from each group were directly tested as they were drawn from their individual bags and the five others after sterilization. Bacterial cultures of each individual archwire were incubated for five days, then diluted at 10^{-1} , 10^{-2} and 10^{-3} and membrane-filtered. Each bacterial colony was counted and isolated: a variety of bacteria appeared. Bacteria were then morphologically identified, Gram stained, catalase tested and biochemically recognized.

RESULTS: Tests showed the presence of *micrococcus* and *staphylococcus* colonies on three of the five unsterilized copper Ni-Ti® archwires. All other archwires were free of bacterial contamination.

CONCLUSION: The observed presence of non-pathogenic bacteria on three unsterilized copper Ni-Ti® archwires may be related to deficient sealing of the bags, allowing later contamination by environmental factors. Worthy of note is that no truly pathogenic bacteria were found. It is assumed that manufacturers package their products in sterilized rooms. This pilot study strongly suggests that further investigation is required. The same approach should be applied to larger samples drawn from a variety of batches chosen at random.

441 ASYMMETRY OF MANDIBULAR MEASUREMENTS

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AIM: To evaluate asymmetry of the mandible (linear and angular measurements) in dental patients.

MATERIALS AND METHOD: Panoramic radiographs of 95 patients of both genders, all under 18 year of age, who had not undergone orthodontic or implantology treatment. Angular and linear measurements were recorded (ramus height and width) and condylar angle for both sides of the mandible. The results were analysed with the Statistical Package for Social Sciences, version 17.0 for Windows (SPSS Inc., Chicago, Illinois USA). A descriptive analysis of mandibular asymmetry was performed.

RESULTS: The right ramus average height was 45.3 ± 7.1 , left 44.5 ± 9.3 . The average right ramus width was 33.2 ± 3.9 , left 33.0 ± 5.2 . The average height of the right corpus was 74.9 ± 30.9 , left 70.6 ± 34.9 . The asymmetry index (Yañez *et al.*) was non-significant in 80 per cent of subjects for ramus height, 64.2 per cent for ramus width, 57.4 per cent for corpus width and 74.7 per cent for condylar angle.

CONCLUSION: There is a certain asymmetry between both sides of the mandible, corpus width being the most asymmetrical measurement.

442 ECTOPIC MAXILLARY CANINES: PREVALENCE RATE AND DIFFERENT FIXED APPLIANCE TREATMENT TECHNIQUES

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AIM: To determine the prevalence rate of maxillary buccally displaced canines and which therapy (extraction, non-extraction) is the most efficient and stable over time,

SUBJECTS AND METHOD: Three hundred and twenty three patients aged between 7-13 years diagnosed with various forms of dentomaxillary disharmonies (DDM) with crowding. DDM with crowding was noted in 110 patients (34%), DDM and a reverse bite in 50 patients (15.47%) and a DDM with buccally displaced maxillary canines in 36 patients (11.14%). The patients with buccally displaced maxillary canines were treated by either extraction or non-extraction therapy. After evaluating panoramic and periapical radiographs and calculating Tweed's analysis on dental casts, it was decided to gain space by extraction of the first premolars and distalization.

RESULTS: Based on dental cast examination, cephalometrics and clinical aspects the majority of 36 patients aged between 11-13 years had DDM with crowding. Of these ectopic canines accounted for 23 patients, 17.24 per cent in the upper jaw and 4.92 per cent that represented 13 patients with bimaxillary location. The approach was excellent for alignment, good aesthetic and function.

CONCLUSION: The increased frequency of DDM with crowding was caused by premature extraction and decay of the temporary dentition. The main consequence is loss of space with displacement of the last teeth that should erupt, canines on the upper jaw and second premolar on the lower jaw. This study reveals an increasing incidence rate and attracts a warning on the importance of knowing the aetiology, clinical aspects and especially prevention.

443 EFFECTS OF SELF-ETCHING PRIMERS ON THE SHEAR BOND STRENGTH OF ORTHODONTIC BRACKETS.

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AIM: To evaluate the shear bond strength (SBS) of an antimicrobial and fluoridereleasing self-etch primer (SEP; Clearfil Protect Bond) and to compare it with Transbond Plus SEP and a conventional acid etching and priming system.

MATERIALS AND METHOD: Forty-eight extracted human premolars were divided randomly into three groups. In group 1, the teeth were bonded with conventional acid etching and priming method, in group 2 with Clearfil Protect Bond SEP and in group 3 with Transbond Plus SEP. The samples were stored in 37°C distilled water and thermocycled. The SBS of the sample was then evaluated with a Zwick testing machine. Descriptive statistics, analysis of variances (ANOVA), Tukey's and Kruskal-Wallis tests were used to analyze the data.

RESULTS: ANOVA showed that the mean of group 3 was significantly lower than the other groups. Most of the sample showed a pattern of failure within the adhesive resin.

CONCLUSION: Clearfil Protect Bond and Transbond Plus SEP have sufficient SBS to bond orthodontic brackets. The mode of failure of bonded brackets with these two SEPs is safe for enamel.

444 EFFECT OF SURFACE TREATMENT ON THE BOND STRENGTH OF ORTHODONTIC BRACKETS TO RESIN COMPOSITE SURFACES

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AIM: To evaluate the effects of different surface treatments, time and orthodontic adhesive type on the shear bond strength (SBS) of brackets on different resin composites.

MATERIALS AND METHOD: Two hundred and four discs of two restorative composites (Z100 and point4) were prepared and divided into two equal groups and then mounted in acrylic blocks. Half of specimens of each group (52) were stored in distilled water at 37°C for 3 months before bonding to evaluate the effect of water ageing. Each of the four groups was again divided into four groups of 13 specimens according to the surface treatment (application of diamond bur followed by phosphoric acid etching or phosphoric acid etching alone) and the adhesive system used (chemical and light cured). SBS was measured with a Dartec testing machine after bracket bonding. Statistical analysis was undertaken with four-way analysis of variance.

RESULTS: There was no statistically significant difference between the two restorative composite materials (P = 0.529). Other studied variables (time, surface treatment type and orthodontic adhesive type) had a significant effect on SBS between orthodontic brackets and composite resin surface (P < 0.05).

CONCLUSION: Surface treatment, orthodontic adhesive type and timing after composite setting influences bracket bonding on composite surfaces. Application of light cured orthodontic adhesives after surface roughening by bur and acid etching can increase bond strength.

445TEMPOROMANDIBULAR JOINT EFFECTS OF HERBST TREATMENT

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AIM: To show the effects of the Herbst appliance use on the temporomandibular joint (TMJ).

MATERIALS AND METHOD: A literature review of dental and orthodontic journals from 1979 to 2011 was carried out using the Medline database and Silverplatter CISNE database. The pre- and post-treatment lateral cephalograms of a sample of skeletal Class II patients treated with a Herbst appliance for 24 hours a day for an average of 6 months were also evaluated.

RESULTS: Herbst treatment produced bone remodelling of the glenoid fossa and condyle in a posterior direction. Condylar growth was greater in the vertical plane. After treatment, the condyle was placed in a centred position into the glenoid fossa. Articular disk morphology was not modified although there was advancement of the disk position as a result of condylar and glenoid fossa morphological changes. The articular disk, condyle and glenoid fossa relationships were not modified. Other structures related to the TMJ were also modified during treatment, although they regularized after removal of the Herbst appliance. All these changes improved maxillomandibular relationships. It was not shown that use of the Herbst appliance caused temporomandibular dysfunction. In contrast, it allowed better maxillomandibular relationships decreasing the risk of any other TMJ pathology.

CONCLUSION: Use of a Herbst appliance 24 hours a day for 6 months in patients with skeletal Class II malocclusions, produces an anterior and inferior mandibular advancement. It occurs as a result of condylar and glenoid fossa structural changes. Therefore, use of this device produces an improvement in maxillomandibular skeletal relationships, improving Class II or even achieving a Class I.

446 SURFACE TREATMENT OF ORTHODONTIC NICKEL TITANIUM WIRES

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AIM: To evaluate the influence of surface treatment on friction of orthodontic wires. In this *in vitro* study, hydrogenated amorphous carbon films were deposited on orthodontics brackets by radio frequency plasma-enhanced chemical vapour deposition (RF PECVD). Since friction is a function of the wire surfaces and brackets, it is important to evaluate them after coating.

MATERIALS AND METHOD: The technique chosen for the deposition of diamondlike carbon (DLC) film was RF PECVD. The structural arrangement of DLC films was probed by Raman spectroscopy and adhesion was evaluated by scratching. The samples were divided into two groups, with and without surface treatment, and frictional forces were measured with a custom made jig. Coil spring traction was applied in an axial direction and deformation of the spring and the variation of this force over time was recorded to determine frictional force. The friction force was recorded via a load cell (A5, Alpha Instruments) that sent signals to an instrument for acquiring and processing data type (Lab View). The sliding speed used was 5 mm/minute and the test duration was 300 seconds. From the data obtained, it was possible to plot the force versus time curves. The values were compared using a Student's *t*-test.

RESULTS: Nickel titanium (NiTi) wire did not show a statistically significant difference (P > 0.05) in friction after surface treatment.

CONCLUSION: DLC surface treatment of superelastic NiTi wires proved effective for use in orthodontics since it effectively protects the wire and does not interfere negatively with the coefficient of friction of stainless steel bracket/superelastic NiTi wire.

447 RESISTANCE TO ACID CORROSION: COPPER NICKEL TITANIUM ARCHWIRES VERSUS BRAIDED STAINLESS STEEL ARCHWIRES

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AIM: To compare resistance to corrosion in a low pH environment of two types of orthodontic archwires used in the early stages of treatment.

MATERIALS AND METHOD: Ten braided stainless steel (D-rect®) and 10 coppernickel-titanium (Copper Ni-Ti 35®) 0.017×0.025 inches archwires. Scanning electronic microscopy and Castaing microprobe were used to establish composition of one archwire of each type. Ten archwires of each type were immersed during one hour in artificial saliva, acidified by citric acid adjunction (pH = 2.52). The electrochemical behaviour of the wires was characterized by defining the corrosion potential according to time (Ecorr) and the corrosion current intensity according to potential (Icorr).

RESULTS: Metal composition analysis shows that D-rect® contained, in massic percentage, iron (62.36%), chromium (17,01%) and nickel (7.80%), whereas copper Ni-Ti 35® contained nickel (46.75%), titanium (45.58%) and copper (5.47%). Electrochemical analyses showed: D-rect® Ecorr = 256.35 ± 71.27 mV; D-rect® Icorr = $13.25 \pm 2.24 \times 10^{-6}$ mA; Copper Ni-Ti 35® Ecorr = -384.51 ± 172.81 mV; copper Ni-Ti 35® Icorr = $2.36 \pm 0.47 \times 10^{-6}$ mA. Ecorr, as well as Icorr, were higher for D-rect®. The Mann-Whitney *U* test showed a highly significant difference for both tests (*P* < 0.001) between the two archwires.

CONCLUSION: Braided stainless steel archwires have better resistance to acidcorrosion than copper NiTi archwires (higher D-rect® Ecorr). However once the copper NiTi corrosion process is initiated, corrosion slows down due to the formation of a passivation layer (lower Copper Ni-Ti 35® Icorr). Would this passivation layer explain why allergies due to nickel-rich copper Ni-Ti 35® archwires are so rarely reported?

448 DOES PREVALENCE OF OCCLUSAL PROBLEMS INCREASE FROM THE PRIMARY TO THE PERMANENT DENTITION?

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AIM: To assess the prevalence and type of malocclusion in preschool and school children, to compare both groups, and to determine whether severe occlusal problems are more frequent in the primary than in the permanent dentition.

SUBJECTS AND METHOD: One hundred children (5- 14 years) randomly selected, without previous orthodontic treatment. Occlusal anteroposterior relationships were assessed based on Angle's classification. Other variables examined were overjet, overbite and midline.

RESULTS: Eight per cent of children in the primary dentition had an Angle Class II malocclusion, while 6 per cent were Angle Class III. An increased overjet was found in 16 per cent of respondents. An open bite was registered in 6 per cent, and midline discrepancies in 6 per cent. In the permanent dentition 28 per cent of children had an Angle Class II and 8 per cent an Angle Class III. An increased overjet was found in 46 per cent, an open bite in 10 per cent, and a midline discrepancy in 42 per cent.

CONCLUSION: Prevalence of occlusal problems increased from the primary to the permanent dentition. There appears to be a need for early orthodontic treatment, which can lead to resolution of problems or easier treatment in later periods.

449 MAXIMUM MOUTH OPENING, MAXIMUM LATEROTRUSION AND CONDYLAR PATH INCLINATION IN CHILDREN

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AIM: To describe the normal range of mandibular movements and condylar kinematics in children, and to test the null hypothesis that these variables are not associated with gender, facial type and weight.

SUBJECTS AND METHOD: Ninety-two healthy children (7.2-10.6 years of age) and 40 adult controls (18-34.7 years of age). Examination included maximal mouth opening capacity and laterotrusions to the right and to the left. The condylar path inclination angle was calculated at 3 and 5 mm protrusion of the mandible. Kinematic variables were registered using the ultrasonic JMA system. Statistical data analysis was carried out with the SPSSTM release 17 software (SPSS Inc., Chicago, Illinois, USA). Robustness of categorical data (facial type, gender) allowed the use of one-way analyses of variance. Associations of body weight with the dependent kinematic variables were described using Spearman's rank correlation rho.

RESULTS: Maximal mouth opening capacity averaged 46.73 mm for the children and 53.53 mm for the adults. The mean values of the lateral movements were 9.36 mm to the right and 9.62 mm to the left for the boys, and 9.91 and 9.68 mm for the girls, respectively. Mean condylar path inclination in the children was 36.5 (right) and 36.2 (left) at 3 mm of protrusive movement, and 34.3 (right) and 34.0 (left) at 5 mm of protrusive movement. Associations of the kinematic variables with gender, weight, or facial type were insignificant.

CONCLUSION: Younger school children have not yet reached the maximum mouthopening capacity. Correlation analysis suggests some weak, but insignificant associations of gender, facial type and weight with mouth opening, laterotrusions and the condylar path inclination angle. The null hypothesis was not rejected.

450 GINGIVAL CLEFTS – A POTENTIAL RISK FOR ORAL HEALTH AND ORTHODONTIC TREATMENT?

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AIM: To evaluate the incidence of gingival clefts and their impact on oral health and orthodontic treatment outcome.

SUBJECTS AND METHOD: Thirty patients with completed orthodontic treatment involving tooth extractions. Altogether 101 extraction areas were included. Forty extraction areas demonstrated gingival clefts, the others served as the control. Clinical and treatment related parameters e.g. probing depth, completeness of space closure or time from extraction to space closure were recorded. Microbiological probes from the gingival clefts, pool probes of the sulci and a polymorphism for Interleukin-1 (IL-1) were evaluated. For statistical analysis Newman-Keuls *post hoc* test or linear regression was performed. *P* values were set at 0.05.

RESULTS: Gingival clefts occurred significantly more in the lower than in the upper jaw. Thirty per cent of the extraction sites with gingival clefts showed reopening of the tooth contact after space closure versus 0 per cent in the control. The development of gingival clefts was highly correlated with the time from extraction to the beginning of space closure. Microbiological findings indicated an independent and partially periodontal pathogen microflora in the gingival cleft compared with the pool probes. The IL-1 polymorphism showed a tendency to be an influencing factor for development of gingival clefts.

CONCLUSION: The stability of orthodontic treatment is endangered by the occurrence of gingival clefts and their impact on oral health cannot be foreseen from the current state of knowledge. Further research and more effort must be undertaken to avoid gingival clefts in orthodontic treatment.

451 NUMERICAL SIMULATION AND BIOMECHANICAL ANALYSIS OF ORTHODONTIC TREATMENT OF SUBJECTS WITH SEVERE ATTACHMENT LOSS***

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AIM: To analyse the biomechanical behaviour of teeth in selected orthodontic loading cases after severe vertical alveolar bone loss.

MATERIALS AND METHOD: Four cone beam computed tomographic data sets from dental patients were anonymously selected. These patients underwent periodontal treatment after generalised periodontitis and were scheduled for subsequent orthodontic treatment. Residual bone height was measured in the upper anterior region and mean bone loss was calculated. Using this data and tooth positions of one patient, an idealised three-dimensional finite element model of the periodontally damaged dentition was generated and discretised with tetrahedral elements. Material parameters of tooth (E = 20 GPa), healthy periodontal ligament (PDL) (bilinear elastic, E1 = 0.05 MPa, E2 = 0.22 MPa, e12 = 7.5%) and bone (homogeneous, isotropic, E = 2 GPa) were taken from previous experimental/numerical studies. In a further step, parameters of PDL were varied in order to simulate periodontal destruction. Incisor intrusion was simulated with an intrusive force of 0.8 N for the anterior segment (12 to 22) employing Burstone's segmented arch technique. Pure couples of forces were applied to determine the

locations of the centres of resistance (CR). For comparison, the same simulations were conducted with a model of a healthy situation.

RESULTS: Comparison of diseased and healthy models showed: 1. At equal forces high strains (0.12 μ strain) occurred in the disease model, while values remained normal in the healthy situation. 2. At 0.8 N, small foci of increased strains resulted, in particular at the second incisors. 3. A reason for the increase in periodontal loading was the loss of alveolar bone height, which was reflected by the shift of the CR to the root apex from one-third to roughly two-thirds of the root length.

CONCLUSION: Periodontal loading increased drastically with loss in alveolar bone height. As this is correlated with the root volume surrounded by bone, the relationship is non-linear. A respective rule for force adaptation must be derived.

452 DENTISTS' OPINIONS TOWARD ORTHODONTIC BONDED RETAINERS IN THE NETHERLANDS

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AIM: Prolonged orthodontic retention and potential side effects of bonded retainers require long-term supervision by orthodontists and/or dentists. The aim of this study was to survey dentists' opinion toward bonded retainers in the Netherlands.

SUBJECTS AND METHOD: Two hundred Dutch dentists were randomly selected. Four researchers conducted telephone interviews using a questionnaire that consisted of multiple choice questions focusing on (1) retainer failures and repairs, (2) advantages and side effects, (3) communication of orthodontists with dentists, and (4) the issue of who is responsible for retainer supervision. A preliminarily letter was sent to inform the dentists of the aim and importance of the study.

RESULTS: One hundred eighty three dentists (91.5%) answered the questions. The vast majority (95%) were satisfied with the effectiveness of bonded retainers. Problems with restorations and with removal of calculus was mentioned by 80 and 67 per cent of the respondents, respectively. One-third of the dentists were not familiar with possible retainer side effects, such as torque differences between adjacent teeth. Orthodontists' communication with dentists regarding bonded retainers was inadequate. One-third of the respondents agreed that the orthodontist, and the dentist, and the patient have a combined responsibility for the retainer.

CONCLUSION: (1) A bonded retainer hinders the dentist in daily practice, since problems with restorations and with removal of calculus was mentioned by a high percentage of the respondents; (2) Dentists need to be informed about the possible side effects of a bonded retainer; (3) Communication between orthodontists and dentists pertaining to orthodontic retainers should be improved; (4) There is no agreement regarding responsibility for the orthodontic bonded retainer, which results in suboptimal care for patients after active orthodontic treatment.

453 THREE-DIMENSIONAL VOLUMETRIC EVALUATION OF SOFT TISSUE ASYMMETRY DURING SOCIAL SMILING IN AN ADULT POPULATION

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AIM: To evaluate the prevalence and characteristics of an asymmetric social smile (regardless of the hard tissues) in a population.

SUBJECTS AND METHOD: Three hundred randomly selected individuals between 20 and 50 years of age. Two groups of the same size (females and males) were

scanned with a Di3D face scanner. Multiple scans were undertaken so that the most average social smile expression of an individual was chosen and analyzed. The asymmetry was evaluated in the native software environment (Di3D) and also in Dolphin imaging and Anatomage software. Smile midline definition was defined by a researcher. Asymmetric soft tissues shape and positioning in the face was evaluated. Patients with a fraenulum or lip surgery were excluded.

RESULTS: Nine per cent of analyzed subjects had an asymmetric smile secondary to canting of the upper lip. There was no statistically significant difference in the amount of symmetry among the facial thirds within each gender (P > 0.05). The average linear parameters values were less than 1 mm and did not differ significantly between genders (P > 0.05). One angular parameter showed slight lip line asymmetry in both genders.

CONCLUSION: Greater elevation of the lip on one side of a smile, which is an innate characteristic that cannot be changed, gives the appearance of a cant to the maxillary dentition when it is symmetric. For a patient who complains about smile asymmetry, they must understand that asymmetric lip movements will not be changed by treatment. Although there was not a high incidence, the results indicate there is clinically evident upper lip canting associated with smiling in the adult population that needs to be considered in patients undergoing orthognathic and cosmetic surgery.

454 TOOTH NUMBER AND MORPHOLOGY IN PATIENTS WITH A CLEFT LIP AND PALATE

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AIM: To identify the prevalence of malformations and number of teeth in a group of individuals with unilateral cleft lip (UCL), isolated cleft palate (ICP) and combined cleft lip and palate (CLP).

SUBJECTS AND METHOD: Ninety patients, 30 with a UCL, 30 with an ICP and 30 with a unilateral combined CLP. The material included panoramic radiographs, single dental radiographs, intraoral photographs and patient records. Analysis of the dentition was based on visual inspection of the clinical photographs and panoramic radiographs. Agenesis, supernumerary teeth, narrow crowns and short roots with abnormal morphology were listed. In addition, information about operations and extractions was available from the records.

