ABSTRACTS

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Orals

1 DOES ORTHOGNATHIC SURGERY HAVE AN EFFECT ON TEMPOROMANDIBULAR DISORDERS IN PATIENTS WITH DENTOFACIAL DEFORMITIES?

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AIM: In a systematic review (Abrahamsson *et al*., 2007) considering alterations in temporomandibular disorders (TMD) after orthognathic surgery, heterogeneous results were found. The aim of this research was to investigate whether patients with dentofacial deformities benefit from orthognathic surgery considering TMD, and furthermore compare if the prevalence of TMD may change during the same period of time in a control group.
SUBJECTS AND METHOD: One hundred and twenty one consecutive patients, mean age 22.5 ±7.4 years, 70 (58%) females and 51 males, referred for orthognathic surgery examined by means of a questionnaire and a clinical examination regarding signs and symptoms of TMD. Three years after treatment, 98 (81%) of the patients completed a follow-up examination. A control group was formed of 56 age- and gender matched individuals, mean age 23.4 ±7.4 years, 33 (59%) females and 23 males. Thirty-eight (68%) were reached for the follow-up examination. TMD diagnoses according to Research Diagnostic Criteria for Temporomandibular Disorders were used at both examinations.
RESULTS: Before treatment 47 (49%) patients had at least one diagnosis of TMD compared with 19 (19%) after treatment ($P < 0.001$). The patients who improved most were those with myalgia without limited opening ($P = 0.005$), disc displacement with reduction ($P = 0.040$) and arthralgia ($P < 0.001$). Before surgery the patient group had a higher frequency of diagnosed TMD ($P = 0.007$) compared with the control group, however after surgery the patient group and control group were comparable regarding frequency of TMD ($P = 0.934$).
CONCLUSION: Orthognathic surgery was beneficial in patients with dentofacial deformities considering the frequency of TMD.

2 VITAMINS AND CLEFTING: PUTATIVE BIOLOGICAL MECHANISMS

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AIM: In the aetiology of cleft lip and palate (CLP), both genetic and environmental factors are involved. While the genetic aetiology of CLP is starting to become unravelled, the environmental factors are still not completely understood. Understanding their action could be of value for the prevention of CLP. In this context, dietary supplements such as vitamins, are of particular interest. The aim of this research was to identify the putative biological mechanisms underlying the association between maternal vitamin use and CLP in the offspring. The main focus was on folate and retinoic acid (RA).
MATERIALS AND METHOD: A systematic review was performed using PubMed (1953-December 2009) to review the effects of folate and retinoic acid on cellular processes involved in palatogenesis and CLP.
RESULTS: Retinoic acid (RA) and folate interfere with several signalling pathways that are also involved in the regulation of palatogenesis. RA inhibits EGF, bone morphogenetic protein, and platelet derived growth factor-C signalling, which regulate mesenchymal proliferation. The transforming growth factor (TGF)-ß3 and Wnt pathway, which are crucial for epithelial fusion, are also affected. Furthermore, RA directly inhibits the synthesis of extracellular matrix components, and the formation of filopodia and desmosomes. It further inhibits disintegration of the epithelial seam by reducing matrix metalloproteinase activity and apoptosis. Low folate status disturbs homocysteine metabolism and affects cell proliferation, adhesion, and apoptosis. This might be mediated by inhibition of TGF-ß, IGF, Sonic hedgehog, and EGF signalling.
CONCLUSION: RA overexposure and folate underexposure interfere with important signalling pathways in palatogenesis. The inhibition of EGF, TGF-ß, and Wnt pathways might be crucial for the development of CLP. Better understanding of vitamin action on palatogenesis is vital for CLP prevention.

3 A RANDOMIZED CONTROLLED TRIAL FOR ONE YEAR AFTER ORTHODONTIC TREATMENT, ASSESSED BY QUANTITATIVE LIGHT FLUORESCENCE

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AIMS: A variety of techniques can be used to determine demineralisation of teeth after orthodontic appliance treatment. Quantitative light fluorescence (QLF) allows non-invasive longitudinal monitoring (Higham *et al*., 2009). Lesions found by QLF are not always clinically evident. The aim of this randomised controlled trial was to detect the prevalence of demineralising enamel after orthodontic treatment in a patient cohort treated with fixed appliances, and to longitudinally monitor the effect of three toothpastes with differing fluoride concentrations on the enamel over a 12 month period.
SUBJECTS AND METHOD: Patients aged 14 years and over at debond were recruited until 90 had completed 12 months of post-treatment data collection on six occasions at debond, 2 weeks and 1, 3, 6 and 12 months. Digital and QLF images were obtained of the labial surfaces of the six upper and six lower anterior teeth. The patients were stratified into cells by the number of presenting lesions. Thirty patients drawn from similar strata were given toothpaste with fluoride at either 250, 1100 or 2800 ppm blind from the clinical trial team and patient. The inclusion criterion was at least one demineralised lesion detected by QLF.
RESULTS: Twenty-four per cent had 1-2; 55 per cent had 3-6 and 21 per cent had 7-12 demineralized lesions. The lesion size, measured in terms of area of tooth surface, reduced significantly over 12 months for each of the three toothpaste trial groups by 30-31 per cent. There was no difference between the groups after 12 months, which was confirmed by an ANCOVA model. The earliest significant remineralisation was at 3 months with both 250 and 1100 ppm ($P < 0.05$). At 6 months, the 2800 pm toothpaste had a significant effect ($P < 0.01$).
CONCLUSION: QLF discriminates changes in enamel demineralisation not clinically apparent. All patients using fluoride toothpastes showed remineralised enamel over a 12 month period. The effect is detected later when 2800 ppm fluoride is used.

Higham S, Pender N, de Josselin de Jong E, Smith P 2009 Application of biophysical technologies in dental research. Journal of Applied Physiology (in press)

4 *IN VIVO* COMPARISON OF TWO CONE BEAM COMPUTED TOMOGRAPHY SYSTEMS VERSUS PANORAMIC IMAGING

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AIM: Mismanagement and inaccurate diagnosis of impacted maxillary canines may cause complications during development and eruption. The most frequent adverse effect of canine impaction is resorption of the adjacent incisor. The aim of this study was to compare the radiographic diagnostic accuracy for the localization of maxillary impacted canines and the detection of root resorption in adjacent incisors between conventional radiographic procedures using a two-dimensional (2D) panoramic radiograph with that of two three-dimensional (3D) cone beam computed tomography (CBCT) systems.
MATERIALS AND METHOD: The clinical records of 60 consecutive patients who had impacted or ectopically erupting maxillary canines were identified from patients seeking orthodontic treatment. For each case, two sets of radiographic information were obtained. The sample was divided into two groups group A (n = 30) included those for whom a panoramic and CBCT obtained with a 3D Accuitomo Tomograph was available, and group B (n = 30) who had a panoramic and CBCT obtained with a Scanora 3D CBCT. Panoramic and CBCT images were produced and subsequently analyzed by 11 examiners.
RESULTS: There was a highly significant difference observed between the 2D and 3D images for the width of the canine crown, canine location, and canine angulation to the occlusal plane. Moreover, there was a highly significant difference between the panoramic and Scanora CBCT images in canine angulation to the midline ($P < 0.001$). The presence or absence of root resorption and the severity of the lateral incisor was also significantly different between 2D and 3D in both groups. Detection of central incisor root resorption was significantly different between the Accuitomo and panoramic images.
CONCLUSION: The use of CBCT imaging for the assessment of impacted canines has a potential diagnostic effect and may reduce treatment time, complexity, complications, and cost. CBCT is a reliable method for detecting root resorption of adjacent teeth and more accurate for the different diagnostic tasks than panoramic radiography.

5 STABILITY OF SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION AND RAPID MAXILLA EXPANSION

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AIMS: To evaluate the changes in dental, skeletal, nasal structures and nasopharyngeal airway 5 years after rapid maxillary expansion (RME) and surgically assisted (SARME), and to compare these changes with a control group.
SUBJECTS AND METHOD: Group 1 comprised 10 patients (6 males, 4 females) with a mean age of 15.51 years (range 13.33-17.58 years), treated with RME, and group 2, 10 patients (7 males, 3 females) with a mean age of 19.01 years (range 16.25-25.58 years) treated with SARME. All subjects had maxillary arch width deficiency with bilateral crossbites. The control group consisted of 10 untreated, skeletal Class 1 subjects (6 males, 4 females) with a mean age of 15.27 years (range 13.42-17.00 years) matched to group 1 for gender and age. Lateral cephalometric and postero-anterior films were taken before expansion (T1), post-expansion (T2) and three (T3) and five (T4) years after the retention period. Analysis of variance (ANOVA) and Duncan's tests were used to compare the changes between the groups.
RESULTS: After RME and SARME, significant increases were observed for dental, skeletal and nasal transverse widths ($P < 0.01$). No statistically significant differences were found in the measurements related to soft palate morphology or nasopharyngeal dimensions among the SARME, RME or control groups; however, increases in soft palate angulation, and superior and inferior pharyngeal spaces following expansion/control were greater in the SARME group than in other groups. At T3, some of the increases in both transverse and sagittal dimensions of the nasomaxillary complex were lost, but without any statistical significance. The changes between T3 and T4 were almost negligible.
CONCLUSION: Both RME and SARME procedures remained stable, more stable and effective with SARME, at the 5 year follow-up with some amount of relapse, compared with the control group.