RESULTS: UCL group: In this group supernumerary lateral incisors in the cleft area were found in 10 cases, agenesis of lateral incisors in four cases and deviant morphology of the incisors in 11 cases. Combined CLP group: Lateral incisor agenesis was found in 15 cases and supernumerary lateral incisors in three cases. Deviant morphology of the incisors was found in 21 cases in the cleft area and malformed roots in the molar/premolar area in 16 cases. ICP: Anterior agenesis was seen in three cases, in the premolar/molar area in three cases and malformed roots in 16 cases.

CONCLUSION: In the various cleft types there is great variation in the incidence of agenesis, supernumerary teeth and malformations. The different patterns of dental abnormalities are important contributors to the phenotypic and genotypic understanding of the three cleft types.

455 FEASIBILITY OF REUSING ORTHODONTIC BANDS AFTER INTRAORAL USE – CONTROL OF CROSS INFECTION

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AIM: To evaluate the effectiveness of two methods of sterilization and disinfection of orthodontic bands, after use in the mouth. Simultaneously, the protocol of the Department of Orthodontics, Dental Faculty, Oporto University (DO-DFOU) was tested.

MATERIALS AND METHOD: Thirty-five orthodontic bands were placed on the first molars of 10 individuals. They were removed from the mouth and five were separated for the positive control. The remaining 30 bands were immersed in an ultrasonic bath with disinfectant (Elusept®) for 15 minutes and then divided into three groups. The first served as disinfection control, the second and third were subjected to additional sterilization with dry heat (210°C, 30 minutes) and steam (121°C, 33 minutes), respectively. The third group simulated the protocol of the DO-DFOU. Finally, each band was placed in a phosphate buffer saline solution to remove adherent microorganisms and the resulting suspension was inoculated in a nutrient agar. The number of colony-forming units (CFU) was observed in each plate after 4 days of incubation at 37°C. In order to relate the results and meet the international standards, a literature search was performed of the PubMed database using the keywords: cross infection control, orthodontics, orthodontic bands, decontamination, sterilization, disinfection. Twenty-five articles and two books were selected.

RESULTS: The samples used as positive controls presented a high number of CFUs while those that underwent different disinfection treatments did not show CFUs.

CONCLUSION: Considering the methodology used, based on the study of bacterial life forms and that all guidelines for decontamination have been strictly applied, all decontamination methods have proved to be effective and the DO-DFOU protocol is safe. Therefore orthodontic bands can be reused taking into account the guidelines for decontamination.

456 EFFECT OF 'BLACK TRIANGLES' ON THE PERCEPTION OF SMILE AESTHETICS

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AIM: To assess the effect of black triangles on the perception of smile aesthetics among orthodontists, general dentists and lay people.

MATERIALS AND METHOD: A photograph of a smile without black triangles was selected and digitally manipulated using Adobe Photoshop C3 (Adobe Systems Inc., San Jose, California, USA.) in order to generate five additional images: one with a black triangle between 11 and 12, a second image with black triangles between 11 and 12 and 21 and 22, a third with black triangles between 11 and 21 and 11 and 12, a fourth with black triangles between central incisors and a fifth with black triangles between 11 and 12, and 11 and 12, a fourth with black triangles between central incisors and a fifth with black triangles between 11 and 12, a fourth with black triangles between 21 and 22. The six images were evaluated by 30 orthodontists, 30 general dentists and 30 members of the general public. The average age of the three groups was between 40 and 50 years. Gender distribution in each group was 15:15. The subjects awarded each photograph a score: 1 if the image was thought aesthetically acceptable, 2 if it was considered moderately acceptable, 3 if it was considered aesthetically unacceptable. Data were analysed with the Kruskal-Wallis (P < 0.05) and Mann-Whitney tests, applying Bonferroni's correction (P < 0.016).

RESULTS: Of the six images evaluated, the only significant difference detected between the three groups (P < 0.05) was in the evaluation of the image showing black

triangles between 11 and 12 and between 21 and 22. These differences (P < 0.016) occurred between orthodontists (median = 2) and the general population (median = 1). CONCLUSION: Orthodontists, dentists and lay people evaluate the presence of black triangles between anterior teeth in the same way, except when these are situated between 11 and 12 and between 21 and 22; in this case orthodontists take a more critical view than the general public.

457 RANKL PRODUCTION IN PERIODONTAL LIGAMENT CELLS UNDER COMBINED STIMULATION WITH COMPRESSIVE FORCE AND HEAT-INACTIVED A. ACTINOMYCETEMCOMITANS

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AIM: The up-regulation of gene expression and production of receptor activator of nuclear Kappa B ligand (RANKL), an osteoclast differentiation-stimulating factor, by periodontal ligament (PDL) cells has multiple aetiological factors, such as mechanical stress or presence of lipopolysaccharides (LPS) from periodontal-pathogen bacteria. However, the effect of combined action LPS and mechanical force on RANKL production in PDL cells is poorly understood. For that reason, the effect of RANKL production in PDL cells, were stimulated by bacterial lysates from *A. actinomycetemcomitans* and compressive force, was studied.

MATERIALS AND METHOD: Human PDL cells were distressed with compressive force (2 g/cm²) or or 1×10^7 CFU/ml of *A. actinomycetemcomitans* alone. Then, both factors, heat-inactivated bacteria and mechanical stress, were applied to a PDL cell culture. The biological readout took place by reverse transcription real time polymerase chain reaction and protein quantification of RANKL.

RESULTS: As expected, treatment of PDL cells with compressive force or periodontal-pathogens stimulated the expression of RANKL at the transcriptional and translational level. However, the combination of compressive force and heat-inactivated *A. actinomycetemcomitans* activated RANKL gene expression synergistically. The production of RANKL protein was increased in PDL cells treated with compressive force and periodontal-pathogens as compared with cells stimulated by mechanical stress or *A. actinomycemtemcomitans* alone.

CONCLUSION: The presence of periodontal-pathogen bacteria may have deleterious effects on bone remodelling during orthodontic tooth movement by stimulating osteoclast-activating factors such as RANKL.

458 RELIABILITY OF THREE DIMENSIONAL SUPERIMPOSITIONS IN UPPER MOLAR DISTALIZATION TREATMENT

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AIM: To establish an easy method to obtain three-dimensional (3D) superimpositions of cone beam computed tomographs (CBCT) on stable anatomical landmarks in growing patients.

SUBJECTS AND METHOD: Six patients with a Class II molar relationship who had undergone a tomographic examination before and after distalization of the upper first molars, using two appliances: the Hilgers' Pendulum and the MGBM system. The results were compared with two-dimensional superimpositions done with the 'best fit' and the structural method by Björk. The examination consisted of an IlumaTM CBCT, set at 0.3 mm² voxel dimension. The realization process was divided into three steps: image orientation, in order to orientate each volume at the same position; volume segmentation, to reconstruct the 3D images of every anatomical structure that will be superimposed and localization of the same landmarks on the two volumes.

RESULTS: The superimposition method proposed may be considered acceptable since the variation between the two volumes corresponded to the dental and skeletal changes induced by treatment, and comparison with the two-dimensional (2D) superimpositions. The final result is not complete because it cannot be used to quantify the extent of growth or displacement induced by treatment. Comparison with the 2D superimpositions also highlighted the limitations of teleradiography and the advantages of CBCT. The teleradiography has some basic errors that do not permit unique landmark localization. CBCT allowed evaluation of every anatomical structure with no image superimposition or magnification, the sagittal and vertical variations of the different patient's sides and the condylar and dental root position.

CONCLUSION: Converting all diagnostic tools in three-dimensions is the ultimate aim and this method can be a starting point to create a system accessible to all the orthodontists.

459 HOW CAN WE ASSESS THE IMPACT OF DENTAL APPEARANCE ON MALOCCLUSION/ORTHODONTIC TREATMENT NEED

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AIM: To assess current tools used to evaluate the impact of dental aesthetics on psychosocial features of the quality of life of subjects affected by malocclusion.

MATERIALS AND METHOD: One electronic database, Medline via PubMed, was utilized to find studies about the psychological and social impact of dental aesthetic from January 1975 to July 2011. Electronic research was integrated by reference linkage. Successively, eligible articles were reviewed and the tools used to evaluate the psychosocial impact of dental aesthetic were registered.

RESULTS: From 80 reviewed articles, 69 were selected for their availability and their relevance; studies that dealt with orthognathic surgery were excluded. Of the 69 eligible, eight were reviews and four were prospective studies. The more frequent instruments utilized were: Psychosocial Impact of Aesthetic Questionnaire (PIDAQ), Oral Aesthetic Subjective Impact Scale (OASIS), Oral Impact Daily Performance (OIDP), Children Perception Questionnaire (CPQ) and Oral Health Impact Profile (OHIP). PIDAQ was developed for young adults and met the criteria of a good instrument. OASIS, which was utilized above all in studies of children and adolescents, was simple and direct and could be used as a measure for orthodontic treatment need. CPQ was the most utilized but was criticized by children; in fact some questions were not considered relevant. OIDP based its evaluation of how much malocclusion and oral problems affect main daily tasks. OHIP was the first questionnaire introduced for seniors to provide a comprehensive measure of self-reported dysfunction, discomfort and disability attributed to oral health.

CONCLUSION: OHIP, OIDP and CPQ are questionnaires evaluating all spheres of the Oral Health Related Quality of Life, while PIDAQ and OASIS were developed specifically to evaluate how dental aesthetics influence social and psychological behaviour. Although there are many suitable means, it is necessary to investigate further issues related to a patient's personality and their opinions.

460 QUALITY OF LIFE IN PATIENTS REQUIRING ORTHODONTIC TREATMENT

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AIM: To assess current opinion about the impact of dental appearance, due to malocclusion/orthodontic treatment need, on social and psychological aspects of the quality of life (QoL).

MATERIALS AND METHOD: Medline, via PubMed, was used to search for articles regarding the impact of malocclusion/orthodontic treatment need on psychosocial aspects of the QoL published since January 1975 to July 2011. Electronic researches were integrated by reference linkage. Eligible articles were reviewed.

RESULTS: From 80 reviewed articles, 69 were selected for their availability and relevance; studies that dealt with orthognathic surgery were rejected. Eight of these articles were reviews. Of 69 eligible articles 43 were conducted among child/adolescent populations. The majority of the studies evaluated orthodontic treatment need through standardized indices such as the Dental Aesthetic Index and Index of Orthodontic Treatment Need. The tools more used to assess the psychosocial impacts on quality of life were the Child Perception Questionnaire (CPO) and Oral Impacts of Daily Performance (OIDP), which are two questionnaires evaluating the Oral Health Related Quality of Life. According to these studies, aesthetic and social aspects are motives for seeking orthodontic treatment. Moreover, among children severe malocclusions are the cause of teasing and severe upsets. Upper anterior crowding >2 mm, median diastema >2 mm, overjet >4 mm are the malocclusion characteristics affecting psychosocial and social aspects of the QoL. In adults, individuals with malocclusions might develop feelings of shame about their dental arrangement, and may feel shy in social contacts.

CONCLUSION: Dental aesthetics contribute to the psychosocial well-being of children, adolescents and adults. However, current studies suffer from a lack of some instruments that integrate psychological aspects and the perception of psychosocial impacts of dental aesthetics.

461 EFFICACY OF HAAS RAPID PALATAL EXPANDER ANCHORED ON THE PRIMARY TEETH TO CORRECT ANTERIOR CROSSBITES IN THE EARLY MIXED DENTITION.

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AIM: An anterior crossbite requires early correction in order to avoid enamel abrasion or fracture, dental compensation, gingival recession, tooth mobility and temporary mandibular joint disease. The aim of this study was to evaluate the effectiveness of a Haas rapid palatal expander (RPE) anchored on the primary teeth to induce spontaneous correction of permanent incisor crossbite in the early mixed dentition.

MATERIALS AND METHOD: A retrospective study was conducted on 52 patients (32 males, 20 females) mean age 8 years 4 months showing an anterior crossbite of one or more permanent incisors. The total number of maxillary permanent incisors in crossbite was 74: 12 URLPI, 22 URCPI, 26 ULCPI, 14 ULLPI. The patients were treated with a Haas RPE anchored on the primary teeth. The appliance was activated once a day until the anterior space was considered to be adequate for incisor eruption and/or alignment.

RESULTS: After RPE use, the anterior crossbite was corrected spontaneously in 86.49 per cent of the sample. In the event of self-correction, this usually occurred within two months from the start of treatment. No statistical difference was found between correction of the central and lateral incisors.

CONCLUSION: A RPE on the primary teeth is an efficient and effective procedure to obtain spontaneous correction of an anterior crossbite in the mixed dentition.

462 LONG-TERM ASSESSMENT OF PERIODONTAL STATUS AFTER ORTHODONTIC TREATMENT IN ADULT PATIENTS

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AIM: To improve aesthetics and functional status in periodontal patients requiring orthodontic treatment.

SUBJECTS AND METHOD: Twenty subjects (mean age: 57.6 years) with moderate-advanced chronic periodontitis and complete occlusal disturbances. The following parameters were recorded for every patient: bleeding on probing, periodontal pocket depth, attachment loss and tooth loss. All of them, except attachment loss, were recorded at the following time points: previous periodontal treatment (baseline), before and after orthodontic treatment and at the 5 year follow-up. Attachment loss was recorded at baseline and at the 5 year follow-up.

RESULTS: There was a high degree of dental stabilization as well as a high survival rate.

CONCLUSION: Use of fixed orthodontic appliances in patients with advanced periodontal attachment loss is not necessarily related to a worsening of the periodontal conditions.

463 STABILOMETRIC CHANGES DURING ORTHODONTIC TREATMENT WITH REMOVABLE FUNCTIONAL APPLIANCES FOR DISTAL OCCLUSION I Rubleva, M Markova, L S Persin, A Slabkovskaya, Department of Orthodontics, Moscow State University of Medicine and Dentistry, Russia

AIM: To define the influence of removable functional appliances on stabilometric parameters in children with distal occlusion

SUBJECTS AND METHOD: Sixty-five children, aged 8-12 years, divided into three groups: group 1 (control), 25 children with a normal occlusion, group 2, 20 children with a distal occlusion treated with a pre-orthodontic trainer, and group 3, 20 children treated with Persin's appliance for distal occlusion. The children were investigated on a stabilometric platform before, on day 1, and after 3 and 6 months of treatment.

RESULTS: Comparison of groups 2 and 3 with group 1 revealed significant changes in the key parameters. There was an improvement of stabilometric parameters in groups 2 and 3. In group 3 the crossed distance reduced to 2 times, and in group 2 -1.6 times. The sway area was reduced 1.9 and 2.2 times in groups 2 and 3, respectively. The ellipse surface in group 3 decreased by 3.8 times while in group 2 the reduction was 3.1 times. The parameters of the statokineziograms in patients whose treatment was undertaken with individually-made devices, improved more than in the group of children treated with standard structures. At 3 and 6 months, the stabilometric study showed significant improvement of the main parameters in 75 per cent of patients with distal occlusion.

CONCLUSION: Orthodontic treatment with appliances for mandibular movement in children with distal occlusion significantly improved postural balance.

464 FACIAL PROFILE AESTHETIC PARAMETERS AFTER ORTHOGNATHIC SURGERY: EFFECTIVENESS OF TRUE VERTICAL M^a B Ruiz Navarro, E Espinar Escalona, J M Llamas Carreras, J M Barrera Mora, E

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AIM: To determine which facial features are the most and least valued when considering facial profile aesthetics and the relationship existing between such proportions with clinical standards established for surgical planning.

MATERIALS AND METHOD: A series of black and white profile photographs of patients with Class II and III malocclusions before and after orthognathic surgery, and normocclusion skeletal Class I models without orthodontic treatment were shown to three different groups of observers (orthodontists, maxillofacial surgeons and lay persons). The profiles were aesthetically assessed by the observers. They were also asked to highlight the features that lead them to make their decision. The most and least valued profiles were selected and statistical analysis was performed to assess the best and worst quality characteristics.

RESULTS: The profiles considered more aesthetic showed a protrusive upper lip. Chin (Pg'), nasal projection and nasolabial angle showed mean values that met the standard in subnasal true vertical. Cephalometrically point B' and Pogonion were more positively evaluated in the post-surgical and normocclusion profiles. The worst results were for the Class II pre-surgical patients. For the Class III profiles the upper lip and point A' were the most valued.

CONCLUSION: The use of true vertical as an aesthetic parameter to perform surgical planning is effective in terms of evaluating the results obtained by the surveyed population. The profiles considered more aesthetic correspond to postsurgical patients and those with a normocclusion, which meet the clinical standard in Sn TV. The profiles away from this standard, both Class II and III, showed the lowest scores. This measure is sufficiently sensitive to diagnose the aesthetics of the profile.

465 EFFECTS OF MEDICATION ON ORTHODONTIC TOOTH MOVEMENT M Ruiz Soler, J Fernández Paz, A García Cabrera, R Vignolo Lobato, Á Gutiérrez Pastor, Ortodoncia UPC, Universidad Politecnica de Cataluña Centro de Estudios Superiores Vitaldent, Barcelona, Spain

AIM: Several reviews have been published on the effects of medication on tooth movement. This study aimed to synthesize the effect of some of the main drugs on tooth movement.

MATERIALS AND METHOD: A review, using PubMed (1992-Oct 2011), on the effects of medication and dietary supplements on orthodontic tooth movement was carried out.

RESULTS: Ibuprofen, acetylsalicylic acid, flurbiprofen, thiazide diuretics, ipriflavone, progestogens, fluorides and, calcium reduce tooth movement. Anabolic steroids, PGI₂, PGE₂, PGE₁, misoprostol, vitamins D3, K2 and D and corticosteroids stimulate tooth movement. Rofecoxib, acetaminophen, polyunsaturated fatty acids and prednisone seem not to affect tooth movement.

CONCLUSION: At the beginning of orthodontic treatment it is important to know the medication that the patient is taking and how it affects treatment.

466 RELATIONSHIP BETWEEN ERUPTION DISORDERS OF SIX-YEAR MOLARS AND OTHER TYPES OF MALOCCLUSION IN THE MIXED DENTITION

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AIM: To analyse the prevalence of eruption disorders in six-year molars, and to study the relationship between eruption disorders of the first permanent molars and the occurrence of other types of malocclusion in the early mixed dentition. SUBJECTS AND METHOD: Eight thousand and forty one randomly selected mixed dentition children were examined in a comprehensive cross-sectional study. Clinical examinations were performed in two subsequent school years within the regular dental screening of the school children. The average age of the study sample was 6.9 years. Disturbances in eruption of the first permanent molars were recorded when: (1) the distal cusps of the molars had erupted further than their mesial cusps, (2) the occlusal surface of the molars was mesially inclined and (3) when the first permanent molars had erupted beneath second primary molars.

RESULTS: A disturbed eruption of the first permanent molars was found in 102 children of the total sample (1.3%). The upper first permanent molars were affected more often (88.5%) than the lower first molars. Bilateral disturbed eruption of the upper first molars was the most frequent combination of symptoms found. Although disturbed eruption was diagnosed more often in 6 and 7-year old children, 20 per cent of the recorded eruption disturbances were still found in 8-year olds. Crowding ($P \le 0.001$), lateral crossbite ($P \le 0.001$) and mandibular prognathism (P = 0.010) were found significantly more often in children with eruption disorders.

CONCLUSION: Although eruption disorders of the first permanent molars occur rarely in young children, they are early predictors for future dental arch problems, especially in the sagittal and transverse dimensions. Disturbances in eruption of the six-year molars are easy to detect clinically and should be diagnosed on time. After then early interceptive measures can help correct future space or interarch problems more efficiently.

467 ACTIVE AND PASSIVE SELF-LIGATION BRACKET PRESCRIPTIONS: ROLE IN LOWER ANTERIOR TEETH LABIOLINGUAL ROOT ORIENTATION R Salih, Orthodontic Department, Hjoerring Community Dentistry, Denmark

AIM: To analyse the ability of two types of self-ligating brackets (SLB) systems in controlling torque using three-dimensional (3D) imaging techniques.

SUBJECTS AND METHOD: Forty-nine patients treated using two types of SLB systems: 29 received passive SLB (Damon 3MX®, Ormco) and 20 active SLB (In-Ovation R[®] Roth, Dentsply, GAC International). All brackets had a 0.022×0.028 The treatment protocol and wire sequences were performed as inch slot. recommended by the manufactures. All patients underwent pre- and post-treatment cone beam computed tomography (CBCT) scanning. A specific 3D analysis was developed to study the inclination and orientation of the lower anterior teeth based on the CBCT scans. Six teeth (from mandibular right to left canine) were studied for labiolingual orientation in relation to several planes. The long axis of the tooth was determined by the most coronal and apical points of the dental pulp. Two dental planes (frontal-orientated along the mesiodistal direction, and sagittal along the labiolingual direction) were defined. These two planes crossed each other perpendicularly at the tooth true long axis and formed the dental coordinate system. For each tooth the angular relationship to the occlusal were studied.

RESULTS: For each tooth the torque, expressed as the inclination of the frontal dental plane to the occlusal plane, exhibited a marked deviation from the manufacturers' prescribed values. Moreover, a large variation in inclination was seen between adjacent teeth. These results were true for both SLB systems.

CONCLUSION: The play between the wire and the brackets was considerably larger than that anticipated using the recommended finishing wires. This was truer for the passive brackets system than for the bracket system with the active clip.