6 APICAL ROOT RESORPTION AFTER LEVELLING WITH SUPERELASTIC AND MULTISTRANDED STAINLESS STEEL WIRES

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AIM: Orthodontic root resorption is influenced by both patient and treatment related factors. It can be identified in the early treatment stages. Superelastic archwires are now widely used in everyday clinical practice. However, their effect on orthodontic root resorption has not been thoroughly investigated. The aim of this prospective study was to compare root resorption between teeth treated with superelastic archwires and conventional multistranded stainless steel archwires after the levelling phase of treatment.
SUBJECTS AND METHOD: A total of 156 orthodontic patients were consecutively allocated to a treatment group, where levelling was performed either with superelastic heat-activated Sentalloy archwires, or conventional multistranded stainless steel archwires. Pre- as well as post-levelling periapical radiographs were taken for all maxillary and mandibular incisors. After exclusion due to unsatisfactory radiographs, a total of 82 patients (41 in each group) were included in the study. Variables recorded for each patient included gender, age, ANB angle, impacted canines, invagination and anterior crossbite. Crown and root lengths of all incisors were measured on pre- and post-levelling periapical radiographs corrected for image distortion. The percentage of root shortening and root length loss in millimetres was calculated.
RESULTS: No significant differences were observed between the two groups concerning apical root resorption for each incisor separately. It was found that apical root resorption of the maxillary lateral incisors was significantly associated with the presence of an anterior crossbite on the affected side.
CONCLUSION: Root resorption of maxillary and mandibular incisors after levelling did not differ between patients treated with superelastic and conventional stainless steel wires. An anterior crossbite seemed to be a risk factor for root resorption of the maxillary lateral incisors during the initial stages of orthodontic treatment.

7 COMPARATIVE EFFECTS OF MANDIBULAR INCISOR INTRUSION USING MINI-IMPLANTS AND A UTILITY ARCH

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AIM: To evaluate dentofacial, periapical, and gingival effects of mandibular incisor intrusion obtained using mini-implants, and to compare these with the effects of an intrusion utility arch.
SUBJECTS AND METHOD: Twenty-six individuals at the post-pubertal growth period who had an increased overbite of more than 5 mm. The subjects were randomly divided into two equal groups. In group 1 mandibular incisor intrusion was achieved using a segmented archwire supported by two mini-implants placed between the roots of the lateral incisors and canines. In group 2 mandibular incisor intrusion was carried out using a utility arch. The dentofacial and periodontal effects

were evaluated on lateral cephalograms, periapical radiographs, computed tomograms and orthodontic models. Gingival index scores were also recorded during treatment. Parametric and non-parametric statistical analyses were used to determine any significant differences between and within the groups at the 95 per cent confidence interval.
RESULTS: Both intrusion methods were found to be successful for mandibular incisor intrusion. In both groups protrusion of incisors were observed. Distal tipping of the mandibular molars was noted in group 2. In group 1, since there was no posterior anchorage unit, intrusion did not cause a significant change in molar position. Both techniques caused a minimal amount of apical root resorption and the difference between the groups was not significant. Tomographic evaluation revealed a significant decrease in the density of apical root material of the mandibular left lateral incisor in group 2. The increase in scores for probing depth, keratinized gingival and plaque index, were similar between the groups after treatment.
CONCLUSION: Mandibular incisor intrusion with mini-implant anchorage or an intrusion utility arch results in similar changes in dentofacial, periapical, and gingival regions.