468 CHANGES IN INCISOR POSITION AND THE WIDTH OF THE LOWER JAW IN PATIENTS TREATED WITHOUT EXTRACTIONS

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AIM: Despite the proven relationship between relapse and changes in the dental arch, the tendency is to undertake orthodontic treatment without extractions advocating expansion as a way of gaining space. The aim of the present study was to determinate the transverse and anteroposterior changes in the lower arch of patients treated without extractions when an attempt at not changing the dental arch had been made using three different arch forms, and to study the correlations between protrusion of the lower incisor and the dental discrepancy, the curve of Spee and the intercanine width (ICW), interpremolar width [for the first (1IPW) and second (2IPW) interpremolar width] and intermolar width (IMW) if the lower dental arch had changed.

SUBJECTS AND METHOD: Thirty-five patients with a mean of age of 14.8 years, treated without extractions. The MBT technique and a 0.022 inch slot were selected. Initial and final cephalometric radiographs and dental casts were digitized and measured using the Dolphin Imaging and Management Solutions® program. For statistical analysis Pearson's correlation coefficient, a paired Student's *t*-test and Student-Newman-Keuls's test were employed.

RESULTS: ICW, 1IPW, 2IPW and IMW increased significantly, on average 1.01, 1.39, 1.8 and 0.8 mm, respectively. AL did not change. There was, on average, lower incisor protrusion of 2.7 mm and 8 mm to APo and 5.8 degrees in Tweed's angle. There were significant correlations between protrusion of the lower incisor and dental discrepancy, ICW, 1IPW, 2IPW, IMW and the curve of Spee.

CONCLUSION: Despite trying to preserve the arch form, using three different arch types, a mild undesired expansion of the lower arch occurred. Expansion did not avoid lower incisor proclination. This protrusion is correlated with the discrepancy and the curve of Spee.

469 FREQUENCY AND TOOTH FORMATION STAGES OF DELAYED ERUPTION OF THE MAXILLARY FIRST MOLARS

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AIM: Congenital missing and delayed eruption of the maxillary first molars is rare. In a previous study, teeth (M1), i.e. erupted in the space of the maxillary first molar, were classified as delayed crown development from panoramic radiographs, and erupted 2 SD. The aim of this study was to clarify further details of delayed eruption of M1 by adding an additional 20 cases (total 73 cases).

MATERIALS AND METHOD: Panoramic check-up radiographs of the treatment of 73 patients (total 131 teeth) without eruption of M1 at the correct time with no systematic history. Formation of M1 and M2 (erupted in the space of the maxillary second molars) was evaluated using the method of Moorrees. These teeth were observed and evaluated longitudinally until their eruption.

RESULTS: Thirty-one out of 2001 patients were considered to have delayed eruption of M1 (1.55%), i.e. eight out of 806 male patients (0.99%) and 23 out of 1195 patients (1.92%), respectively. In 58 all subjects 73 cases (55 Angle Class III and eight Angle Class II cases), bilateral delayed eruption of M1 was observed (79.5%). Fifteen subjects exhibited unilateral delayed eruption of M1 (20.5%, right: 5, left: 10). Tooth formation of M1 developed between the average maxillary first and second molars.

CONCLUSION: M1 was erupted until R3/4 stage of Moorrees's tooth formation stages.

470 DENTOSKELETAL CHANGES IN SKELETAL CLASS II DIVISION 1 EARLY ADOLESCENTS AND YOUNG ADULTS TREATED WITH HERBST APPLIANCE

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AIM: To assess the effectiveness of Petrovic's analysis in the prediction of skeletal effects induced by the Herbst appliance in skeletal Class II division 1 early adolescents and young adults.

SUBJECTS AND METHOD: All Class II division 1 patients in the permanent dentition treated with a Herbst appliance between 2008 and 2010. For all 29 subjects lateral head films pre-treatment and after appliance removal were available. The films were analyzed by standard cephalometric analysis. According to their skeletal maturity, assessed using the cervical vertebral maturation (CVM) method, the subjects were divided into an adolescent group (AG, CVM 1 to CVM 5, n = 24) and a young adult group (YA, CVM 6, n = 5). The subjects in the AG and YA groups were then divided into sub-groups according to Petrovic's growth categories as follows: group AG (A1D, n = 5; A2D, n = 8; R2D, n = 6; R1N, n = 2; A1N, n = 3), group YA (A1D, n = 1; R2D, n = 3; A1N, n = 1). A *t*-test was used to evaluate variations between pre-and post-treatment cephalometric measurements.

RESULTS: The AG and AY groups patients were treated successfully to a Class I occlusal relationship with a normal overjet and overbite. Skeletal changes contributing to overjet and molar relationships were less in the YA group (10 and 16%, respectively) than in the AG group (63 and 55%, respectively). The mandibular base advancement, decrease in ANB angle and Wits appraisal observed in group AG were significantly higher than those in group YA. No statistically significant differences were observed among A1D, A2D, R2D, R1N and A1N sub-groups in the AG group.

CONCLUSION: Good treatment results were achieved in both adolescents and adults, however more skeletal effects were observed in the AG group. Within the limits of the present study, Petrovic analysis was not found to be predictive of the changes induced by the Herbst appliance.

471 NON-SURGICAL TREATMENT OF ANTERIOR OPEN BITES

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AIM: To present the orthodontic treatment of a number of adult and adolescent patients with an anterior open bite (AOB). The treatment objectives included establishing a stable occlusion and improving facial aesthetics through non-surgical orthodontic treatment.

SUBJECTS AND METHOD: Sixteen patients with AOBs of more than 5 mm. Five were treated with removable orthodontic appliances in the mixed dentition stage, and 11 in the permanent dentition were treated by a full bracket appliance. Pre- and post-treatment lateral cephalograms were traced and compared.

RESULTS: The excessive posterior vertical occlusal dimension was significantly reduced by intruding the posterior teeth in 14 patients. The occlusal interferences in the posterior area were eliminated by expansion of the maxillary dentoalveolar arch. The functional occlusal plane was reconstructed and a normal overjet and overbite were created. A stable occlusion with adequate posterior support and anterior guidance was established.

CONCLUSION: Most of these patients were advised to undergo orthognathic surgery, which they did not accept. Considering the risks and costs of orthognathic

surgery procedures, as well as the duration and probability of relapse, it seems necessary to re-evaluate the parameters of case selection, especially for AOB patients with good facial proportions.

472 CHANGES IN THE TIME ASPECT OF OROFACIAL MUSCLE ACTIVITIES DURING DEGLUTITION IN MANDIBULAR PROGNATHISM C Sasakura, T Fukui, I Saito, Division of Orthodontics, Department of Oral Biological Science, Niigata University Graduate School of Medical and Dental Sciences, Japan

AIM: To investigate changes in the time course of orofacial muscle activity during deglutition in patients with mandibular prognathism before and after orthognathic surgery.

SUBJECTS AND METHOD: Six mandibular prognathic patients (2 males, 4 females), and 12 volunteers (2 males, 10 females) as the controls. Electromyographic (EMG) activity was recorded from the masseter, orbicularis oris, mentalis, suprahyoid and infrahyoid muscles before and after orthognathic surgery. Each subject was asked to swallow 4 ml of half-solid nutrient made of 0.8 per cent agar powder. This task was repeated five times. For analysis of swallowing, the mean value of the durations and of the onset and offset times of the EMGs of all muscles were calculated.

RESULTS: The durations of EMG of the masseter, obricularis oris, suprahyoid and infrahyoid muscles were significantly decreased after surgery. The onset time of the orbicularis oris and mentalis muscles were significantly closer to the onset time of the suprahyoid muscle. The offset times of the masseter and infrahyoid muscles were also significantly closer to the onset time of the suprahyoid muscle.

CONCLUSION: There are changes in the pattern of orofacial muscle activity such as duration and the onset and offset times in patients with mandibular prognathism before and after orthognathic surgery. The results suggest that the activities of the orofacial muscles during deglutition after orthognathic surgery are likely to adapt to the post-operative morphological changes.

473 A SYSTEMATIC REVIEW OF THE STABILITY OF ORTHOGNATHIC SURGERY IN ADOLESCENCE

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AIM: To assess the stability and effectiveness of orthognathic intervention to address dentofacial disharmony during adolescence.

MATERIALS AND METHOD: Multiple electronic databases were searched to obtain studies assessing changes following combined orthodontic-surgical treatment in subjects ranging from 8 to 16 years of age. Restrictions were not applied in respect of publication status or language of publication. Two clinicians were involved in the selection of relevant studies, quality assessment and data extraction. Methodological quality was assessed using seven pre-determined criteria.

RESULTS: Eight relevant studies were included; all were retrospective in design. Outcomes from the included studies indicated that early correction of Skeletal II disharmony and vertical growth discrepancy may be potentially stable. Just one trial considered early surgical correction of Skeletal III deformity; results from this study were unsatisfactory. No meta-analysis was possible.

CONCLUSION: Further prospective research considering long-term stability, growth implications and psychosocial effects of early surgical correction of jaw discrepancy is required.

474 INTERCEPTIVE ORTHODONTIC TREATMENT IN BULLIED ADOLESCENTS AND ITS IMPACT ON SELF-ESTEEM AND ORAL HEALTH RELATED QUALITY OF LIFE

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AIM: To measure the self-reported frequency and severity of bullying in orthodontic patients who have commenced interceptive orthodontic treatment and to investigate the effect on an individual's self-esteem and Oral Health Related Quality of Life (OHRQoL).

SUBJECTS AND METHOD: A follow-up study conducted at three United Kingdom Hospitals. Forty-three previously identified adolescents who were being bullied due to the presence of a malocclusion were invited to take part in a follow-up study following commencement of orthodontic treatment. Validated questionnaires were used to assess the self-reported frequency and severity of bullying, self-esteem and OHRQoL.

RESULTS: Following commencement of orthodontic treatment 21 (78%) participants reported they were currently no longer being bullied due to the presence of their malocclusion. Bullied participants undergoing orthodontic treatment experienced significantly less bullying related to their malocclusion and improvement in functional limitations (P = 0.021), emotional (P = 0.008) and social impact (P = 0.008) related to their oral condition. There appears to be no effect on an individual's self-esteem.

CONCLUSION: Orthodontic treatment has a significant positive effect on adolescents experiencing bullying related to their malocclusion and their OHRQoL.

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475 EVALUATION OF ATLANTOAXIAL RELATIONSHIPS IN A SPANISH POPULATION BY CONE BEAM COMPUTERIZED TOMOGRAPHY

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AIM: To describe the relationship between the atlas (C1) and axis (C2) vertebrae in a healthy Spanish population, using cone beam computerized tomography (CBCT).

MATERIALS AND METHOD: A database of CBCT examinations carried out on patients without cervical complaints was analyzed and 140 subjects (50% male, 50% female) were selected. They were then subdivided into seven groups by age (from 10 to 70 years). The CTs were performed in a CBCT i-CAT 17-19. The software used was i-CAT Vision 17.1. For the sagittal plane, the distance was measured from the midpoint of the apophysis of the odontoid process to the midpoint of the surface of C1. For the frontal plane, several measurements were taken between C1 and C2, and between the lateral surface of the odontoid process and the midpoint of the vertebral body of C1.

RESULTS: The sagittal plane ranged from 0.67-3.58 mm. For the frontal plane, between C1 and C2, the measurements ranged from 0.67-6.02 mm; and those from the odontoid process and C1 from 1.50-7.50 mm. Older subjects showed a shorter distance for the majority of the measurements, with significant differences for some of them in the various age groups (especially in females). In the paediatric population, it

was also observed that males had a significantly larger distance than females for the majority of the measurements.

CONCLUSION: CBCT images provide evidence of the influence of age and gender on the atlantoaxial relationships.

476 EVALUATION OF THE FORCE DECAY OF VARIOUSLY PRICED ELASTOMERIC CHAINS

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AIM: To compare the force decay of three brands of closed elastomeric chain sold at varying market prices.

MATERIALS AND METHOD: Elastomeric chains were selected so as to have one expensive (Alastik CK Clear Closed 406-622, 3M) price £5.00 per foot (n = 10), one inexpensive (Memory chain II, clear, closed 630-0006, Hawley Russell) price £0.88 (n = 10), and one intermediate priced type of chain (Dura chain clear, closed 406-622, Ortho Care) price £3.16 per foot (n = 10). This research was based on the International Organization for Standardization (ISO) for testing elastomeric auxiliaries for use in orthodontics (ISO 21606:2007). The initial force was measured (0 hours), then residual force measurements at 1 and 24 hours and 7 and 28 days were obtained using an Instron Universal testing machine. Linear mixed models analysis and pairwise comparison of the systems with Sidak's adjustment were used.

RESULTS: The mean force levels for Dura Chain, Memory Chain II, and Alastik at the successive time intervals were: 0 hours: 1.51 N (SD ±0.01); 3.04 N (SD ±0.05) and 2.35 N (SD ±0.02); 1 hour: 1.53 N (SD ±0.07); 2.81 N (SD ±0.12) and 2.23 N (SD ±0.29); 24 hours: 1.39 N (SD ±0.06); 2.18 N (SD ±0.06) and 1.73 N (SD ±0.16); 7 days were: 1.28 N (SD ±0.07); 1.97 N (SD ±0.09) and 1.49 N (SD ±0.18); 28 days were: 1.15 N (SD ±0.06); 1.74 N (SD ±0.08) and 1.24 N (SD ±0.12).

CONCLUSION: Memory chain II delivered the greatest force at all time intervals. Dura Chain showed the least force decay with 76.1 per cent of initial force remaining after 28 days. Force decay for all three types of elastomeric chains is greatest in the first 24 hours. There is statistically significant difference between the systems.

477 REPRODUCTION OF THE MAXILLARY OCCLUSAL PLANE ANGLE IN ORTHOGNATHIC SURGERY PLANNING

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AIM: To compare the occlusal plane inclination of models mounted on an articulator with the actual occlusal plane inclination as measured on a cephalometric radiograph (gold standard), and to investigate the effect of altering the occlusal plane angle when reproducing a standardised Le Fort I osteotomy.

MATERIALS AND METHOD: Facebow recordings were obtained from 36 patients undergoing orthognathic surgery using the Denar Slidematic facebow and articulator system. The maxillary casts were then mounted and the Erickson model stage was used to measure the distances between two dental reference points and the upper edge of the mounting ring. These measurements were transferred to the lateral cephalogram tracings to reproduce the transferred Frankfort horizontal plane (TFHP). The angle between this TFHP and cephalometric Frankfort horizontal plane (CFHP) was then measured. Model surgery was undertaken to demonstrate the consequence of an inaccurate facebow transfer when reproducing a standardised Le Fort I procedure. RESULTS: Four facebow registrations conformed to the cephalometric gold standard. The mean angle between the CFHP and TFHP was 6 degrees, with a range extending from -4 to +15 degrees. Therefore, the TFHP recorded by the facebow, tended to be steeper than that existing in the patient. As the steepness of the occlusal plane was artificially increased, a clockwise rotation of the maxilla resulted in under-advancement of the mandible. Clinically, this would manifest as a deficient improvement in facial profile. The error study showed no statistically significant difference (P > 0.05) between the two sets of data relating to all angular and Erickson measurements.

CONCLUSION: An inaccurate facebow registration has implications on the functional and aesthetic outcome. Therefore, it is recommended that clinicians verify the position of the maxillary cast on the articulator before model surgery is undertaken.

478 ODONTOMETRIC INDICATION OF THE UPPER FIRST PREMOLAR IN SUBJECTS WITH CROWDING OR SUFFICIENT SPACE IN THE DENTAL ARCH

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AIM: To reveal the difference between measurements and forms of the upper first premolars in subjects with crowding and an Angle Class I or in those with sufficient space with an Angle Class II malocclusion.

MATERIALS AND METHOD: Odontometric research of 82 upper first premolars extracted due to orthodontic treatment in 23 patients with crowding and an Angle Class I (group 1) and 21 patients with an Angle Class II (group 2) with extraction of teeth. The patients in group 2 had sufficient space in the upper dental arch, so the extractions were compensatory.

RESULTS: There was a statistical difference between groups 1 and 2 in that the parameters: in group 2 such as the height of the tooth and root were larger and the vestibulolingual and mesiodistal lengths of the crown were lower, than in group 1 (*t*-test: 0.003; 1.32×10^{-5} ; 0.0002 and 5.41×10^{-8} , respectively. Moreover, the patients in group 1 had a higher module and solidity of the crown, and their crown index and neck of the tooth was lower (*t*-test: 7.65×10^{-7} ; 4.32×10^{-7} ; 0.0096; 2.56×10^{-6} , respectively).

CONCLUSION: The upper first premolars of patients with crowding and an Angle Class I have solid crown with a triangular form and lower root height. The formation of the tooth roots is probably affected by sufficient jaw space.

479 A FIXED TONGUE APPLIANCE AND FIXED FACEMASK APPLICATION FOR CLASS III TREATMENT IN GROWING PATIENTS*** A Showkatbakhsh¹, M Behnaz¹, A Jamilian², Departments of Orthodontics, ¹Shahid Beheshti Medical Science University, Tehran and ²Islamic Azad University, Dental Branch, Tehran, Iran

AIM: To compare the effects of a fixed tongue appliance and fixed intraoral appliance combined with facemask traction.

SUBJECTS AND METHOD: Twenty subjects with Class III maxillary deficiency randomly divided into two groups .The first group included 10 patients (mean age 9.82 ± 0.56 years) treated with a fixed tongue appliance and the second group 10 patients (mean age 10.34 ± 0.99 years) treated with an intraoral fixed appliance combined with facemask traction. The average treatment time was 10 months. Pre-

and post-treatment study models, radiographs and photographs were taken and cephalometric data were compared in both groups.

RESULTS: There were no significant differences in SNA and nasolabial angles in either group; SNB showed a minor change, although this was not significant. The maxillary base showed clockwise rotation in the facemask group and counterclockwise rotation in the tongue appliance group. The facemask group showed a minor increase in AFH when compared with the tongue appliance group, but this was not significant. There was statically significant difference (P < 0.05) in U1-SN between the two groups.

CONCLUSION: Both appliances were effective in the skeletal treatment of patients with Class III malocclusions. The visibility of the facemask resulted in a lack of cooperation and an increase in treatment time. The mandibular vertical growth redirection should be considered in facemask application for patients with a vertical growth pattern and maxillary deficiency to avoid unfavourable consequences, and the required measurement should be applied.

480 NEED FOR ADVANCED ORTHODONTIC CARE FOR CRANIOFACIAL SYNDROMES, CLEFT LIP AND PALATE AND ORTHOGNATHIC SURGERY PATIENTS***

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AIM: The medical field is developing rapidly and is becoming more specialized. Orthodontics is no exception. Thus, the purpose of this study was to evaluate the necessity of establishment of a surgical orthodontic fellowship programme for orthodontists in order to provide them with a better insight.

SUBJECTS AND METHOD: A 10 multiple choice question survey was taken of 270 orthodontists who participated in the European Orthodontic Society Congress in Istanbul, 2011. The results were tabulated and analyzed.

RESULTS: Fifty-two per cent of the respondents believed that knowledge of treatment of orthognathic surgery patients can be significantly improved by adding a fellowship in orthognathic surgery after the residency programme.

CONCLUSION: The addition of such a programme can be very constructive and will give better a insight to orthodontists with regard to treatment of orthognathic patients.

481 A COMPARATIVE ASSESSMENT OF MOMENTS GENERATED BY LINGUAL AND CONVENTIONAL BRACKETS

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AIM: To assess the effect of bracket type on labiopalatal moments generated by lingual and conventional brackets.

MATERIALS AND METHOD: Incognito lingual brackets (3M Unitek), STb lingual brackets (Light Lingual System, Ormco), In-Ovation L lingual brackets (Dentsply GAC) and conventional 0.018 inch slot brackets (Gemini, 3M Unitek) were bonded on identical maxillary acrylic resin models with levelled and aligned teeth. Each model was mounted on the Orthodontic Measurement and Simulation System and 10 0.0175×0.0175 inch TMA wires were used for each bracket type. The wire was ligated with elastomerics and each measurement was repeated once after re-ligation.

A 15 degree buccal root torque (+15) and then a 15 degree palatal root torque (-15) was gradually applied to the right central incisor bracket. After each activation the bracket returned to its initial position and the moments in the sagittal plane were recorded during these rotations of the bracket. The magnitude of maximum moments on each bracket type was evaluated, as well as the torque angles at which the crown torque fell below the minimum levels of 5 or 2 Nmm. Additionally, the moment/torque ratio was evaluated at the last part of the activation/deactivation curve, between 10-15 degrees. The data were analysed using one-way-ANOVA with *post hoc* multiple comparisons (Tukey test at 0.05 error rate) and linear regression on selected segments of the activation/deactivation curves.

RESULTS: The magnitude of maximum moment at +15 ranged from 5.75, 8.78, 8.16 and 7.07 N for the In-Ovation L, Incognito, STb and conventional Gemini brackets, respectively; similar values were recorded at -15: 5.68, 8.64, 8.13 and 7.01 N, respectively. The produced moments were different among all four bracket types.

CONCLUSION: The highest torque losses were observed with the self-ligating lingual brackets, followed by the conventional brackets. The Incognito and STb lingual brackets exerted the highest moments.

482 COMPARATIVE INVESTIGATION OF DEEP OVERBITE TREATMENT. A PILOT STUDY

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AIM: To evaluate, in a pilot study, the effects induced of the Bite Turbo® (Ormco Corp., Glendora, California, USA) appliance as an auxiliary mechanism in orthodontic treatment of patients with a deep overbite.

SUBJECTS AND METHOD: Fourteen patients (mean age 11 years). Seven were treated exclusively with fixed appliances (control group) and seven with fixed appliances and a Bite Turbo® bonded to the upper central incisors. The average evaluation period in both groups was 9 months. The standard error deviation for each variable used in the study was calculated from the double determinations using Dahlberg's formula and evaluation of cephalometric changes between groups by Wilcoxon's non-parametric test at the 5 per cent level.

RESULTS: The Bite Turbo® group showed a significant improvement of the deep overbite, with an increase in total face height and extrusion of the first molars, which led to an increase in facial depth.

CONCLUSION: Whilst use of the Turbo Bite® led to a significant improvement in deep overbites, mandibular rotation should be taken into account when considering the orthodontic treatment plan in different facial types.

483 ERUPTION DISORDERS OF THE MAXILLARY PERMANENT CANINE IN TWO- AND THREE-DIMENSIONAL IMAGING

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AIM: To determine eruption disorders of the maxillary permanent canines as seen on cone beam computer tomographs (CBCT) and dental pantomograms (DPT) at the same developmental time.

MATERIALS AND METHOD: CBCTs obtained during 2007-2009. The children were born in 1989 or later and had an eruption disorder of the maxillary permanent canines. The DPT images of the same patients were chosen as the best fit to the

timing of the CBCT image. The mean ages in DPT and CBCT were 11.43 and 11.65 years in girls and 12.15 and 12.18 years in boys.

RESULTS: All palatally erupting canines could be diagnosed on the DPT. When the lateral incisor was also missing, the canine was found palatally and in transposition cases labially. An abnormally erupting canine on the right side overtook the lateral incisor further towards the midline than the left side. When the largest width of the follicular space of the canine was measured on the CBCT it was always larger than that on the DPT. In addition, the follicle seemed to be somewhat larger with the palatally erupting canines compared with the labial ones. Resorption of the adjacent teeth, mainly lateral incisors, caused by the erupting canine, was found in 17 per cent and contact in 55 per cent of the cases on the CBCT. Root resorption was found in proportion to 3 to 2 in girls and boys.

CONCLUSION: The results confirm earlier findings that canine eruption disorders are more common in girls than boys as well as root resorption. It seems that the follicle of the maxillary canine gravitates towards the area of least resistance such as between the roots of the adjacent teeth and the labial and palatal sides of the alveolar bone. The follicle also showed differences in size palatally and labially. It is suggested that the follicle may play an important role in the eruption pattern of the maxillary canine.

484 DO TITANIUM-MOLYBDENUM ALLOYS ARCHWIRES CORRODE IN AN ACID ENVIRONMENT?

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AIM: To compare *in vitro* the resistance to corrosion of titanium molybdenum alloy (TMA) archwires available from four different suppliers in an environment simulating the acidity of soda drinks.

MATERIALS AND METHOD: Three 0.017×0.025 inch TMA archwires from the same batch provided by Ormco[®], 3M-Unitek[®], RMO[®], and AO[®]) were compared between themselves and with three braided stainless steel archwires (D-Rect[®] Ormco[®]) that also deliver soft forces. Metal composition of one archwire of each group was analysed both by scanning electron microscopy and Castaing microprobe. Two archwires of each group were immersed for 24 hours in artificial SAGF saliva, acidified with citric acid (pH = 2.52). Corrosion potential according to time (Ecorr) and corrosion current intensity according to potential (Icorr) were measured.

RESULTS: The metal composition of TMA of all archwires from the four suppliers was highly similar (Ti: 87.8/88.6; Mo: 5.6/6.2; Zr: 3.0/3.5; Sn: 2.0/2.2). Unlike braided steel archwires, they contained no nickel. Ecorr (-1/73 mV) as well as Icorr $(5.1 \times 10^{-9}/ 8.62 \times 10^{-9})$ of all TMA alloys in this study were similar. The ratio between TMA archwires and braided steel archwires corrosion intensities was 1 to 5.

CONCLUSION: In an acid environment, resistance of TMA to acid-corrosion is 5 times higher than that of stainless steel. The nickel-free TMA studied are appropriate for the treatment of orthodontic patients known to have an allergy risks. Whilst the results of this pilot study are encouraging, further research is required on a larger number of archwires.

485 RESIDUAL ORTHODONTIC TREATMENT NEED AFTER SERIAL EXTRACTION OF PRIMARY CANINES

A Sjögren¹, J Huggare², ¹Department of Orthodontics, Postgraduate Dental Education Center, Public Dental Service, Örebro County Council and ²Department of Dental Medicine, Division of Orthodontics, Karolinska Institutet, Stockholm, Sweden AIM: To investigate the need for additional tooth extractions and/or appliance treatment after removal of the primary canines as a part of serial extraction procedures.

SUBJECTS AND METHOD: Seventy-one children, with moderate to severe anterior space deficit in the early mixed dentition, were randomized into extraction (n = 32) and control (n = 39) groups. Dental casts and four photographs (*en face* and in profile) from registrations in the late mixed dentition were available for orthodontic treatment need assessment, according to a 4-graded scale and suggestions regarding additional extractions and appliance therapy. Three orthodontists were randomly chosen for assessments on each subject. Two or more conforming assessments were considered as a true value. Results regarding treatment need evaluation and suggestions for additional extractions and appliance therapy were dichotomized and analyzed using the chi-squared test.

RESULTS: Orthodontic treatment need was significantly greater in the extraction group compared with the control group (30/32 versus 24/39; P < 0.001). Likewise, additional extractions and appliance therapy were suggested significantly more frequently in the extraction group (22/32 versus 7/39; P < 0.001 and 30/32 versus 23/39; P = 0.001, respectively.

CONCLUSION: Early extraction of primary canines does not reduce orthodontic treatment need in the late mixed dentition.

486 AN INTERDISCIPLINARY APPROACH TO OCCLUSAL CORRECTION IN PATIENTS WITH PERIODONTAL TISSUE DISEASES

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AIM: To design a treatment algorithm for patients with periodontal tissue disease and secondary deformation of the dentition while retaining the maximum number of natural teeth with achievement of high functional, aesthetic and long-term results.

SUBJECTS AND METHOD: Seventeen patients (11 females, 6 males) aged 38 to 57 years with mild (group I) and moderate (group II) periodontal disease. Secondary deformity included: crowding in three patients, bimaxillary protrusion and trauma in three patients, Class II, complicated by an abnormal position of the teeth in five subjects, Class III complicated by an abnormal position of the teeth in three patients and a crossbite complicated by abnormal positions of the teeth (buccal 1 patient, lingual 2 patients). The following investigations were carried out: clinical, anthropometric, radiographic (panoramic tomography, teleradiography, computed tomography of the temporomandibular joint), myography, florida probe and occlusal analysis (T-scan)

RESULTS: Treatment included removal of microbial factors, inflammatory process management, removal of occlusal trauma factors, orthodontic correction of occlusion, removal of pathological insertion of soft tissue in the vestibular oral cavity and fraenectomy, closed and open curettage with augmentation of periodontal pockets. Treatment was successful in both groups. However, while use of wire ligature retainers was possible for temporary splinting in group I, the patients in group II needed more long-term and stronger splinting with retainers made of composite material using laboratory-based methods.

CONCLUSION: Orthodontic therapy of patients with periodontal disease, as part of comprehensive treatment, provides favourable conditions for stabilization of inflammatory and dystrophic processes making it possible to maintain the integrity of teeth with achievement of high functional and aesthetic results.

487 EFFECT OF TIO₂ AND SIO₂ NANOPARTICLES ON ANTIMICROBIAL ACTIVITY OF ORTHODONTIC POLY METHYL METHACRYLATE ACRYLIC RESINS

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AIM: To test the hypothesis that TiO_2 and SiO_2 nanoparticles, as additives to poly methyl methacrylate, can induce self-sterilizing properties in orthodontic acrylic resins.

SUBJECTS AND METHOD: Seven groups of acrylic specimen were prepared according to the content of acrylic liquid: containing nano-TiO₂ in two concentrations of 0.5 and 1 per cent, nano-SiO₂ in the same concentrations and combination of SiO₂ and TiO₂ nanoparticles in two concentrations of 0.5 and 1 per cent, in addition to a control group containing no nanoparticles. Each group comprised 15 specimens made of orthodontic acrylic resin (Selecta Plus) with a size of $20 \times 20 \times 1$ mm. The specimens were also divided into three groups to evaluate the effect of light conditions: kept in the dark, daylight and ultraviolet (UV) light for 15, 30, 45, 60, 75 and 90 minutes. Colony forming units (CFU)/ml for *Lactobacillus* and *Streptococcus mutans* were counted. Statistical analysis was done by means of one- and two-way ANOVA.

RESULTS: The greatest reduction in the number of bacterial colonies was observed for acrylic specimens containing 1 per cent TiO_2 with SiO_2 and *S. mutans*. It significantly differed from the control group (P < 0.05). Within each group, specimens exposed to UV light, demonstrated the minimum bacterial colonies. The least reduction was measured for 0.5 per cent SiO₂ nanoparticles; although higher than the control group these were not significantly different (P > 0.05).

CONCLUSION: Adding TiO_2 and SiO_2 nanoparticles can improve the antimicrobial activity of orthodontic acrylic resins, especially a combination of 1 per cent TiO_2 and SiO_2 nanoparticles in UVA.

488 ANTIMICROBIAL EFFECT OF SILVER NANOPARTICLES ON POLY METHYL METHACRYLATE INCORPORATED IN ORTHODONTIC AND PROSTHODONTIC APPLIANCES

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AIM: To investigate the antimicrobial effect of silver nanoparticles on poly methyl methacrylate incorporated in orthodontic and prosthodontic appliances.

MATERIALS AND METHOD: Using a chemical reduction method, acrylic liquid containing 0.05, 0.1, 0.2 and 0.4 per cent silver nanoparticles was prepared and mixed with powder. These and the control acrylic blocks, which did not have nanoparticles, were maintained in a microbial suspension of *Candida albicans, Streptococcus mutans, Lactobacillus acidophilus* and *Streptococcus sanguinis*. The colony forming units (CFU)/ml of each culture was determined via serial dilution for investigation of the effect of 1,2, 4, 24, and 48 hours. Analysis of variance was used for statistical analysis.

RESULTS: For all groups, an increase in concentration of silver nanoparticles significantly reduced the number of microbial colonies. For *C. albicans, S. mutans* and *S. sanguinis*, the duration of predisposition to silver nanoparticles significantly

decreased CFU. On the other hand for the *L. acidophilus* group at concentrations of 0.05 and 0.1 per cent, increasing the time did not significantly diminish CFU.

CONCLUSION: The addition of silver nanoparticles to acrylic resin can induce antimicrobial effects in a concentration dependent pattern.

489 DENTAL AND SKELETAL EFFECTS OF A TONGUE CRIB APPLIANCE IN THE TREATMENT OF CLASS III PATIENTS

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AIM: To evaluate the dental and skeletal effects of a tongue crib in the treatment of skeletal Class III malocclusions.

SUBJECTS AND METHOD: In this quasiexperimental before-after study, 12 patients were treated with a tongue crib. It was a removable appliance that was used for at least 16 hours a day. Patients were under treatment for approximately 1 year and at the end of treatment a cephalogram was taken.

RESULTS: An increase in SNA was seen which represented the more anterior position of the maxilla. Anteroposterior growth of the mandible was continued. The mandibular incisors were retruded and the maxillary incisors showed protrusion. Forward rotation of the maxilla was seen. No significant change in the soft tissues was observed in the nasolabial region.

CONCLUSION: A tongue crib is effective in the treatment of skeletal and dental Class III malocclusions in maxillary deficient patients; it causes maxillary protraction and so improves the sagittal relationship of the jaws.

490 LITERATURE REVIEW OF ORTHODONTIC MEASUREMENT ACCURACY ON DIGITAL MODELS COMPARED WITH PLASTER DENTAL CASTS

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AIM: Classic orthodontic diagnosis includes manual measurements realized with a calliper on plaster dental casts. The aim of this study was to conduct a literature review regarding accuracy and reliability of the measurements made on digital versus plaster models, in order to evaluate their use in daily orthodontic practice.

MATERIALS AND METHOD: Research was conducted of PubMed, Medline and Embase databases until November 2011 using the following search strategy: ((((((accuracy) OR reliability) OR reproducibility)) AND measurements) AND digital models) AND orthodontic. Duplicates were removed and abstracts were screened, to exclude records that were not pertinent. Full-text articles were assessed for eligibility and those not pertinent were excluded. Additional records were identified through manual searching of references lists of these selected articles.

RESULTS: Digital models showed accuracy and reliability for various measurements. The differences compared with measurements on plaster model casts were not clinically relevant.

CONCLUSION: Plaster dental casts are still considered the gold standard in orthodontics, being a cheap routine dental laboratory technique allowing easy realization and measurement. Several studies have compared measurements from plaster casts with those from digital models in analysis of patients' occlusion. To date, digital models represent a reasonable alternative to plaster dental casts, allowing valid, reproducible and clinically acceptable measurements. Their use does not negatively affect diagnosis and treatment planning. It is important that orthodontists using digital models are expert in virtual image management in order to avoid manual errors that could affect measurement accuracy.

491 DENTAL ARCH WIDTH CHANGES AFTER BILATERAL SAGITTAL SPLIT RAMUS OSTEOTOMY IN SKELETAL CLASS III MALOCCLUSION*** S E Son, S S Kim, W S Son, S B Park, Y I Kim, Department of Orthodontics, Yangsan Pusan National University Dental Hospital, Pusan, Korea

AIM: To evaluate arch width change after mandibular setback surgery using a bilateral sagittal split ramus osteotomy (BSSRO), and to identify the relationship between the posterior arch width change and the hard and soft tissue changes.

SUBJECTS AND METHOD: Thirty-five adult patients (19 males, 16 females) who underwent a BSSRO for mandibular set-back. Three-dimensional computed tomographs (3D CT) were taken before and just or within one month after orthognathic surgery. Using individual 3D CT software, intercanine, interpremolar, intermolar and intercoronoidal widths, and masseter muscles thickness were measured.

RESULTS: The maxillary second intermolar width was decreased after surgery (P < 0.05). Intercoronoidal width (P < 0.001) and masseter muscle thickness was increased after surgery (left P < 0.05, right P < 0.001).

CONCLUSION: The thickened masseter muscle seemed to affect maxillary posterior arch width after surgery because of increased pressure. Therefore, masseter muscle management seems to be necessary for mandibular set-back surgery using BSSRO.

492 RELATIONSHIP BETWEEN CONDYLAR POSITION, MORPHOLOGY AND CHIN DEVIATION IN SKELETAL CLASS III PATIENTS WITH FACIAL ASYMMETRY

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AIM: Facial asymmetry is usually evaluated from the difference in the length and angulation of the maxilla and mandible. But asymmetric position or shape of the condyle can also affect expression of asymmetry. The purpose of this study was to evaluate the correlation between condylar asymmetry and chin point deviation in subjects with facial asymmetry.

SUBJECTS AND METHOD: Fifty adult skeletal Class III patients who had a cone beam computed tomograph. Thirty patients (15 females, 15 males) who had more than 4 mm menton deviation formed the asymmetric group and 20 patients (10 females, 10 males) who had less than 4 mm menton deviation and had no noticeable facial asymmetry, the symmetric group. The anteroposterior and transverse positions of both condyles, the angulation to the coronal plane and the greatest mediolateral diameter (GMD) on the axial plane were measured. The height and volume of the condyles were evaluated.

RESULTS: There was no statistical difference in the symmetric group between condyle position, angulation, GMD, height and volume. In the asymmetric group, the non-deviated condyle was larger in GMD, height and volume than the deviated side. There was no statistical difference in position and angulation. The GMD, height differences and condylar volume ratio (non-deviated/deviated) were positively correlated with chin deviation.

CONCLUSION: The non-deviated side condyle is larger than the deviated condyle. Condylar asymmetry can affect the expression of facial asymmetry.

493 ASSESSMENT OF ROOT RESORPTION CAUSED BY IMPACTED CANINES USING CONE BEAM COMPUTED TOMOGRAPHY P Sosars, Department of Orthodontics, Riga Stradins University, Latvia

AIM: To determine root resorption of adjacent teeth caused by impacted canines.

MATERIALS AND METHOD: Scans of impacted maxillary canines (n = 35) from 31 consecutive patients (20 females, 11 males) taken with an i-CAT cone-beam computed tomograph. Each scan was evaluated twice with OsiriX (v.3.9.1) software and the proximity of the impacted canine to the adjacent teeth was defined as resorption of less than 0.5 mm. Resorptions were graded into four categories: no resorption - intact root surfaces, slight resorption - midway to the pulp, the pulp is not exposed, moderate resorption - the pulp is exposed and the involved length of the root is less than one-third of the root, severe resorption - the pulp is exposed and the involved length is more than one-third of the root).

RESULTS: Resorption of adjacent teeth was found in 88 per cent of the evaluated cases. In 82.8 per cent root resorption was detected on the lateral incisors, in 22.8 per cent on the central incisors and in 22.8 per cent on the first premolars. In total 48 adjacent teeth were resorbed; 72.9 per cent of teeth showed slight root resorption, 22.9 per cent moderate resorption, and 4.2 per cent severe root resorption.

CONCLUSION: Resorption of adjacent teeth caused by impacted canines was found in 88 per cent of cases. In some cases (37%) more than one of adjacent tooth was involved.

494 INFORMATION SEEKING BEHAVIOUR IN ADOLESCENT ORTHODONTIC PATIENTS

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AIM: To investigate how adolescent orthodontic patients find information about orthodontic treatment, why they search for this information, and in what way they would prefer information to be made available to them.

SUBJECTS AND METHOD: The first part of the study involved semi-structured indepth interviews with 15 adolescent orthodontic patients to collect qualitative data and identify themes to develop a patient-based questionnaire. Part two of the study involved development of a questionnaire based on the main themes which arose from the interviews. This was then piloted and distributed.

RESULTS: The content analysis of the interviews identified a number of main themes: information needs, information preference, use of written information, verbal information, the Internet and the media. Fifty patients completed the questionnaire. Patients had gained information about braces mainly through talking to their orthodontist and friends and also by reading information leaflets. In addition to the information they already had, patients wanted to know if having a brace fitted hurt and how it would affect cleaning and eating. The preferred method of receiving information was talking to their orthodontist followed by talking to their family. The next preferred methods were watching a video, information leaflets and talking to their family dentist.

CONCLUSION: 1. Verbal communication with the orthodontist remains the preferred source of information about braces. 2. Patients also sought information from their parents, therefore, educating parents is important as children are likely to seek further information from their family. 3. Patients wanted more information on how a brace is fitted thus this should be incorporated into the planning appointments as it may reduce anxiety in some patients. 4. Audio-visual information could be beneficial to parents and patients with a low reading ability or a language barrier.

495 CAPTURING ANATOMICAL VARIATION IN NASAL MORPHOLOGY ON THREE-DIMENSIONAL SCANS

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AIM: To develop a set of repeatable homologous soft tissue landmarks to capture anatomical variation of the nose, and to fully describe nasal morphology on soft tissue three-dimensional (3D) scans. It is hoped that this will allow improved treatment planning and assessment of treatment outcomes in the long-term.

MATERIALS AND METHOD: This investigation was a cross-sectional data acquisition study. A laser scanner was used to create soft tissue facial scans of Caucasian subjects and customized software was used to display the facial scans. A set of nasal landmarks was developed which included landmarks previously described by Farkas (1994) and additional landmarks created by the researchers. In order to determine whether there were sufficient landmarks to describe the morphology of the nose, landmarked facial scans were assessed visually by warping and by colour mapping techniques. Landmark repeatability was determined using univariate statistical analysis; this involved calculating the standard deviations of the mean differences for each landmark.

RESULTS: Fifty-six landmarks were identified to describe the morphology of the nose for five subjects. The majority of landmarks showed acceptable or good intraoperator repeatability although landmark repeatability differed between the subjects. The nose may be considered as a group of subunits, with each subject and subunit demonstrating varying degrees of landmark repeatability. It was found that increasing the number of landmarks in the midline of the nose improved capture of nasal bridge morphology.

CONCLUSION: Soft tissue nasal morphology was adequately captured on 3D facial scans, which has not been captured in this detail previously. The ability to capture nasal morphology has the potential to improve treatment planning and future work should focus on creating a set of landmarks for a larger population.

496 EFFECT OF SOFT TISSUE THICKNESS ON PROFILE APPEARANCE IN CLASS II DIVISION 1 MALOCCLUSION SUBJECTS

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AIM: To determine the characteristics of the soft tissues in Class II division 1 malocclusion subjects, through analysis of profile radiographs.

MATERIALS AND METHOD: Fifty-two profile radiographs of 23 males and 29 females, age range 15 to 25 years, with a Class II division 1 malocclusion. Linear and angular parameters were analyzed using the methods of Burstone and Steiner.

RESULTS: Soft tissue thickness in the subspinal and supramental regions in males was significantly reduced (P < 0.001). Upper lip thickness in females was reduced but at a lower significance level than in males, but nevertheless, it was very high (P < 0.001). There was an insignificant increase of lower lip thickness with an insignificant reduction of soft tissue thickness in the supramental region in females in relation to standard value. Males had a partially compensatory effect.

CONCLUSION: Increased lower lip and soft tissue thickness in the supramental region in females in comparison with males results in a more harmonious profile and partially compensates for the irregularity.