8 CERVICAL VERTEBRAE ANOMALIES ASSESSED ON LATERAL CEPHALOGRAMS AND CONE BEAM COMPUTED TOMOGRAPHS

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AIMS: A high prevalence of cervical spine anomalies has been associated with various malocclusions by Sonnesen *et al*. These findings have recently been challenged due to difficulties in reliably determining vertebral spine anomalies on a single lateral cephalogram (Koletsis, 2009). The aims of this research were to study the prevalence of cervical spine anomalies on lateral cephalograms in Class II subjects and to compare the findings with those obtained from cone beam computed tomographs (CBCT).
MATERIALS AND METHOD: Standardized cephalograms of 238 patients (129 males, 109 females) with at least a three-quarter Class II molar relationship and overjet $\geq$ 4 mm were analyzed. Vertebral anomalies were identified by visual assessment and structural tracing. Both a cephalogram and CBCT were available for an additional 21 subjects. Cephalometric values were correlated with vertebral morphology, and logistic regressions were calculated. Intraobserver agreement was evaluated using the kappa index.
RESULTS: Inspection of the lateral cephalograms excluded an anomaly of the cervical vertebrae in 90.3 per cent of the subjects, while 9.7 per cent showed potential fusion. No posterior arch deficiency or block fusion was found. The measurements showed good repeatability (kappa 80). No correlations were found between the cephalometric values and potential vertebral anomalies. In the 21 patients with both a CBCT and a lateral cephalogram, visual assessment of the lateral cephalogram yielded a possible fusion in nine cases, while none could be confirmed with the CBCT.
CONCLUSION: A low number of potentially fused cervical vertebrae could be detected using lateral cephalograms in Class II patients. The possible fusions did not correlate with any cephalometric values nor could they be confirmed in those patients with a CBCT, the gold standard for assessing cervical vertebrae anomalies. Visual examination of a single cephalogram may result in a false-positive finding and does not allow reliable diagnosis of cervical vertebral fusion.

9 PALATAL IMPLANT SUPPORTED VERSUS CONVENTIONAL DENTAL ANCHORAGE IN ADOLESCENTS. A RANDOMIZED CONTROLLED TRIAL

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AIM: To clinically compare 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 post-pubertal growth spurt.
SUBJECTS AND METHOD: Thirty patients with homogeneous facial skeletal characteristics (mean age 14.22 ± 1.37 years) randomly allocated to two groups. In the PI group (n = 15, mean age 14.15 ± 1.2 years) Orthosystem® implants were placed in 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), maximal 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 extraction gap closure. In the PI group the duration of anterior retraction ($P < 0.001$) and total treatment time was shorter ($P < 0.05$). No significant difference in mesial molar movement was found in either treatment phase even if the net molar anchorage loss was 4.35 ± 1.69 mm in the DA group while 3.7 ± 1.94 mm in the PI group ($P = 0.35$).
CONCLUSION: A shorter orthodontic treatment period was achieved by fastening the anchorage teeth to a PI compared with DA. The use of PI supported anchorage was without complication, representing a safe alternative in growing adolescents requiring maximum anchorage.

10 FRICTIONAL FORCES IN ARCH GUIDED TOOTH MOVEMENT OF CONVENTIONAL AND SELF-LIGATING BRACKETS

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AIMS: Bracket design and the method of ligation have a crucial influence on frictional resistance in arch guided tooth movement. Manufacturers continuously try to improve the quality and effectiveness of their products and especially self-ligating brackets are reported to have optimised sliding properties. It was the aims of this research to further investigate the differences in the frictional behaviour between various self-ligating bracket systems and standard-edgewise brackets, and to compare the results with former studies.
MATERIALS AND METHOD: Three types of orthodontic brackets were investigated using the Orthodontic Measurement and Simulation System: (1) conventional ligating brackets (Victory Series and Mini-Taurus), (2) self-ligating brackets (SmartClip, passive self-ligating bracket, Time3 and Speed, active self-ligating brackets), and (3) a conventional low friction bracket (Synergy). All brackets had a nominal 0.022 inch slot size. The brackets were combined with three archwires (rectangular, 0.019 × 0.025 inch) (1) Remanium (stainless steel, Dentaurum), (2) Nitinol SE [nickel titanium NiTi)], and (3) Beta III Titanium [titanium molybdenum (TMA), both 3M Unitek]. Stainless steel ligatures were used with the conventional brackets. Arch guided tooth movement was simulated over a retraction path of 4 mm using a superelastic NiTi coil spring (force 1 N).
RESULTS: Force loss due to friction was lowest for the Victory and SmartClip brackets in combination with the steel guiding arch (36 and 35%, respectively) and highest for the Speed and Mini-Taurus brackets in combination with the TMA wire (71 and 64%). Friction gradually increased by 10 per cent for each bracket type in combination with the different wires in the following sequence: steel, NiTi, TMA.
CONCLUSION: In agreement with former studies, self-ligating brackets did not show improved performance when compared with conventional brackets.