497 DESCRIPTION OF TEMPOROMANDIBULAR JOINT ARTHRITIS INDUCED OROFACIAL SYMPTOMS IN JUVENILE PATIENTS

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AIM: Temporomandibular joint (TMJ) inflammation in juvenile idiopathic arthritis (JIA) patients may interfere with optimal joint and muscular function and lead to mandibular growth disturbances. Additionally, orofacial symptoms are reported in relation to TMJ arthritis. Knowledge about the clinical manifestation of these symptoms is important for TMJ arthritis diagnosis and clinical decision making. Based on questionnaires, the aim of this study was to evaluate and describe pain magnitude, frequency, main complaints, and localisation of TMJ arthritis induced orofacial symptoms.

SUBJECTS AND METHOD: Thirty-three consecutive JIA patients with orofacial symptoms from arthritis in 55 TMJs were included (mean age 14.11 years; range 11.1-18.6)). The questionnaire had both categorical variables, a descriptive part where patients could describe symptoms in their own words and sketch pain localization on a face drawing. Pain magnitude was reported on a visual analogue scale (0-100 mm).

RESULTS: Orofacial pain levels: minimum: 17.9 (SD 17.1), average: 38.4 (SD 17.3) and maximum: 64.8 (SD 16.1). Constant orofacial symptoms were only seen in one patient; however, 13 of the 33 patients reported daily pain. The patient majority experienced orofacial symptoms during mastication (25/33) and/or maximal mouth opening procedures (13/33). Eleven patients reported morning stiffness. The orofacial region most often symptomatic was the TMJ area in combination with the masseter muscle region. Hardly any symptoms were related to the temporal area.

CONCLUSION: Pain levels showed very large variations and were often related to function. The high frequency of muscle pain suggests that arthritis associated orofacial symptoms are a product of both the primary TMJ inflammation in combination with secondary myogenic and hence functional problems.

498 TEMPOROMANDIBULAR JOINT ARTHRITIS IN JUVENILE PATIENTS: SMALLEST DETECTABLE DIFFERENCES IN CLINICAL EXAMINATION VARIABLES

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AIM: Reduced mouth movement capacity and orofacial symptoms are common clinical findings in relation to temporomandibular joint (TMJ) arthritis in juvenile idiopathic arthritis (JIA) patients. Measurement precision of TMJ function as well as the patient's own assessment of their orofacial symptoms is unknown but essential in diagnosis and treatment evaluation. The aim of this study was to determine the smallest detectable differences (SDD) in mandibular movement and orofacial pain intensity scores between two consecutive observations/assessments. The SDD is the minimal amount of change that with certainty can be identified clinically between two consecutive observations.

SUBJECTS AND METHOD: Two separate studies were conducted. In 42 JIA patients, measurements of maximal mouth opening, laterotrusion, and protrusion were carried out by two experienced dentists with a calibrated metallic ruler. Each measurement was done three times by each observer. Additionally, 33 JIA patients with TMJ induced orofacial symptoms were asked to complete repeated questionnaires with visual analogue scale (VAS) pain-intensity assessments (0-100

mm) of minimal, average and maximal orofacial symptoms. Intra- and interobserver variation and the SDD were calculated for each variable.

RESULTS: The SDD were (one measurement): maximal mouth opening: 7 mm, laterotrusion: 3 mm, and protrusion: 4 mm, but this was reduced with repeated measurements. In relation to the orofacial symptoms, the SDD were: minimal pain: 11 mm, average pain: 13 mm, maximal pain: 14 mm on a VAS.

CONCLUSION: This study offers new knowledge about the TMJ examination precision and orofacial pain assessments in JIA patients. The discriminative validity of the clinical variables of mandibular movement and orofacial symptoms must be taken into account when diagnosing and evaluating TMJ arthritis treatment results in JIA patients. Variations are large but can be reduced with repeated measurements.

499 TONGUE ROLLING AND ITS ASSOCIATION WITH OCCLUSAL CHARACTERISTICS

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AIM: The ability to roll the tongue is an inherited trait. The aim of the current study was to determine if occlusal characteristics are associated with this ability.

SUBJECTS AND METHOD: One hundred patients who were under orthodontic treatment and classified as tongue-rollers (TR+) or non-tongue-rollers (TR-). Pretreatment orthodontic records were used to measure intercanine and intermolar widths, arch length, space deficiency, overjet and overbite. The records were also used to determine the presence or absence of a posterior crossbite, and the molar Angle classification. Independent sample t- and Mann-Whitney tests were used to examine differences in the variables studied and Pearson's chi-square tests to determine the association between tongue rolling ability and the presence of a crossbite and space deficiency. Multiple linear regression analyses were performed accounting for gender and age, for variables that showed significant differences between the two groups.

RESULTS: Patients that were TR+ showed larger mandibular intermolar widths (1 mm, $P \le 0.05$) and less mandibular space deficiency (1.9 mm, $P \le 0.05$). Mandibular space deficiency was present in 18.5 per cent of TR+ compared with 49.3 per cent in TR- ($P \le 0.05$). When multiple linear regression analyses were performed, including gender and age as confounding factors, age was the most important factor accounting for differences in intermolar width and space deficiency.

CONCLUSION: Although differences in mandibular intermolar width and space deficiency were found between TR+ and TR- patients, age seems to account for a large part of the statistical significance of the differences observed.

500 LEFT/RIGHT DIFFERENCES IN THE TIMING OF PERMANENT TOOTH ERUPTION

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AIM: To obtain basic data concerning the diagnostic criteria for delayed permanent tooth eruption through a survey of the synchronicity of eruption of the same tooth type on the left and right sides.

MATERIALS AND METHOD: Documentation of eruption timing was obtained from a longitudinal series of dental casts of 40 males and 56 females aged between 5 years and 19 years 10 months. The status of permanent tooth eruption at two-monthly intervals was recorded, and left/right differences in eruption timing for each type of tooth were investigated. RESULTS: For incisors and first molars, eruption of both left and right molars occurred within four months of each other in <80 per cent of both males and females. In particular, there was almost no left/right difference for the mandibular central incisors, with the average left/right difference being 1.0 ± 1.2 months in males and 1.5 ± 1.6 months in females, with eruption occurring on both the left and right sides within four months of each other in 99 per cent of subjects. For the mandibular canines and maxillary first premolars, eruption occurred on both left and right sides within four months of each other in approximately 80 per cent of subjects, for maxillary canines and mandibular first premolars in approximately 75 per cent, and for maxillary and mandibular second premolars in approximately 70 per cent. The mandibular second molars erupted on both left and right sides within four months of subjects. The difference was greatest for the maxillary second molars, eruption occurred on both right and left sides within four months of each other in 75 per cent of subjects.

CONCLUSION: Excluding the second premolars and second molars, eruption occurred on both left and right sides within four months of each other in <75 per cent of teeth. If the same tooth on the other side has not erupted after four months, this could indicate delayed eruption.

501 A PATIENT SATISFACTION SURVEY AFTER ORTHODONTIC TREATMENT***

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AIM: Patients have various subjective judgments about treatment results and there are a few coincidences concerning the estimation of patients and clinicians. The aims of this study were to evaluate patient satisfaction during the retention phase using a questionnaire, which was examined for its validity, and to investigate the relationship between satisfaction and the results of functional examinations.

SUBJECTS AND METHOD: The data was obtained from 56 retention patients [18 who had undergone a sagittal split ramus osteotomy (OPE) and 38 non-surgically treated patients (N-OPE)]. Lip-closure force, bite force and occlusal contact areas were measured immediately after treatment (T1) and 1 (T2) and 3 (T3) months after treatment. Patient satisfaction was evaluated with a questionnaire. Spearman's correlation coefficient test between patient satisfaction and functional inspection results were evaluated.

RESULTS: Lip-closure force was increased in OPE and there were significant differences at T1 and T2 between OPE and N-OPE. Bite force was increased in N-OPE and there were significant differences at T1 between OPE and N-OPE. In OPE, there were significant positive correlations between lip-closure force, bite force and Q4 Did you get to be able to chew well? and Q5 Can you bite food with your front teeth well?

CONCLUSION: Following surgery it became easier to close the mouth but it took time for the masseter muscle to recover from surgical stress. There was a tendency for the difference between OPE and N-OPE to decrease with time. There was no relationship between the psychostatus of patients who eat food easily after treatment and the increase of occlusal contact areas. It is suggested that there are a few coincidences of patient satisfaction and the rate of change of occlusal contact areas.

502 HYPODONTIA FAMILIES – SOME CHARACTERISTICS OF PROBANDS

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AIM: Hypodontia is one of the most studied and frequently occurring dental anomalies. Its genetic origin is highly probable. Despite intensive biological and molecular research, the type of genetic transmission is not wholly clarified. Direct analysis of hypodontia families can contribute to solving this ongoing question.

SUBJECTS AND METHOD: Data were collected of 544 families of Prague schoolchildren and clinic patients who had one or more congenitally missing teeth (excluding third molars). Probands and first-degree relatives were examined. Hypodontia was diagnosed and recorded from radiographic evidence. The homogeneity of the sample was proved by previous studies. A descriptive analysis of the probands' conditions of hypodontia was undertaken.

RESULTS: 1. Lateral incisors and second premolars were nearly equal in frequency of absence. These two morphological classes were the teeth most often missing in the sample of probands. 2. Regarding location, maxillary hypodontia occurred more frequently than mandibular hypodontia. 3. The dental anomaly occurred symmetrically in most cases (bilateral hypodontia was more frequent than the unilateral phenotype). 4. Regarding the number of missing teeth, in the individual, hypodontia of two teeth was the most common condition. 5. Mesioocclusion (Angle Class III) was observed in significantly increased frequency in the probands with hypodontia.

CONCLUSION: The occurrence of characteristics of hypodontia in this sample were not significantly different from the results of hypodontia studies of the general population. Thus, this sample of individuals with hypodontia is valid for further analysis and family studies.

503 HYPODONTIA FAMILIES – CLINICAL GENETIC ANALYSIS

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AIM: Molecular research has not yet fully determined the transmission of hypodontia. Thus, family studies are considered the 'gold standard' for assessing genetic health risk and should be among the key methods in this research effort.

SUBJECTS AND METHOD: A cohort of 544 families with hypodontia (absence of one or more teeth, excluding third molars) was collected from the mid-1970s in Prague. The sample was almost coherent, and therefore suitable for pedigree analysis. Probands were selected mainly from schoolchildren. Probands and first-degree relatives were examined. Hypodontia was diagnosed and recorded from radiographic evidence and the frequency of hypodontia among first-degree relatives was calculated. RESULTS: Of the parents, 15.5 per cent were affected (mothers 20.4%, fathers 10.6%). The frequency of hypodontia in siblings was 18.5 per cent (sisters 20.5%, brothers 16.2%). Segregation analysis revealed an extremely high frequency (nearly 50%) of hypodontia in siblings in families where both parents were affected, and the lowest frequency in families where both parents had no missing teeth.

CONCLUSION: It is evident from these first results that hypodontia is mainly genetically determined and its transmission is not explainable by a single-gene hypothesis.

504 EFFECT OF THERMOCYCLING ON SHEAR BOND STRENGTHS OF CERAMIC BRACKETS BONDED TO ER:YAG LASER-PREPARED ENAMEL B Tagrikulu, E Oztas, M Sarac, Department of Orthodontics, Faculty of Dentistry, Istanbul University, Turkey

AIM: To evaluate the effects of thermocycling on shear bond strengths (SBS) of ceramic brackets bonded to Er:YAG laser prepared human enamel with two different irradiation parameters.

MATERIALS AND METHOD: Eighty, defect-free, human premolars randomly assigned to eight groups. The teeth received the following treatments: group 1: 80 mJ, 30 Hz Er:YAG laser ablation and Radiance ; group 2: 80 mJ, 30 Hz Er:YAG laser ablation , Radiance and thermocycling; group 3: 120 mJ, 20 Hz Er:YAG laser ablation and Radiance; group 4: 120 mJ, 20 Hz Er:YAG laser ablation, Radiance and thermocycling; group 5: 80 mJ, 30 Hz Er:YAG laser ablation and Clarity; group 6: 80 mJ, 30 Hz Er:YAG laser ablation and Clarity; group 5: 80 mJ, 30 Hz Er:YAG laser ablation and Clarity; group 6: 80 mJ, 30 Hz Er:YAG laser ablation and Clarity; group 8: 120 mJ, 20 Hz Er:YAG laser ablation, Clarity and thermocycling; group 7: 120 mJ, 20 Hz Er:YAG laser ablation, Clarity and thermocycling. Transbond XT adhesive was used in all groups for bracket bonding. Thermocycling was performed 3000 times between 5°C and 55°C. Samples were stored in deionized water at 37°C for 24 hours followed by SBS testing with a universal testing machine at a crosshead speed of 1 mm/minute. The enamel surfaces were examined with a stereomicroscope at ×16 magnification to determine the failure sites using a modified adhesive remnant index (ARI).

RESULTS: Thermocycling significantly decreased the SBS of both Radiance and Clarity brackets bonded to enamel prepared by Er:YAG laser with two different parameters (P < 0.001). No statistically significant differences were found between the two different laser irradiation parameters with or without thermocycling (P > 0.05). No statistically significant differences were found between the groups tested (P>0.05).

CONCLUSION: Thermocycling significantly decreases the SBS of ceramic brackets bonded to premolars etched with an Er:YAG laser. Neither the type of ceramic brackets nor the laser irradiation parameters used prevented the adverse effects of thermocycling.

505 EXPOSURE OF UNERUPTED FIRST AND SECOND PERMANENT MOLARS

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AIM: To make a retrospective assessment of the outcome of treatment of unerupted permanent first and second molars.

MATERIALS AND METHOD: Post-treatment clinical and radiographic examinations were carried out on 24 subjects, who had 30 unerupted permanent first and second molars. The pre-treatment positions as well as the stage of eruption and development of the unerupted molars were evaluated from the available patient documents.

RESULTS: The mean post-treatment follow-up-time was 4.6 years (range 0.7-17.8 years). Exposure of the first and second molars was performed at 9.1 years of age (range 6.9-10.6) and 15.6 years (range 13.8-21.5), respectively. Of the 30 molars, 14 (47 %) were diagnosed as impacted, 13 (43 %) as primary retained and three (10 %) as secondary retained. Twelve (40 %) were permanent lower second molars, nine (30 %) lower first molars, five (17 %) upper second molars and four (13%) upper first molars. The pre-treatment development stage of the molar apex was closed in 39.2 per cent and in 60.7 per cent root length was total or still developing and the apex was

still open. No significant difference was found in the stage of development between the unerupted right and left molars. Out of the 30 molars, 27 (90%) erupted in occlusion and 18 (60%) were considered to be in a good position in the dental arch. Only two teeth had to be extracted during the follow-up period.

CONCLUSION: Exposure is a recommendable method to treat unerupted permanent first and second molars even if root development is complete.

506 DENTAL DEVELOPMENT OF UNILATERAL CLEFT LIP AND PALATE CHILDREN IN SINGAPORE

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AIM: To investigate and compare the dental development of unilateral cleft lip and palate (UCLP) children with non-CLP children in Singapore.

SUBJECTS AND METHOD: Sixty UCLP children with a mean age of 6.64 ± 0.90 years and a non-CLP control group matched for age, gender and race were. Dental records and radiographs were studied and the dental development stages and dental age were determined using the method of Demirjian (1973).

RESULTS: UCLP children were delayed in dental development compared with non-CLP children by a mean of 0.55 ± 0.75 years and this delay was statistically significant (P < 0.001). Of 791 pairs of teeth in the UCLP group, 187 (23.6%) pairs developed asymmetrically, compared with the 52 (6.27%) asymmetrically developing tooth pairs found in 829 tooth pairs of the control group. The UCLP group had a significantly higher risk of asymmetrically developing tooth pairs than the control group (P < 0.001).

CONCLUSION: Singaporean UCLP children demonstrated delayed dental development and a higher occurrence of asymmetrical tooth-pair formation than non-CLP children.

507 EFFECT OF STATIN ON EXPRESSION OF PTHRP AND SOX 9 IN THE SPHENO-OCCIPITAL SYNCHONDROSIS: AN EXPERIMENTAL STUDY USING THE MOUSE CRANIAL BASE ORGAN CULTURE

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AIM: To investigate the effect of statin on the growth of spheno-occipital synchondroses organ culture, by measuring the amount of PTHrP and Sox 9 expression

MATERIALS AND METHOD: Fifty spheno-occipital synchondroses and surrounding tissue dissected from 1-day-old male BALB/c mice were randomly assigned to control and experimental groups. Each group was subdivided into five different time points (6, 24, 48, 72 and 168 hours), each subgroup contained five synchondroses. In the control group, the spheno-occipital synchondroses were immersed in the BGJb medium and in the experimental group in the BGJb medium and 2.5 μ M statin solution. Tissue sections were subjected to immunohistochemical staining for quantitatively analysis of PTHrP and Sox 9 expression, using an image analyzer.

RESULTS: There was a statistically significant increase of 159 and 203 per cent in the expression of PTHrP in the experimental group compared with the control group at 24 and 48 hours consecutively (P < 0.001). Furthermore, there was a significant increase of 105 per cent in the expression of Sox 9 in the experimental group compared with the control group at 24 hours (P < 0.001).

CONCLUSION: Statin increased the growth response of spheno-occipital synchondrosis through increasing expressions of PTHrP and Sox 9. Increased levels

of expression of both factors could play a role in growth of the spheno-occipital synchondrosis. This finding creates the therapeutic possibility of chemical control of growth across synchondrosis.

508 FINISHING IN LINGUAL ORTHODONTICS – A COMPARATIVE STUDY OF TWO BONDING TECHNIQUES

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AIM: To compare two methods of lingual bracket bonding, analyzing the number of bends needed to finish orthodontic treatment

SUBJECTS AND METHOD: Forty randomly selected patients to be treated with lingual orthodontics using the technique of Hiro, based on a hand-made set-up, while another 40 patients were treated using the Geron technique, based on the positioning of brackets using lingual bracket jigs. In all cases, the same archwire sequence was used, finishing arches being 0.016×0.016 inch TMA. First, second and third order bends were recorded. Exclusion criteria were: surgical and extraction cases. All patients were treated by the same orthodontist using sliding mechanics. Data were analyzed with the Statistical Package for Social Sciences version 17.0 for Windows (SPSS Inc., Chicago Illinois, USA). A *t*-test was performed.

RESULTS: The mean number of bends for the Hiro technique was 5.68 ± 3.62 and for the Geron technique 21.13 ± 5.05 (P < 0.05)

CONCLUSION: Despite the fact that both techniques are useful to achieve the treatment goals, the Geron technique needs more bends in the finishing archwires than the Hiro technique.

509 FIBRE REINFORCED COMPOSITES IN PREVENTIVE DENTISTRY*** M Tavallaee, Department of Preventive Dentistry, Hormozgan Dental School, Bandar Abbas, Iran

AIM: The premature loss of primary molars and the failure to protect this site during normal growth and developmental may put the normal occurrence of occlusions at risk in the permanent dentition. Protection of dental arch relationships in the event of premature loss of teeth can only be ensured with placement of space maintainers. The purpose of this study was to evaluate the clinical performance of fibre reinforced composite (FRC) resin as a space maintainer.

SUBJECTS AND METHOD: Thirty-four space maintainers were applied in 24 children. Old restorations in the buccal surfaces were removed and grooves in the mesiodistal direction were prepared on the decalcified or carious buccal surface of the abutment teeth. Teeth surfaces were etched, rinsed and dried. The required length of fibre was cut and then saturated with a few drops of bonding agent. The fibre was placed and a flowable composite was applied on the prepared grooves and fibre. The patients were followed for 12 months.

RESULTS: The median survival time was 11.65 months and the success rate of FRC as a space maintainer was 88.24 per cent. At the end of the study, there was no significant difference between linear and angular measurements in initial and final casts (P > 0.05).

CONCLUSION: FRC can be an appropriate substitute appliance in preserving the space following premature loss of primary teeth to prevent space loss.

510 STRESS DISTRIBUTION AND DISPLACEMENT IN THE NASOMAXILLARY COMPLEX USING DIFFERENT MATERIALS

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AIM: To compare stress distribution and displacement patterns within the periodontal ligament (PDL) and nasomaxillary complex of two different materials for Hyrax expansion screws during rapid maxillary expansion using a finite element model (FEM).

MATERIALS AND METHOD: A FEM of human skull was generated using data from three-dimensional (3D) computed tomographic scans of an 11-year-old female. A Hyrax expander was adopted for the FEM and expanded 0.4 mm simulating the clinical situation. The 3D pattern of displacement and stress distribution were analyzed for two different materials (nickel titanium versus stainless steel).

RESULTS: With a stainless steel screw more displacement was observed in the maxillary dental arch as well as in the nasomaxillary complex, while the stress within the PDL did not increase at the same proportion.

CONCLUSION: As the rigidity of an expansion screw increases, higher stress generates within the PDL (unfavourable) and is not proportionate to the increased displacement observed in the nasomaxillary complex and dental arch.

511 PULPAL REGENERATION AND ROOT DEVELOPMENT AFTER SUBCUTANEOUS TRANSPLANTATION OF CRYOPRESERVED IMMATURE TEETH IN RATS

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AIM: To investigate *in vivo* revascularization and root growth after autotransplantation of cryopreserved immature teeth in rats.

MATERIALS AND METHOD: Immature molar teeth were extracted in 4-week-old Wistar rats. In the test group, teeth were cryopreserved for one week and transplanted subcutaneously to the abdomen. In the control group, teeth were transplanted subcutaneously immediately after extraction. Data was collected from the test and control animals at intervals of 1, 2, 4 and 10 weeks post-transplantation and histologic and microradiographic examination was performed.

RESULTS: During the first weeks after transplantation, pulpal repair was similar in both groups, although degenerated pulpal tissue was replaced more slowly in cryopreserved teeth and some differences in the types of hard tissue formation were found between the test and control teeth. After 10 weeks, the observed differences in the regenerated pulpal tissue between cryopreserved and control teeth during the first weeks were no longer detectable. No root growth was detected microradiographically 10 weeks after transplantation in any of the transplanted teeth.

CONCLUSION: Although the repair process proceeded more slowly, the cryopreserved immature teeth showed a similar pulpal regeneration pattern after subcutaneous transplantation compared with immediately transplanted teeth. No conclusions can be made concerning the effects of cryopreservation on root development.

512 CRANIOFACIAL GROWTH ALTERATIONS AND THEIR THERAPEUTIC CONSEQUENCES IN SOME GENETIC DISORDERS

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AIM: Participation as part of a clinical team comprising geneticists, endocrinologists, orthodontists, psychologists, and logopedists to investigate the increase in the number of genetic disorders.

SUBJECTS AND METHOD: A group of patients (aged 3-30 years) diagnosed with different types of genetic disorders (feminine Turner syndrome, masculine Turner syndrome, Klinefelter syndrome, Down syndrome, multiple epiphyseal dysplasia, Laurence-Moon-Biedl syndrome, progeria, Hurler syndrome, Cornelia de Lange syndrome), were clinically investigated. Anthropologic and cephalometric investigations were performed for each patient.

RESULTS: Cephalometric analysis revealed a series of 'embryologic' features of the cranial base including: underdevelopemnt of the clivus, a decrease of the foramen angle (NOpBa), a large sphenoidal angle. In gonad disorders, progeria and Down syndrome, a retrognathic maxilla was observed, due to the increased sphenoid angle and to its morphological underdevelopment. In most of the syndromes (except for Klinefelter, characterized by mandibular prognathism), the mandible was retrognathic. Both the body and vertical rami of the mandible were smaller than normal, but the gonial and condylar angles values increased – also embryologic features.

CONCLUSION: Growth modifications of the cranial base, maxilla and mandible, with severe consequences over the occlusal relationships, stomatognathic system and facial aesthetics, require a complex therapeutic approach in specialized institutions, aimed to facilitate those patients social reinsertion. The most important role in these cases is that of the orthognathic and plastic surgeon.

513 THREE-DIMENSIONAL FACIAL SURFACE IMAGES DURING SMILING AFTER ORTHOGNATHIC SURGERY

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AIM: One of the treatment goals for patients with jaw deformity is to obtain satisfactory facial appearance and function with harmony of their soft and hard tissues. It is considered that heavy muscular tensions on the face are released after orthodontic treatment combined with orthognathic surgery. The aim of this study was to investigate three-dimensional facial images during smiling after orthognathic surgery.

SUBJECTS AND METHOD: Seven female patients, who had undergone a bilateral sagittal split ramus osteotomy and Le-Fort I osteotomy to correct mandibular prognathism. Surface images of the face during smiling and at rest were obtained with a laser scanner (Vivid 907, Konica Minolta, Tokyo, Japan) before and after surgery. Three-dimensional (3D) average surface images were made of the images of the face at rest and during smiling before and after surgery using 3D analysis software (3D-Rugle 4, Medic Engineering, Kyoto, Japan). The values of forward changes in the face in the sagittal plane were calculated before and after surgery, and at rest and during smiling. Cross-sections and volumes in the cheek region of the face at rest were compared with those during smiling pre- and post-surgery.

RESULTS: The concave profiles were successfully corrected in all subjects. The bulge of the buccal region when smiling increased after two-jaw surgery. The distance of the most frontal and most backward points increased post-surgery in the sagittal plane via the middle point with the endocanthion and the exocanthion. The cross-sections and volumes of soft tissue displacement at rest and during smiling were larger post- than pre-surgery. These changes may be due to increases in forward

movement of the bulges of the buccal regions and retraction of the mouth regions during smiling.

CONCLUSION: 3D movement of the soft tissues becomes more dynamic after orthognathic surgery.

514 OCCLUSAL SURFACE FORM OF MAXILLARY FIRST MOLARS WITH DELAYED ERUPTION

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AIM: Teeth (M1s) erupted in the space of the maxillary first molar (U6) have been reported to be erupted with a delay of 2 standard deviations (SD) compared with normally erupted teeth, and exhibit delayed crown development from panoramic roentgenograms. The aim of this study was to investigate the occlusal surface forms of delayed eruption of M1s compared with normal erupted U6 using images from a laser surface scanner.

SUBJECTS AND METHOD: Orthodontic patients whose M1s were delayed in eruption more than 2 SD, were compared with Japanese subjects with normally erupted teeth, who did not have third molars or a systematic history. The controls were derived from orthodontic patients of the same generation with U6 and maxillary second molars (U7) who had not undergone any dental treatment. The material consisted of dental cast models of the subjects and controls. M1, U6 and U7 in dental cast models, were scanned by a laser scanner (Vivid 9i, Konica Minolta, Tokyo, Japan) to obtain their three-dimensional (3D) tooth crown form using 3D analysis software (3D-Rugle 4, Medic Engineering, Kyoto, Japan), and compare their occlusal surface forms.

RESULTS: The area of the triangle between the three tops of the mesiobuccual, mesiolingual and distobuccal cusps of M1, U6 and U7 were 81.7 mm^2 , 91.1 mm^2 and 88.6 mm^2 , respectively. These triangles in M1 were similar to an equilateral triangle. Small or defective distolingual cusps were exhibited in M1.

CONCLUSION: M1 exhibited an occlusal surface form between that of U6 and U7.

515 CAN COMPUTERS PREDICT CERVICAL VERTEBRAL MATURATION STAGES?

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AIM: To develop software to numerically describe the shape of the cervical vertebrae, so that instead of a user's subjective assessment, numerical values could be used for comparison of different cervical vertebral maturation (CVM) stages. Using the look-up table (Baccetti *et al.*, 2002), the computer finds the best fit (closest match) of the calculated parameters in one of the five CVM stages, and hence determines and proposes the stage of CVM.

MATERIALS AND METHOD: Lateral cephalograms of 80 subjects (40 males, 40 females) aged 9-14 years were analyzed in two ways: standard and computer. Computer analysis: three parameters for the third (C3) and fourth (C4) cervical vertebra were calculated using image processing techniques, and used to describe the concavity of the lower border of the vertebrae, differentiate between different types of rectangular shapes of the vertebra body, and between a rectangular and a trapezoidal shape of the vertebra.

RESULTS: Inter-rater agreement [Kappa (κ)] showed a good agreement between software and standard assessment of CVM stages (Weighted $\kappa = 0.744$. Computer

and observer estimated the same CVM stages in 48 cases (60%). Computer overestimated CVM stages in 26 cases (32.5%), and underestimated in six cases (7.5%).

CONCLUSION: There was good correlation between the two methods: standard cephalometric analysis for assessment CVM stages and computerized assessment. Computerized assessment provides better possibilities compared with the standard method.

516 THE EFFECT OF ORTHODONTIC EXTRA-ORAL APPLIANCES ON DEPRESSION AND ANXIETY LEVEL OF PATIENTS AND PARENTS***

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AIM: To evaluate changes in the depression and anxiety levels of orthodontic patients and parents due to extraoral appliances; 1 year follow-up.

SUBJECTS AND METHOD: The first group consisted of 50 patients (age range 12-15 years) awaiting orthodontic treatment who had not received orthodontic treatment and one parent of each patient (age range 32-50 years). The second group comprised 45 patients (age range 12-15 years) who had been undergoing treatment for a period of 1 year with extraoral appliances (headgear, reverse headgear), and one parent of each patient (age range 32-50 years). Personal information were obtained from the children using the depression scale for children, body image scale, self-report for childhood anxiety related disorders, state-trait anxiety inventory (STAI) in both groups. For parents, the Beck anxiety inventory and Beck depression inventory were applied to all groups. Independent-sample *t*-tests were used to determine differences between the groups.

RESULTS: Depression scales for children were significantly higher in the second group $(9.42 \pm 5.64; P = 0.014)$. In addition, the STAI was increased significantly for the second group $(39.8 \pm 49.29; P = 0.021)$. In parents, Beck depression inventory scores were significantly greater for the second group $(8.03 \pm 6.04; P=0.046)$.

CONCLUSION: Extraoral appliances may negatively affect the orthodontic patient's mood. It is important to motivate such patients before and during treatment. Cooperation with their parents is also important, as they may be as affected as their children.

517 MICROBIOLOGY OF WHITE SPOT LESIONS – NEW INSIGHTS

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AIM: White spot lesion (WSL) development on the enamel surface is an important iatrogenic effect of fixed orthodontic therapy. The purpose of this study was to examine what changes take place in the bacterial composition of plaque on the enamel surface while WSLs are developing.

MATERIALS AND METHOD: WSLs induced on enamel under specially designed orthodontic bands on premolars *in situ*, which were due for extraction for orthodontic reasons. Plaque samples were taken from the buccal surface of 23 premolars before placement of the orthodontic bands (visit 1), 3 weeks after placement (visit 2) and 7 weeks after placement (visit 3). The samples were analyzed for the presence of 300 oral bacteria in the oral cavity with microarray technology (HOMIM). RESULTS: A significant shift in the composition of the bacterial flora was detected from visit 1 to 3. Twenty-five bacterial species increased significantly in quantity, while 15 were reduced. The majority of the premolars (87%) at visit 3 had developed pronounced WSLs. The changes in the microbiota were thus accompanied by incipient caries development. At visit 2 the composition of the bacterial flora was somewhere between visit 1 and 3. In addition, each subject had a specific bacterial composition that maintained its signature throughout the observation period.

CONCLUSION: The experiments showed that (1) this model with specially designed orthodontic bands is excellent for studying bacterial changes in dental biofilm, (2) there is no single bacterium that can be said to start the demineralization process, (3) the bacterial flora involved in the development of WSLs is complex, and (4) WSL development is a result of changes in the ecology of dental biofilm.

518 PATIENT COMPLIANCE WITH ORTHODONTIC REMOVABLE APPLIANCES RECORDED WITH A MICROCHIP SENSOR

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AIM: To evaluate the compliance of orthodontic patients with removable appliances, in which a Theramon® chip was previously integrated. The chip recorded the effective time span the appliances were worn.

SUBJECTS AND METHOD: Forty-nine patients [27 males (55.1%), 22 females (44.9%)] treated with removable appliances between October 2010 and June 2011. The median age of the patients was 12.1 years. The patients and their parents were informed about the presence and function of the microchip. With the Theramon® software, the effective wear time could be determined. Additional parameters also recorded were: the type of removable appliance, the level of patient cooperation, as evaluated subjectively by the practitioner, and other individual problems or factors that could have an effect on patient compliance.

RESULTS: The mean percentage of effective to recommended wear time was 53.4 per cent and the median percentage was 64 per cent. Seven patients did not wear their appliances at all. On a daily basis the mean and the median wear time per day were 6.1 and 6.9 hours, respectively.

CONCLUSION: Despite the fact that the patients were informed about the presence of the Theramon® microchip in their appliances, the median wear time did not exceed 7 hours per day. This is only about the half of the recommended wear time. None of the other parameters was significantly correlated with wear time.

519 THREE-DIMENSIONAL MEASUREMENT OF CANINE DRIFT INTO EXTRACTION SPACE

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AIM: To present a method for three-dimensional (3D) measurement of tooth movement and to measure canine drift into the extraction space.

MATERIALS AND METHOD: One hundred and ten models of 55 orthodontic patients. In these patients upper and/or lower first premolar teeth were extracted as part of their orthodontic treatment. These patients were part of a prospective clinical trial evaluating root resorption repair. Upper canine drift into the extraction space was evaluated from models taken before and after a 3 month-period. Three points

were selected on the medial or lateral end points of prominent rugae. These points were marked with conic burs (height: 1 mm, diameter 1 mm). After marking of these points, the models were transformed into digital format using a 3D scanner (3Shape R700 3D Scanner, 3Shape A/S, Copenhagen, Denmark). Models, taken before and after the observation period, were superimposed on these three points. After this superimposition, the canine movement was measured in three planes of space, i.e. sagittal, transverse, and vertical. The models were divided into two subgroups according to canine position, i.e. displaced canine and canine within the arch.

RESULTS: Study model analysis showed that distal, vertical and transverse canine drifts were 1.79, 1.06 and 0.31 mm, respectively. Distal (2.44 mm) and vertical (1.79 mm) movements of displaced canines were greater than distal (1.36 mm) and vertical (0.57 mm) movements of canines within the arch (P < 0.001). No significant difference was observed between transverse drifts of displaced canines (0.33 mm) and canines within the arch (0.28 mm).

CONCLUSION: The superimposition of digital models on three points marked on the palatal rugae is a reliable method for 3D measurement of tooth movement. Displaced canines showed more distal and vertical drifts than canines within the arch.

520 COMPARISON OF SHEAR BOND STRENGTH OF BRACKETS BONDED WITH A COMPOSITE RESIN BEFORE AND AFTER the EXPIRATION DATE H Turkkahraman¹, A Y Gungor², H Alkis¹, Departments of Othodontics, Faculties of Dentistry, ¹University of Süleyman Demirel, Isparta and ²University of Akdeniz, Antalya, Turkey

AIM: To compare the shear bond strength (SBS) of brackets bonded with a composite resin before and after the expiration date.

MATERIALS AND METHOD: Thirty freshly extracted premolar teeth were randomly divided into two equal groups. Ormco Mini 2000 (Ormco Corp., Glendora, California, USA) premolar metal brackets were used. Group I: The brackets were bonded with Blugloo (Ormco Corp.) adhesive paste before the expiration date. Group II: The brackets were bonded with the same light cure composite resin 1 year after the expiration date. Both groups were cured with a light emitting diode. After bonding, the SBS of the brackets was tested with a Universal testing machine. Independent samples *t*-tests were used to compare the SBS of the groups. The chi-square test was used to determine significant differences in the adhesive remnant index (ARI) scores between the groups. Significance for all tests was predetermined at P < 0.05. All analyses were performed with the Statistical Package for Social Sciences, version 17.0.0 (SPSS Inc, Chicago, Illinois, USA).

RESULTS: No statistically significant difference was found in SBS and ARI scores between the groups (P > 0.05). There was a greater frequency of ARI scores of 2, 3 and 4 in both groups.

CONCLUSION: Expiration dates do not have not a significant effect on the SBS of the tested composite material.

521 SKELETAL EFFECTS OF SLOW MAXILLARY EXPANSION IN THE MIXED DENTITION

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AIM: To retrospectively evaluate the sagittal, transverse and vertical effects of slow maxillary expansion on dentofacial structures in mixed dentition patients.

SUBJECTS AND METHOD: Two groups of patients whose pre- and post treatment lateral and frontal cephalograms were available. The slow maxillary expansion group

consisted of nine females and six males (mean age: 9.26 years). Removable appliances were used and the screw activation schedule was one turn (0.25 mm) every four days. The control group, comprised five females and 10 males (mean age: 10.54 years) selected from patients who had treatment to correct one or two teeth in anterior crossbite with a removable appliance – no expansion took place. A total of 10 variables, including eight on the lateral and two on the frontal cephalometric radiographs, were measured. A paired *t*-test test was used to evaluate the treatment effects (pre- and post-treatment changes) and a *t*-test to determine differences between the groups.

RESULTS: Nasal and maxillary width increased in both groups. No statistically significant difference was found between the groups for any variable.

CONCLUSION: Slow maxillary expansion does not induce skeletal changes additional to growth.

522 ORTHODONTIC TREATMENT SEEKING IS ASSOCIATED WITH SOMATIC DISTRESS, BODY-IMAGE DISTURBANCE, AND TEMPOROMANDIBULAR JOINT CLICKING

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AIM: Many orthodontic patients report temporomandibular joint (TMJ) disorders before, during or after treatment, but the role of occlusal factors remains controversial. It was hypothesized that self-reports of TMJ clicking in care-seeking orthodontic patients are positively associated with psychological traits but not with malocclusion severity.

SUBJECTS AND METHOD: A cross-sectional study was carried out of 353 young adolescents (48.4% female) recruited from five schools in Dunedin, New Zealand, as well as from the Orthodontic Clinic at the University of Otago. Each participant completed a self-administered questionnaire and underwent a clinical examination. Assessments included: somatic distress scores (somatization), self-perception scores for body image, and the strength of motivation for orthodontic treatment. Severity of malocclusion was clinically assessed using the Dental Aesthetic Index. Statistical analysis included analysis of variance, chi-square tests and logistic regression.

RESULTS: TMJ clicking was self-reported by 18.9 per cent (95% confidence interval = 14.9-23.1%) of the sample. Reports of TMJ clicking were associated with higher somatization scores, as well as with body image dissatisfaction (P < 0.001). TMJ clicks were more common in adolescents with mild or no malocclusion (31.1% with clicks) than in those with a moderate (17.6%) or handicapping malocclusion (12.1%; P = 0.018). Relative to patients sent by their parents, adolescents who were self-motivated to seek orthodontic treatment showed higher scores for somatization and body image dissatisfaction (P < 0.001), and tended to report TMJ clicking more often (26.3% versus 7.7%; P = 0.41). No significant association was found between malocclusion severity, somatization scores, and body image disturbances.

CONCLUSION: The strength of motivation for orthodontic treatment in adolescents is significantly associated with psychosocial factors, including somatization and body image dissatisfaction. Adolescents keener to have braces are also more likely to report TMJ clicking.

523 MORPHOLOGICAL NASAL CHANGES ASSOCIATED WITH RAPID MAXILLARY EXPANSION

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AIM: To evaluate morphological nasal changes associated with rapid maxillary expansion (RME), which is used in the treatment of skeletal maxillary narrowness.

SUBJECTS AND METHOD: Twenty patients [12 girls, 8 boys, between the ages of 10 and 15 years $(13.4 \pm 0.99 \text{ years})$] were compared with a control group consisting of 16 subjects [10 girls, 6 boys between the ages of 10 and 15 years $(13.25 \pm 1.18 \text{ years})$]. An acrylic bonded RME appliance was used for expansion. Lateral and posteroanterior films were taken before and after RME, and after retention. Greater alar cartilage width, nasal cavity width, vertical and sagittal movement of the tip of the nose, SNA and nasolabial angle measurements were evaluated to understand the morphological and positional changes of the nose associated with RME.

RESULTS: The greater alar cartilage width returned to its original position, the nasal cavity width increased, and the tip of the nose moved downward and minimally forward. SNA returned to its original value and a small increase occurred in nasolabial angle due to RME.

CONCLUSION: Soft tissue changes may be considered clinically non-significant compared with the controls. The effects of RME on patients' frontal nasal appearance and mid-face soft tissue profile are favourable.

524 LONGITUDINAL SOFT TISSUE PROFILE CHANGES IN TURKISH ADOLESCENT CLASS I SUBJECTS

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AIM: To assess longitudinal changes in the soft tissue profile in untreated subjects from the pre- to the post-pubertal stages of development as defined by the cervical vertebral maturation method.

MATERIALS AND METHOD: The archived records of 14 boys and 15 girls who were followed longitudinally from approximately 10 to 16 years of age with a Class I occlusion, normal antero-posterior and vertical skeletal relationships. Soft tissue profile changes during growth were analyzed on lateral cephalograms. Analysis of variance was used to search for significant changes between developmental periods. Duncan's test was then used to identify the source of any significant difference. Differences between the genders were determined by a Student's *t*-test.

RESULTS: Nasal prominence and dimensions increased more than chin, upper and lower lip prominence and dimensions. Soft tissue dimensions were found to be greater in males. After puberty, males had more soft tissue changes than females. During the growth period, males had a tendency to more convex profiles and females had a tendency to more lip retrusion relative to the nose, chin and soft tissue profile.

CONCLUSION: These results can be used by orthodontists as being representative of soft tissue profile changes during the developmental period.

525 WEIGHT VARIATIONS OF THREE POLY CARBOXYLATE BRANDS AFTER WATER IMMERSIONS

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AIM: Different cements are used for cementation of orthodontic bands that have their own special sensitivity of manipulation, solubility and decomposition after setting. Each of the above plays a role in detachment of the bands, increased possibility of caries and decalcification. The purpose of this study was to evaluate weight changes of three brands of poly carboxylate (PC) cements. MATERIALS AND METHOD: An experimental study was designed to compare three types of PC cements. The cements were categorized according to the ADA 8 index and the data were analyzed with an electronic balance. Weight variations were recorded 6 weeks after floating the samples in water and data were subjected to analysis using repeated ANOVA.

RESULTS: Aria Dent PC at day 42 versus day 1 had the most mean amount of weight gain, followed by Hoffmann and Durelon cements. The changes in different times among the three types of PC cements were statistically significant (P < 0.001).

CONCLUSION: There is a significant difference in weight variation during the investigated period of time among the different types of PC cements. Aria Dent displays greater weight variations over time compared with the other conventional cements. It is suggested that manufacturers manipulate the cements as the differences probably come from their composition.

526 MICROSCOPIC EVALUATION OF ORTHODONTIC MINISCREWS COMPARED WITH OSSEOINTEGRATED IMPLANTS.

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AIM: Miniscrews have ease of insertion and removal, low cost, and no or little delay in loading. Bone has the ability to adapt its shape and size in response to mechanical loads via a process known as re- (modelling, in which bones are shaped or reshaped by the independent action of osteoblasts and osteoclasts). The aim of the present study was to evaluate the difference in bone remodelling between implants and miniscrews.