11 MEASUREMENTS OF DENTAL DIMENSIONS ON DIGITAL MODELS ARE SUPERIOR TO CONE BEAM COMPUTED TOMOGRAPHIC MEASUREMENTS

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AIMS: Recent technological breakthroughs, such as digital models and cone beam computed tomographs (CBCT) enable digital measurement of the dentition. The aim of this study was to determine the accuracy of measurements on digital models of scanned impressions, volume rendered CBCT and teeth separated out of CBCT images. A further aim was to study the time needed for the digital measuring.
MATERIALS AND METHOD: Digital models of 10 patients with a complete permanent dentition were selected. Three digital datasets were available: a Digimodel™ (A), a CBCT image (B) and a segmented model of the dentition of a CBCT image, AnaTomodel™ (C). A commercially available program (Digimodel™) was used for measurements on the digital model. Another commercially available program (Maxillim™) was used for measurements on images B and C. Differences between similar measurements on models A and B and models A and C were statistically analyzed. Two groups of two researchers measured each distance 10 times, so every measurement was performed 40 times. The time needed for the measurements was recorded and analyzed.
RESULTS: Measurements on digimodels and CBCTs were statistically different. On average, measurements on CBCT images were larger. Measurements on digital models were more accurate. Measurements on segmented CBCT models were more accurate than measurements on CBCTs. The mean measuring time on CBCT images was 14.5 minutes longer.

CONCLUSION: Measurements on CBCT images are less accurate compared with those on Digimodels™. The segmentation of the dentition on an AnatoModel™ increases the accuracy of the measurements. The measurement procedure for CBCT images takes more time compared with measurements on Digimodels™.

12 ORTHOPAEDIC EFFECTS OF MAXILLARY PROTRACTION WITH OR WITHOUT PALATAL EXPANSION

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AIM: Maxillary protraction has become a major treatment option for the correction of developing Class III malocclusions. The frequent maxillary retrusion in such patients, with the limited possibility to influence mandibular growth, has increased the popularity of facemask therapy. The aim of this study was to analyze the skeletal effects of maxillary protraction, with and without rapid palatal expansion (RPE).
SUBJECTS AND METHOD: Forty-seven subjects, 15 (group 1) treated with a facemask and RPE, 2) 18 treated with a facemask only and 3) 14 untreated patients with a Class III malocclusion (control group). Radiographs were taken before and immediately after treatment (over a similar time interval for the control group) and at about 2 years post-treatment (33 cases). Statistical analysis was employed (ANOVA).
RESULTS: No statistically significant differences between the expansion and non-expansion groups in cephalometric variables or in overall treatment time were observed. Facemask therapy was effective in correcting the Class III malocclusion. Comparison of the control and treated groups showed significant treatment effects (ANB: group 1 +3.06°***, group 2 +3.36°***), mainly characterized by maxillary advancement (A-McNamara group 1 +2.9 mm*, group 2 +1.61 mm*) and a restraining effect on mandibular growth (Harvold Md: group 1 +3.02 mm ns, group 2 +1.19 mm ns, group 3 +5.85 mm*). A slight increase in the intermaxillary vertical relationship (due to a combination of counterclockwise maxillary rotation and clockwise mandibular rotation) was found in the treated groups, especially in group 1 (Harvold Hf +4.26 mm*). Long-term, the treated patients tended to resume a Class III growth pattern, though the correction of the malocclusion was maintained.
CONCLUSION: A Class III malocclusion can be successfully treated with a facemask. The need for palatal expansion, in the absence of a transverse maxillary discrepancy, was not supported by the findings of this study.