MATERIALS AND METHOD: In four adolescent beagle dogs, two palatal implants were inserted in the median palatal suture, four miniscrews were inserted in the alveolar process of the lower jaw and one prosthetic implant was placed in the upper anterior region. The experimental period was 25 weeks, and the dogs were subjected to a scheme of sequential point labelling with vital staining every 6 weeks. Insertion sites were examined microscopically and histometric analysis was performed.

RESULTS: Bone remodelling was observed around the inserted miniscrews and implants. Histometric measurements revealed the following results: for the palatal implants the amount of osseointegration varied from 43 to 64.3 per cent, for the alveolar inserted screw between 71.8 and 76.6 per cent and for the anterior prosthetic implant between 76.6 and 95.5 per cent.

CONCLUSION: The receptor site anatomy and the different implant types within the same sample showed marked differences regarding bone remodelling and the amount of osseointegration. Remodelling is a process that maintains mechanical integrity of the skeleton. Knowledge of bone microarchitecture helps in understanding and improving orthodontic treatment with miniscrews. The response of microarchitecture parameters to treatment should allow assessment of the real efficacy of miniscrew anchorage. Surface treatment of the endosseous part of the miniscrews might be favourable in enlarging the contact area between the bone and screw and as such improve success rates. Further research in this area is warranted.

527 IMPLANTS FOR UPPER INCISOR REPLACEMENT IN GROWING INDIVIDUALS: A HISTOMORPHOMETRIC STUDY IN ADOLESCENT BEAGLE DOGS

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AIM: Congenital partial anodontia or traumatic tooth loss might compromise facial aesthetics in children or adolescents. The viability of implant use in these patients is questioned since dental and skeletal growth is still present. The aim of the present study was to evaluate histomorphometrically the influence of implant placement in the upper anterior region in growing individuals on marginal bone level around the implant and the neighbouring teeth and on alveolar growth in this region.

MATERIALS AND METHOD: Four out of 5 adolescent beagle dogs received a dental implant immediately after extraction of tooth 1.1. The implants were not provided with a crown. All animals were subjected to a scheme of sequential point labelling with vital staining every 6 weeks. After a period of 25 weeks, the dogs were sacrificed and specimens prepared for histological evaluation. Marginal bone level of the implant and lateral incisor were compared between the test and control sides, and between test and control dogs. The amount of alveolar growth was evaluated by fluorescence microscopy.

RESULTS: Marginal bone loss of 3.9 mm was observed around the implant and of 2.0 mm on the implant side of the neighbouring tooth. The 2.0 mm difference in marginal bone level between the tooth neighbouring the implant and the control tooth on the other side, can be attributed to bone loss caused by insertion of the implant (1.5 mm) and arrest of alveolar growth (0.5 mm).

CONCLUSION: Both arrest in alveolar growth and bone loss due to implant insertion in the upper anterior region in adolescent beagle dogs, contribute to a total decrease of marginal bone level of 2.0 mm as compared with a situation without an implant.

528 INHALATION OR INGESTION OF ORTHODONTIC OBJECTS R Varho¹, H Oksala², A-L Svedström-Oristo¹, Departments of ¹Oral Development and Orthodontics and ²Community Dentistry, Institute of Dentistry, University of Turku, Finland

AIM: Although inhalation or ingestion of orthodontic appliances can lead to serious medical problems, the real incidence of these complications is more or less anecdotal. Thus the aims of this study were to define the frequency of inhalation/ingestion of orthodontic objects and to analyse their further management.

MATERIALS AND METHOD: An electronic, semi-structured questionnaire was sent to all the members of the Orthodontic Section of Apollonia, the Finnish Dental Society, who had given their email addresses (n = 251). A total of 140 members (56%) responded (111 specialist orthodontists, 14 postgraduate students, 15 general practitioners).

RESULTS: Twenty per cent of the respondents reported ingestion or inhalation of an orthodontic object by a patient as having occurred once, and 19 per cent reported it as having occurred 2 to 10 times. The complication usually occurred out of office while eating or sleeping; only 19 per cent happened during treatment in the office. The most common objects ingested were brackets (24%), wires (19%), bands (14%), elastic ligatures (13%) and intraoral elastics (10%). None of the cases had been life-threatening. The procedures following these complications were in order of their frequency: an observation period of 2 to 14 days (in 40% of cases), radiographic examination (26%), medical emergency (9%) and dietary instruction (7%). Surgical removal of the object was needed in two cases (4%). The majority of the respondents (69%) did not change their treatment manner, while 31 per cent reported being more careful after the sequence. Only two respondents (4%) estimated the chance of ingestion or inhalation as strong, while the majority of the respondents regarded this risk as insignificant.

CONCLUSION: Although the risk of inhalation or ingestion of orthodontic objects is small and the consequences rarely serious, it should be taken into consideration. A medical emergency protocol should be included in the informed consent form.

529 QUALITY OF SIMULTANEOUSLY TAKEN, INTEGRATED THREE-DIMENSIONAL FACE SCANS WITH CONE BEAM COMPUTED TOMOGRAPHY

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AIM: As orthodontic treatment planning requires information about hard and soft tissues, photographs are routinely taken of the patients' faces. Combined with panoramic and lateral cephalometric image these diagnostic tools provide sufficient clinical information, however they do not consider the human skull and face in its full three-dimensional (3D) complexity. A newly developed multimodal 3D cone-beam computer tomograph (CBCT) imaging system offers the possibility to simultaneously take 3D CBCT and 3D photographs (3D face scan). The visualization quality of orthodontically relevant structures in these 3D face scans was evaluated in this study. MATERIALS AND METHOD: 3D face scans of 25 patients were evaluated by three examiners regarding their image quality on a scale from 1, very good, to 6, not usable. For all CBCT scans a medical indication was given. The following soft tissue points were considered: nasion, subnasale, orbitale left, orbitale right and pogonion. All scans were taken by a CBCT prototype with integrated faces can (Galileos, Sirona Dental Systems, Bensheim, Germany).

RESULTS: Most scans showed all relevant structures and had a sufficient field-ofview of at least $15 \times 15 \times 15$ cm. The quality of the rated structures was: nasion 1.56 \pm 0.76, subnasale 2.64 \pm 1.05, orbitale right 2.01 \pm 0.86, orbitale left 2.16 \pm 1.16 and pogonion 4.41 \pm 1.22. Relevant constraints were caused by two factors: the fixation device overlayed the patient's anatomy and moving artefacts diminished image quality.

CONCLUSION: Although there were factors that reduced the results of image quality such as artefacts and positioning tools, orthodontically relevant structures could sufficiently be seen and used for 3D-soft tissue analysis. Elimination of these factors and improvement of fixation, which is valuable for both parts of the device, CBCT and face scan, should increase image quality to allow comprehensive 3D-analysis.

530 A COMPARISON OF FIVE CEPHALOMETRIC ANALYSES IN THE DIAGNOSIS OF CLASS III MALOCCLUSIONS

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AIM: A Class III malocclusion has been described as difficult to diagnose. Some cephalometric analyses routinely used in orthodontics have limitations due to the altered structures. The aim of this study was to identify which variables of the most common cephalometric analyses used in orthodontics best discriminate Class III malocclusions and to describe an alternative way of using cephalometrics by combining variables.

SUBJECTS AND METHOD: A discriminant analysis was chosen to obtain both a description of a Class III malocclusion and a predictive model for each cephalometric method to classify these patients. For this purpose, two groups were selected: a study group of 89 adult skeletal Class III subjects and the control group of 69 adult subjects

with ideal occlusion. The following cephalometric methods were analyzed on the lateral cephalograms: Ricketts, Steiner, McNamara, Wits appraisal and Björk-Jarabak analysis.

RESULTS: Discriminant analysis provided a model for each cephalometric method that accurately classified both Class III and control cases.

CONCLUSION: A model for each cephalometric analysis may be used to describe Class III morphology, or with a predictive aim in order to classify future cases with greater reliability.

531 EARLY ORTHODONTIC INTERVENTION CLASS III MALOCCLUSION CHILDREN – EVALUATION OF SWALLOWING AND TONGUE POSTURE

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AIM: To assess the swallowing patterns and tongue posture in children with a Class III malocclusion (CIII) before and after orthodontic treatment and in children without s Class III (non-CIII) using two- and three-dimensional (3D) ultrasonography (US).

SUBJECTS AND METHOD: The swallowing cycles of 11 children with a CIII (mean 6.8 ± 1 years) and 19 non-CIII children (mean 6.2 ± 0.4 years) were recorded using B-and M-mode US. The scan line was set through the tongue tip and the swallowing pattern was assessed. 3D US images of the tongues were obtained using a 3D US system. 3D reconstructions were made using the program, 4D View. Referential 3D US reconstructions were used for the assessment of tongue posture. The children with a CIII were treated with a Fränkel appliance for 1 year and later with a facemask. Both groups of children were ultrasonographically examined after 1 (T1) and 2 (T2) years.

RESULTS: Seventy-three per cent of children with a CIII and 37 per cent of the non-CIII children had a visceral swallowing pattern before treatment (Fisher's exact test, P = 0.13). There were no statistically significant changes in either group at T1. At T2 all the treated children had a somatic swallowing pattern; the change was significant (P < 0.005). There were no significant differences between the groups. Ninety-one per cent of CIII children and 32 per cent of non-CIII children demonstrated tongue posture on the mouth floor (P < 0.005). At T1 there were no statistically significant changes either within or between the groups (P = 0.26). At T2, 46 per cent of the treated children and 26 per cent of the non-CIII children had a tongue posture on the mouth floor. The difference between the groups was not significant.

CONCLUSION: Children with a CIII had more often a visceral swallowing pattern and their tongues were to a much greater extent postured on the mouth floor compared with the non-CIII children. Early orthodontic intervention significantly improved swallowing and tongue posture.

532 CYTOKINES IL-1ß AND IL-6 IN GINGIVAL CREVICULAR FLUID DURING ORTHODONTIC TREATMENT IN CHILDREN AND ADULTS A Vujacic¹, A Konic², J Pavlovic¹, N Milosevic-Jovcic², V Vukicevic¹, ¹Medical Faculty, Kosovska Mitrovica University of Priština, Kosovo and ²Institute for Medical Research, University of Belgrade, Serbia

AIM: The early phase of orthodontic tooth movement is characterized by an inflammatory response, and various proinflammatory cytokines have been suggested to play a role in it. The aim of this study was to determine the expression of IL-1ß
and IL-6 cytokines in gingival crevicular fluid (GCF) in children and adults during orthodontic treatment.

SUBJECTS AND METHOD: Ten children (mean age 13 years) and 10 adults (mean age 20 years), undergoing orthodontic for movement of a single tooth. The untreated antagonistic tooth was used as the control. GCF was sampled at the control and treatment sites before, 24, 72, and 168 hours after initiation of treatment. Cytokines levels in GCF were determined using enzyme-linked immunosorbent assay kits.

RESULTS: GCF levels of IL-1ß and IL-6 for the treated teeth were higher than for the control teeth, with marked fluctuations throughout the period examined, both in children and adults. In children, there was a correlation between cytokine levels and the average velocity of tooth movement.

CONCLUSION: IL-1ß and IL-6 were increasingly expressed during the initial phase of treatment, both in children and adults, but the effect of enhanced cytokine production on tooth displacement was not the same in the two groups.

533 THE VASCULAR ENDOTHELIAL GROWTH FACTOR EFFECT OF SALVIA MILTIORRHIZA ON OSTEOBLASTIC CELLS

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AIM: Salvia miltiorrhiza (SM), a medicinal herb, has previously been shown to produce similar effects on osteoblasts as vascular endothelial growth factor (VEGF). The aim of this *in vitro* study was to investigate whether SM induces the expression of VEGF in osteoblastic cells and whether SM regulates the expression of VEGF receptors, VEGFR-1/VEGFR-2, on osteoblasts using VEGF as a positive control.

MATERIALS AND METHOD: MC3T3-E1 osteoblastic cells were cultured with either SM or VEGF and collected at time points 24, 48 and 72 hours. A blank control group cultured with no intervention was also collected. The mRNA expression levels of VEGF, VEGFR-1 and VEGFR-2 were examined using real- time polymerase chain reaction. Protein expression of VEGF was examined using mouse VEGF enzyme linked immunosorbent assay (ELISA).

RESULTS: SM intervention showed an increased mRNA expression of VEGF by 21 per cent at 24 hours (P < 0.001) which remained increased at 72 hours by 74 per cent (P < 0.001), while VEGF intervention showed decreased mRNA expression of VEGF by 51 per cent at 24 hours (P < 0.001) which increased by 126 per cent at 72 hours (P < 0.001). Following intervention with SM, the ELISA showed a significant increase in protein expression of VEGF at 72 hours (P < 0.05), while intervention with VEGF in the ELISA resulted in no significant changes in protein expression of VEGF. VEGFR-1. mRNA expression in response to SM was increased significantly at 48 hours by 5 per cent (P < 0.001) but was decreased by 8 per cent (P < 0.05) at 72 hours. VEGFR-1 mRNA expression in response to VEGF was decreased at both 24 and 72 hours by 20 (P < 0.001) and 15 (P < 0.001) per cent, respectively. VEGFR-2 mRNA expression was increased in response to SM at 24 and 48 hours by 25 (P < 0.001) and 72 (P < 0.01) per cent, respectively.

CONCLUSION: SM enhanced the expression of VEGF and its receptors in MC3T3-E1 cells, in a manner similar to that of VEGF but increased in magnitude at the concentration used.

534 EFFECT OF RADIX ET RHIZOMA RHEI EXTRACT ON BONE FORMATION IN RABBITS

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AIM: To compare the amount of new bone produced by Radix et Rhizoma Rhei extract in collagen matrix to that produced by collagen matrix *in vivo*.

MATERIALS AND METHOD: Twelve bone defects, 5×10 mm, were created in the parietal bone of six New Zealand White rabbits. Six defects were grafted with Radix et Rhizoma Rhei extract mixed with collagen matrix (experimental group) and six defects were grafted with collagen matrix alone (control group). The animals were killed on day 14 and the defects were dissected and prepared for histological assessment. Quantitative analysis of new bone formation was made on 50 sections from each group using image analysis.

RESULTS: A total of 354 per cent more new bone was produced with Radix et Rhizoma Rhei extract in collagen matrix than those with collagen matrix (control group).

CONCLUSION: Radix et Rhizoma Rhei extract in collagen matrix has the effect of increasing new bone formation locally *in vivo*.

535 RELIABILITY OF SOFT TISSUE MEASUREMENT ON THREE-DIMENSIONAL FACIAL SCANS

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AIM: To evaluate the influence of examiner (repeated placement of landmarks) and patient (change after facial expression and motion) on three-dimensional (3D) facial scans.

MATERIALS AND METHOD: The facial scans of 20 students were taken on the FaceScan3D (3D-Shape) four times: before and after a change of facial expression, after body movement, and after 7 days. Two examiners analyzed the 80 scans; one scan was analyzed five times by each examiner. Using Comparison3D and OnyxCeph3TM programs, 83 distances and angles of each scan and differences of 12 volumes and areas of two moments were determined. Statistical analysis was carried out using the ProcMix- and Means-procedures, coefficient of variation, and mean differences.

RESULTS: Observer reliability was within a difference of <0.2 mm² for areas and ±1 ml for volumes, except for the eye regions (P < 0.05). Coefficient of variation was <0.5 for all distances and angles, showing no observer effect. Differences increased slightly from baseline, up to 1 ml for volumes and 0.002 mm² for areas during measurement. The largest mean differences were found for the distance, Go-Me (2.8 ± 4.63 mm) and lip protrusion (3.29 ± 7.45).

CONCLUSION: The used procedure can be used for patients' long-term studies. Volume differences were found to be reproducible within a SD of 1 mm. Measurement of 3D facial distances and angles are influenced by difficulties in locating the soft tissue landmarks and in patient general effects (e.g. cold, hormones). Further investigations are necessary to identify the best reproducible soft tissue points in 3D facial scans.

536 DIGITAL THREE-DIMENSIONAL IMAGES OF PAIRS OF MODEL CASTS CONNECTED BY A SCAN OF THE VESTIBULAR SIDE S Wriedt¹, M Niemann¹, I Schmidtmann², H Wehrbein¹, ¹Department of Orthodontics and ²IMBEI, Johannes Gutenberg University, Mainz, Germany

AIM: The orientation of maxillary and mandibular model casts in a digital threedimensional ((3D) image can be produced using a bite-scan or a scan of the vestibular side. This research evaluated the use of the vestibular scan for orthodontic studies. MATERIALS AND METHOD: After production of detailed maxillary and mandibular scans, the vestibular scans of 10 pairs of models (different dental and skeletal anomalies; rigid fixation by glue) were performed three times using the scanning device activity 102 (smartoptics). Maxillary, mandibular and vestibular scans were merged to form a complete digital model. These models were superimposed on the mandibular structures. Maximum differences on the vestibular and occlusal sides were determined on each maxillary tooth or gingival region. Using the statistical programs, SPSS and SAS, descriptive analysis and the ProcMix-procedures were performed.

RESULTS: The mean of the maximum differences was $37 \pm 28 \ \mu\text{m}$. There were no significant differences between measurements within the dental arch, between regions with and without teeth, and between occlusal and vestibular sides. The mean difference between repeated vestibular scans was $28 \pm 14 \ \mu\text{m}$, and between repeated maxillary or mandibular scans $15 \pm 8 \ \mu\text{m}$.

CONCLUSION: As digital models created using vestibular scans are precise enough for orthodontic studies, this procedure can be used for further research.

537 PERIORAL SOFT TISSUE CHANGES FOLLOWING HARD TISSUE ALTERATION IN CLASS III PATIENTS WITH MANDIBULAR DEVIATION Y Yakita¹, K Terada², A Kohara¹, K Ochi¹, I Saito¹, Departments of Orthodontics, ¹Niigata University Graduate School of Medical and Dental Sciences and ²The Nippon Dental University School of Life Dentistry at Niigata, Japan

AIM: It is important to understand hard and soft tissue interactions, in surgical orthodontic treatment. For this purpose a three-dimensional (3D) integration system of facial and dental data has been developed. The purpose of this study was to analyze the correlation between the soft and hard tissues by multiple liner regression analysis, and to improve the accuracy for explaining soft tissue changes.

SUBJECTS AND METHOD: Seven skeletal Class III patients, who had undergone a bilateral sagittal split ramus osteotomy (BSSRO). 3D surface data of the face with the anterior teeth, dental casts, and lateral cephalograms were obtained before and after BSSRO. The areas investigated were: subnasal, upper and lower lip, chin, upper and lower buccal regions of the deviated and non-deviated sides. Multiple liner regression analysis was calculated with the variation of the soft tissues as the dependent variables and the explanatory variable as the changes in hard tissues, variation of soft tissue thickness, soft tissue thickness pre-orthognathic surgery, overjet, and midline deviation for each area by the stepwise method.

RESULTS: Each of the squared multiple correlation coefficients were adjusted for the degree of freedom. These values were consistent, including; 0.11 in the subnasal region, 0.87 in the upper lip region, 0.90 in the lower lip region, 0.61 in the chin region, 0.68 in the upper buccal region of the deviated side, 0.75 in the lower buccal region of the deviated side, 0.73 in the lower buccal region of the non-deviated side, and 0.73 in the lower buccal region of the non-deviated side.

CONCLUSION: The results obtained suggest the possibility to precisely explain soft tissue changes after BSSRO using multiple liner regression analysis.

538 A NEW THREE-DIMENSIONAL ANALYSIS OF ASYMMETRY FOR PATIENTS WITH CRANIOFACIAL SYNDROMES!!

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AIM: The use of three-dimensional computed tomography (3D-CT) represents a significant improvement in planning treatment. Many forms of analysis have been

described, although none of them are suitable for craniofacial syndromes. The aim of this study is to introduce a new 3D analysis of clinical value for evaluating asymmetry in subjects with a craniofacial syndrome.

MATERIALS AND METHOD: Virtual 3D models were reconstructed from CT images of 62 normal subjects (35 males, 27 females), more than 18 years old. Measurements of asymmetrical skeletal and dentoalveolar relationships were evaluated and standardised data obtained. The feasibility of the new 3D craniofacial analysis was then evaluated on one patient with severe maxillomandibular asymmetry in the form of hemifacial microsomia.

RESULTS: Standardised 3D data were classified into six maxillary, eight mandibular and seven dentoalveolar measurements. No significant differences were found between males and females (Mann Whitney U test, P > 0.05). Useful data of clinical value was provided for planning orthodontic and surgical treatment of asymmetries, as well as a diagnostic chart.

CONCLUSION: This method is useful for the clinical evaluation of asymmetry in craniofacial syndromes. The use of 3D analysis facilitates surgical and orthodontic treatment planning.

!!Winner of the Houston Research Poster Award.

539 PLACEMENT ANGLE AND DIRECTION OF ORTHOPAEDIC FORCE APPLICATION ON THE STABILITY OF TEMPORARY ANCHORAGE DEVICES***

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AIM: To evaluate the impact of the direction of orthopaedic force and the placement angle on the stability of temporary anchorage devices (TADs).

MATERIALS AND METHOD: Finite element model analysis was performed using TADs with a placement angle of 90, 60 and 30 degrees to the bone surface. An upward and lateral force of 800 g was applied to the TADs at 0, 30, 60, and 90 degrees to the bone surface. In addition, pullout strength of TADs in the experimental bone block was measured at the same angulations to the bone surface.

RESULTS: The maximum von Mises stress and displacement were lowest when the upward force was parallel to the TAD placement angle. According to the increase of upward force angle, the maximum von Mises stress and displacement increased. This tendency was most significant at a placement angle of 30 degrees. Maximum von Mises stress in the bone and displacement of the TAD tended to increase as the angle of upward and lateral force increased. TADs with 30 degrees of placement angle had a rapid increase of maximum von Mises stress and displacement at 60 and 90 degrees of lateral force. In the pullout test, the strength of the cortical bone with 1.0 mm thickness showed a higher value than one with 0.5 mm (P < 0.05). The pullout strength was higher in the axial upward force direction compared with the upward force with lateral vectors.

CONCLUSION: TADs may be the most stable when inserted perpendicular to the bone surface under various force directions; otherwise, it is recommended to change the force direction or to reduce the force magnitude.

540 RADIOGRAPHIC EVALUATION AFTER RETENTION OR RELAPSE FOLLOWING INTRUSIVE FORCES IN RAT MOLARS***

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AIM: To describe radiographic changes caused by molar intrusion with or without retention in rats.

MATERIALS AND METHOD: Thirty 12-week-old male rats were assigned to six groups (n = 5). Molar intrusion was achieved with an intrusion spring to two maxillary molars for 2 weeks. The control group underwent the same experimental protocol, but without the intrusion spring. The intrusion and control groups were then euthanized. In four groups, the intrusion spring was disengaged after intrusion and the new molar positions were either retained or not with an occlusal bite-block for 1 or 2 weeks. Radiographic changes were measured at the cusp tip, root apices, and alveolar crests.

RESULTS: After 2 weeks of intrusion, the cusp tip and root apices had moved apically compared with the control group. However, the alveolar crests were similar in the intrusion and control groups. With a retention bite-block, the new position of the intruded cusp tip was maintained, but the root apices moved occlusally, and the alveolar crest between the two intruded molars had moved apically. Without retention, the cusp tip and root apices moved occlusally, and the alveolar crest between the intruded molars had moved apically. Without retention, the cusp tip and root apices moved occlusally, and the alveolar crest between the intruded molar and unintruded molars also moved occlusally compared with the intrusion group.

CONCLUSION: Rat molars were successfully intruded and maintained at the altered position with bite-block retention. However, apical root resorption was observed as an instant response. The alveolar crest adjacent to the intruded molars was repositioned apically, but there was a delayed response compared with root resorption.

541 CORTICOTOMY: ASSISTED ORTHODONTIC TREATMENT***

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AIM: To review the most recent literature to present a synthesis of the benefits of corticotomy and its mechanism of action.

MATERIALS AND METHOD: The bibliography for the years 2008 to 2011 on corticotomy in the electronic databases (Medline, PubMed, Cochrane Library) were reviewed. Randomised clinical studies, systematic cases with control studies, reviews and meta-analyses were included, while isolated clinical cases, publications connected with manufacturers and opinion articles were excluded.

RESULTS: Twenty-three articles were identified. Twelve were discarded and only 11 could be analysed. Corticotomy is an adjuvant surgical technique in orthodontic treatment. It is believed to present several advantages, such as reduction in treatment time, increase in the traction capacity on the treated dental specimens, greater expansive potential, differential dental movement and also greater stability after orthodontic treatment. Bone remodelling triggered by the inflammatory phenomenon is regulated by the activation of cytokines such as interleukin (IL)-1 β , IL-6, IL-8, tumour necrosis factor- α , prostaglandin and the nuclear factor receptor activating system (RANK), RANKL and osteoprotegerin, which mediate and stimulate osteoclastic and osteogenic activity.

CONCLUSION: Corticotomy permits early and accelerated dental movement, along with greater remodelling activity in the alveolar bone. Surgical intervention itself facilitates the process of osseous apposition and resorption.

542 EFFECT OF FLUORIDE VARNISH ON SALIVARY *STREPTOCOCCUS MUTAN* LEVELS IN ADOLESCENT ORTHODONTIC PATIENTS

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AIM: To determine the *Streptococcus mutan* levels and pH in adolescent patients with fixed orthodontic appliances.

SUBJECTS AND METHOD: Thirty-one patients treated with the same type of fixed orthodontic appliance for a minimum of 6 months with no active carious lesions. Five millilitres of unstimulated saliva samples were collected from each patient at baseline prior to fluoride varnish (Voco Profluorid Varnish®) application. Sample collection was repeated at 1, 3 and 6 monthly intervals. Fluoride varnish application was repeated at the third month evaluation following saliva sample collection. The outcomes examined at the end of the study were the salivary *S. mutan* counts and pH. Shapiro-Wilk, Friedman and Wilcoxon tests were used for statistical analysis.

RESULTS: There was a statistically significant difference in salivary *S. mutan* counts between the third (P = 0.025) and sixth (P < 0.001) month levels and baseline. There was no change in salivary pH at any time interval.

CONCLUSION: Fluoride varnish application may reduce salivary *S. mutan* levels throughout fixed appliance treatment. Regular fluoride varnish application should be suggested for orthodontic patients as a preventive measure.

543 TRENDS AND ATTITUDES REGARDING ORTHODONTIC TREATMENT. A SURVEY OF ORTHODONTISTS IN TURKEY

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AIM: To provide an insight into the tendencies and attitudes of orthodontists regarding their orthodontic material and technique preferences, and to construct a baseline to be used to assess future changes in trends and techniques in Turkey.

MATERIALS AND METHOD: The study was designed as a web-based survey. The contact information of 715 specialists registered with the Turkish Orthodontic Society was obtained and a text explaining the aim and content of the questionnaire was e-mailed to each member. Three hundred and fourteen orthodontists who wished to participate were directed to a secure link in order to connect to the survey web page. The obtained data pool was evaluated using descriptive analysis and chi-square test. Always and mostly choices were considered as 'used in routine'.

RESULTS: The response rate was 44 per cent. A majority of orthodontists routinely used the 0.018 inch conventionally ligated Roth brackets. Acid etching was used routinely by 88.8 per cent, self-etching primers were preferred by 7.6 per cent of the respondents. The majority preferred to use light-cure adhesives (85.6%), the direct bonding technique (96.4%) and light-cure band adhesive cement (52.8%). The initial archwire selection was based on individual arch form (33.7%) and routine preference was nickel-titanium martensitic passive (65.6%) archwires. Headgear was used routinely by 26.4 per cent whereas miniscrews were preferred by 45.5 per cent for anchorage. Lingual retainers were used routinely by 81.4 per cent. Digital archiving of the models was used by 14.6 per cent and digital cephalometric analysis software by 52.5 per cent. The nasoalveolar moulding technique was used by 43.3 per cent of the respondents for cleft patients whereas 10.8 per cent used the Hotz technique. Seventy-seven per cent of the respondents used autoclaves and 22.9 per cent high temperature dry air sterilization.

CONCLUSION: This is the first detailed survey highlighting Turkish orthodontists' treatment and material preferences. This data may be used to construct a baseline to assess trends and newly introduced alternatives that may be used more frequently in the future.

544 COMPARISON OF THE EUREKA SPRING WITH INTERMAXILLARY ELASTICS IN THE TREATMENT OF CLASS II DIVISION 1 MALOCCLUSION E Yıldırım, S Karaçay, Department of Orthodontics, GMMA Haydarpasha Training Hospital, Istanbul, Turkey

AIM: To compare the effects of the Eureka spring with intermaxillary Class II elastics.

SUBJECTS AND METHOD: Forty-four patients with a Class II division 1 malocclusion. Group 1 consisted of 22 patients with a mean age of 13.2 years (12 females, 10 males) treated with the Eureka spring. Group II comprised 22 patients with a mean age of 13.4 years (12 females, 10 males) treated with Class II elastics. Pre- and post-treatment cephalometric radiographs were traced and the differences between two groups were compared with an independent-samples *t*-test while ingroup differences were evaluated with a paired-samples *t*-test.

RESULTS: Comparison of in-group differences revealed that ANB decreased (P < 0.01) and SNB increased (P < 0.05) revealing displacement of the mandible in the anterior direction in both groups. L1/Go-Gn (P < 0.01) and L1/NB (P < 0.05) increased indicating protrusion of the mandibular incisors in groups 1 and 2. Depending on these skeletal and dental alterations, overjet decreased (P < 0.01) and inclination of the occlusal plane increased (P < 0.05) in both groups. When the treatment changes were compared between groups 1 and 2, it was determined that SNB (P < 0.05) and L1/Go-Gn (P < 0.05) alterations were statistically significant revealing that the Eureka spring caused more anterior mandibular displacement and less protrusion of the mandibular incisors. Comparison of the pre-treatment values between the groups showed that the inclination of the palatal plane (SN/ANSPNS) and anterior face height (N-Me) was statistically significant (P < 0.05). Post-treatment values for SN/ANSPNS and inclination of the maxillary central incisor (U1/SN) were also significant (P < 0.05).

CONCLUSION: The Eureka spring is an acceptable substitute for Class II elastics in correcting Class II malocclusions in non-compliant patients.

545 ASSESSMENT OF DENTOALVEOLAR CHANGES ON UPPER PERMANENT MOLAR DISTALIZATION USING THE M-PENDULUM G Yordanova, Department of Orthodontics, Medical University of Sofia, Bulgaria

AIM: To determine short-term dentoalveolar changes in molar distalization with the modified M-Pendulum used in different age groups.

SUBJECTS AND METHOD: Ninety patients aged from 8 to 47 years (average 14.38 \pm 5.72 years). The average length of appliance wear was 5.9 months (4 to 8.5 months). The measurements were made at relatively constant points on pre- and post-treatment plaster models before and after treatment. The patients were divided into four groups: group 1, only first molar erupted (30 per cent); group 2, first and second molars erupted and unerupted third molar (53 per cent); group 3, erupted first and second molars erupted, extracted third molar or absence of third molar germ (10 per cent); group 4, first, second and third molars erupted (7 per cent).

RESULTS: The basic desired result was expressed in first upper permanent molar distalization, average -4.76 mm. and loss of premolar support of 0.54 mm. Transverse changes in the area of the first molar showed an average increase of 1.30 mm.

CONCLUSION: The favourable effect of the M-Pendulum is independent of patient co-operation while its flexibility allows it to be combined with other orthodontic appliances. Knowing the limitations of its effects provides an opportunity for safe application.

546 EFFECT OF FLUORIDE ON REMINERALIZATION AND STRUCTURAL IMPROVEMENT OF ENAMEL CRYSTALS IN DISTILLED WATER M Yoshikawa, M Fujita, A Tanaka, N Suda, Division of Orthodontics, School of Dentistry, Meikai University, Chiba, Japan

AIM: Prior to orthodontic treatment, the surface of tooth enamel has to be polished and acid etched in order to strengthen the bonding effect of orthodontic adhesives. However, etching agents are reported to impair enamel crystals, as seen in the carious lesion. Damaged crystals can be remineralized by fluoride treatment, and it is suggested that minerals in the saliva are important for remineralization. It is known that agents can remineralize damaged crystals by replacing OH- with F- ions, resulting in the conversion of hydroxyapatite to fluorapatite. Although there are a large number of studies reporting remineralization and fluorapatite formation by fluoride mouth rinsing agents, there is no report examining them in distilled water.

MATERIALS AND METHOD: Human permanent teeth were etched with a 34 per cent acid agent for 30 seconds. After rinsing with distilled water, they were divided into control and experimental groups (n = 5). In the control and experimental groups, the teeth were immersed in a 0.2 per cent sodium fluoride solution prepared from a mouth rinsing agent (Bee Brand Medico Dental Ltd.) or in distilled water at 37°C for 2 weeks. The solutions were replaced daily. The samples were subjected to scanning electron microscopy (SEM), transmission electron microscopy (TEM) and Raman microprobe analysis.

RESULTS: After etching, SEM demonstrated that the surface of the tooth enamel in both the control and experimental teeth was covered with powder deposits. TEM revealed the central dissolution of crystals and remineralization was not seen on tooth enamel in either group. Raman microprobe analysis did not identify calcium fluoride or fluorapatite on the enamel surface in either group.

CONCLUSION: A solution of 0.2 per cent sodium fluoride could not induce remineralization or structural improvement of etched demineralised enamel crystals. It is suggested that minerals in saliva are essential for this process.

547 BIOLOGICAL EVALUATION OF PLASMA ION MINISCREWS

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AIM: Plasma ion miniscrews (1T16106, Orlus Korea Inc., Seoul, Korea) and SLA miniscrews (1O16106, Orlus Korea Inc.) were inserted to compare stability by periods. Insertion torque and mobility and histologic analysis were compared by screw type.

MATERIALS AND METHOD: Thirty-two miniscrews (16 plasma ion and 16 SLA miniscrews) were inserted in four beagle dogs. All miniscrews were loaded using a nickel titanium coil spring for 3, 6, 9 and 12 weeks by groups, and mobility was checked by periods. After sacrifice, demineralized samples were obtained to compare the insertion torque, bone to implant contact (BIC), bone volume and number of osteoblasts by groups. Surface change was compared between the plasma and SLA miniscrews using scanning electron microscopy.

RESULTS: 1. The insertion torque was slightly higher on the plasma ion miniscrew than the SLA miniscrew (P > 0.05). 2. The plasma ion planted miniscrew showed lower mobility than the SLA miniscrew at 3 weeks (P > 0.05). 3. BIC was higher at 3 weeks in the plasma ion planted miniscrew than in the other group (P > 0.05). 4. Bone volume was higher at 3 weeks in the plasma ion planted miniscrew group than at 3 weeks in the SLA miniscrew group, but no difference observed at 12 weeks

between the plasma ion planted miniscrew and the 12 week SLA miniscrew. 5. The number of osteoblasts was higher at 3 and 12 weeks with the plasma ion miniscrew than with the 3 and 12 week SLA miniscrew. 6. The plasma ion planted miniscrew showed more stable surface changes after removal than the SLA miniscrew.

CONCLUSION: There was no significant difference between the plasma ion planted and SLA miniscrew in insertion torque, mobility, BIC or bone volume, but the surface changes on the plasma ion planted miniscrew were more stable after removal.

548 SURFACE CHANGE AND MECHANICAL PROPERTIES OF ORTHODONTIC MINISCREWS BY REPEATED STEAM AUTOCLAVING H S Yu¹, K H Yoo², T H Choi¹, J-Y Kim¹, J M Ko¹, ¹Department of Orthodontics, College of Dentistry and ²Graduate School Department of Dentistry, Yonsei University, Seoul, Korea

AIM: To measure the insertion torque and change of surface morphology, chemical composition and crystal structure after repetitive high-pressure steam sterilization of machined surfaced and surface treated miniscrews.

MATERIALS AND METHOD: Forty cylindrical type miniscrews with machined surfaces were prepared at 0, 10, 20 and 30 times high-pressure steam sterilization and 20 taper type miniscrews with SLA surface were prepared at 0 and 20 high-pressure steam sterilization. The mechanical properties of the miniscrews were examined using the insertion torque test according to the number of sterilization. The elemental composition of the surface was compared using energy dispersive X-ray spectroscopy. Changes in structure and chemical states were analyzed using X-ray diffraction and X-ray photoelectron spectroscopy.

RESULTS: Repetitive high-pressure steam sterilization resulted in a reduction in the maximum insertion torque and an increase in the number of sterilizations of the orthodontic miniscrews, but without significance (P > 0.05). The machined surface of the miniscrews was not uniform and had more cleavage. The surfaces of the SLA miniscrews also showed a reduction of surface uniformity and irregular prominences, and depressions were observed. The repetitive high-pressure steam sterilization process did not change the composition of the surface elements of the orthodontic Ti-6Al-4V miniscrews. With repeated high-pressure steam sterilization, no changes in the crystal structure of the surface composition of the miniscrews or the chemical shift of the surface compounds occurred.

CONCLUSION: Orthodontic miniscrews require high-pressure steam sterilization but the more sterilization is performed, the greater the changes in surface morphology and chemical composition.

549 COMPARISON OF CEPHALOMETRIC MEASUREMENTS OF THREE-DIMENSIONAL RECONSTRUCTED IMAGES AND CONVENTIONAL TWO-DIMENSIONAL IMAGES

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AIM: To assess whether the values of different measurements taken on threedimensional (3D) reconstructions from cone beam computed tomographs (CBCT) are comparable with those taken on two-dimensional (2D) images from conventional lateral cephalometric radiographs (LCR), and to examine if there are differences between the types of CBCT software when taking those measurements.

SUBJECTS AND METHOD: Eight patients were selected who had both a LCR and CBCT. The 3D CBCT reconstructions of each patient were evaluated using two different software packages, NemoCeph 3D® and InVivo5®. An observer took 10

angular and three linear measurements on each of the three types of record on two different occasions.

RESULTS: Intra-observer reliability was high except for the mandibular plane and facial cone (LCR), the Na-Ena distance (NemoCeph 3D®) and facial cone and the Ena-Me distance (InVivo5®). No statistically significant differences were found for the angular and linear measurements between the LCR and CBCTs for any measurement and the correlation levels were high for all measurements.

CONCLUSION: No statistically significant differences were found between the angular and linear measurements taken on the LCR and those of the CBCT. Neither were there any statistically significant differences between the angular or linear measurements using the two CBCT software packages.

550 MEASURING CRANIOFACIAL RELATIONSHIPS WITH CONE BEAM COMPUTED TOMOGRAPHY

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AIM: To analyse craniofacial relationships in a sample of patients who had a cone beam computed tomograph (CBCT), and to create a new method for assessing and measuring patients with three-dimensional cephalometry.

SUBJECTS AND METHOD: Ninety patients who had a CBCT (i-Cat®) as a diagnostic register. Ten cephalometric landmarks on the three spatial planes (X, Y, Z) were defined and 17 linear measurements were established. Using these measurements, seven triangles were described and analysed. Analyses were undertaken of the ratios between the sides of three triangles: CdR-Me-CdL; FzR-Me-FzL and GoR-Na-GoL; and the Gl-Me distance. In addition, four triangles of the mandible were assessed (body: GoR-DB-Me and GoL-DB-Me and ramus: KrRCdR-GoR and KrL-CdL-GoL).

RESULTS: Most of the sample corresponded to a pattern of a CdR-Me-CdL triangle of an isosceles type. With regard to the ratios between the sides of the triangles: CdR-Me-CdL, FzR-Me-FzL, GoR-N-GoL and the Gl-Me distance, there is a relationship of 1:1 among all sides except from the CdR-CdL side. As regards the relationship between the four triangles of the mandible, with the criteria, 20 per cent of patients presented symmetry, 43 per cent grade 1, 33 per cent grade 2 and 4 per cent grade 3. No patient had total asymmetry.

CONCLUSION: A new method for assessing craniofacial relationships using CBCT has been established. It could be used for diverse purposes including diagnosis and treatment planning.

551 DIMENSIONAL CHANGES OF THE LOWER JAW IN PATIENTS TREATED WITH PREMOLAR EXTRACTIONS

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AIM: To determine lower incisor position and lower arch width changes in patients orthodontically treated with four premolar extractions, when an attempt at not changing the dental arch form was made using three different arch forms, and to study the correlation between the protrusion of the lower incisor and intercanine width (ICW), interpremolar width [for the first (1IPW) and the second (2IPW), intermolar width (IMW)], the dental discrepancy and the curve of Spee.

SUBJECTS AND METHOD: Thirty-two patients with a mean of age of 15.7 years, with extractions. The MBT technique and a 0.022 inch slot were selected. Initial and final cephalometric radiographs and dental casts were digitized and measured using

the Dolphin Imaging and Management Solutions® program. A matched Student's *t*-test, Pearson's correlation coefficient and Student-Newman-Keuls test were used for statistical analysis.

RESULTS: ICW, 1IPW, 2IPW and IMW increased significantly 1.39, 3.1 and 0.77 mm, respectively, while IMW decreased an average of 1.19 mm. Anterior length decreased significantly. Lower incisor position variation was not statistically significant. Tweed's angle decreased a mean of 1.6 degrees and lingualized a mean of 0.5 mm with respect to the APo line.

CONCLUSION: Despite trying to preserve the arch form, an increase of ICW, 1IPW and 2IPW took place, as well as a decrease of IMW because of mesial movement of the molars. The lower incisor remained in its initial position despite the decrease of the AL, without showing a significant correlation with the expansion, the dental discrepancy or the curve of Spee.

552 ENAMEL ACID ETCHING IN CLINICAL ORTHODONTIC BONDING – A SYSTEMATIC REVIEW

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AIM: To summarize the clinical evidence on different prescriptions of enamel acid etching for clinically successful orthodontic bonding.

MATERIALS AND METHOD: Four electronic databases were searched. Publications were screened with their titles and abstracts after discarding duplications between databases. Full texts of selected papers were sorted for additional relevant publications from their reference lists. Information was extracted from the finally included clinical trials.

RESULTS: Two thousand and ninety six duplicates of 4172 initially retrieved studies were discarded. Then 1526 of the remaining 2076 studies were excluded by their titles and abstracts according to exclusion criteria. Of the remaining 550 studies, 474 laboratory studies, 36 reviews and 26 original clinical studies of fillings and fissure sealants were further excluded. Only 11 orthodontic clinical studies were included. The included clinical trials showed large variations in study design, sample sizes, specimens, assessment criteria and follow-up period. Eight different bonding materials were used in these 11 studies. Thirty-seven per cent phosphoric acid was the most popular acid used. Others agents for enamel etching included three types of self-etching primers and laser. Etching time included 15, 30 and 60 seconds. In some cases, etching time was not mentioned. Despite variations in enamel etching methods, the clinical success of orthodontic bonding was similar.

CONCLUSION: This review showed that successful clinical orthodontic bonding may vary in the enamel acid etching procedure, but this did not seem to affect the clinical outcome.

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