13 RAPID VERSUS SLOW MAXILLARY EXPANSION: A THREE-DIMENSIONAL RANDOMIZED CLINICAL TRIAL

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AIM: A posterior crossbite is a common malocclusion in children, and is generally treated to alleviate dental crowding, to prevent the developing of mandibular skeletal asymmetries in adulthood and to reduce the risk of developing temporomandibular disorders. A PXB is mostly the result of skeletal deficiency of the upper jaw and is often corrected by means of by orthopaedic maxillary expansion. The purpose of this study was to evaluate the skeletal and dentoalveolar effects of rapid maxillary expansion (RME) as compared with to slow maxillary expansion (SME) by means of low dose computed tomography. It was hypothesized that RME was more effective in treating a constricted maxilla because of major orthopaedic effects as compared with SME.
SUBJECTS AND METHOD: The subjects were treated by means of a banded palatal expander and were randomly allocated to two treatment groups: 11 subjects (8 males, mean age ± SD=10.8 ± 2.9; 3 females, mean age ± SD = 9.3 ± 0.4) were allocated to SME group and 15 subjects to the RME group (6 males mean age ± SD = 9.6 ± 1.6; 9 females, mean age ± SD = 10.3 ± 1.2). A low dose three-dimensional computed tomography protocol was used to identify skeletal and dental landmarks. Data were also extracted from dental casts.
RESULTS: Maxillary expansion resulted in an increase of dental and skeletal transverse diameters in both the RME and SME groups. No statistical difference in expansion at different tooth levels was found between groups, with the exception of molar expansion measured at the molar apices, which was significantly lower in the RME group ($P = 0.02$) than in the SME group. Skeletal expansion measured at different bony locations did not differ significantly between the groups.
CONCLUSION: RME was not more effective than SME in orthopaedic expansion of the upper jaw.

14 FABRICATION AND BIOCOMPATIBILITY OF COMPOSITE SCAFFOLDS FOR BONE TISSUE ENGINEERING

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AIM: Tissue engineering is a novel field of research that aims to repair damaged tissues as well as to create replacement organs. In orthodontics, tissue-engineered temporomandibular joints, periodontium, and cranial sutures may have a dramatic impact on treatment possibilities. Tissue-engineered bone can also be useful in patients who need bone grafts or cleft palate repair. The aims of this project were to fabricate a novel composite scaffold for bone tissue engineering and to study the proliferation and differentiation of human mesenchymal stem cells (hMSCs) in this matrix.
MATERIALS AND METHOD: Hydroxyapatite/polycaprolactone (HA/PCL) composite scaffolds were prepared by the wet-chemical method at room temperature. Physico-chemical properties of the composite materials were preliminary characterized by X-ray diffraction analysis, Fourier transform infrared spectroscopy and X-ray photoelectron spectroscopy analysis. Moreover, the scaffold morphology was investigated by scanning electron microscopy and energy dispersive X-ray spectroscopy to validate the process used for the synthesis. Finally, the response of two different lines of hMSCs in terms of cell proliferation and differentiation into osteoblastic phenotype was evaluated using Alamar blue assay, scanning electron microscopy, and alkaline phosphatase activity.
RESULTS: Microstructural analysis indicated that the HA particles were distributed homogeneously within the PCL matrix. Biological results revealed that the HA/PCL composite scaffolds were well recognized from MSCs *in vitro*, supporting cell proliferation and differentiation of bone marrow derived MSC.
CONCLUSION: Tissue engineering by means of composite HA/PCL scaffolds represents a new therapeutic strategy to repair craniofacial bone defects and may have a strong impact in the treatment of complex interdisciplinary orthodontic patients.

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15 DENTOFACIAL EFFECTS OF BONE-ANCHORED MIDFACE PROTRACTION: A CONTROLLED STUDY***

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AIM: To evaluate the treatment effects of bone-anchored maxillary protraction (BAMP; with miniplates in the maxilla and mandible connected by Class III elastics) in Class III malocclusion subjects.
SUBJECTS AND METHOD: Twenty-one Class III patients (mean age 11.10 ± 1.8 years) were consecutively treated with the BAMP protocol, and re-evaluated 1 year later. The treated group was compared with a matched control group of 18 untreated Class III subjects. Significant differences between the cephalometric changes in both groups were assessed with an independent sample *t*-test ($P < 0.05$).
RESULTS: Intermaxillary skeletal measurements revealed highly significant improvements (Wits appraisal +6.7 mm, SD ±1.7). Point A advanced 3.9 mm (SD ±1.4) more than in untreated controls, with significant protraction effects at points, Orbitale (+2.9 mm, SD ± 0.5) and pterygomaxillare (+3.7 mm, SD ±1.1). Significant improvements of overjet and molar relationship were recorded, as well as mandibular skeletal measurements at points B (–2.7 mm, SD ±1.6) and Pogonion. The mean difference in gonial angle changes between both groups was –4.1 degrees (SD ± –1.3). Vertical skeletal changes (NL-ML –0.8°, SD ±1.4) and dental compensations were negligible, except for a significant proclination of the lower incisors (L1-ML +1.9°, SD ±1.6) in the treated group. Significant soft tissue changes reflected the skeletal modifications.
CONCLUSION: Compared with growth of untreated Class III subjects, the BAMP protocol induced an average increment of skeletal and soft-tissue advancement of maxillary structures of approximately 4 mm, and favourable mandibular changes exceeded 2 mm.

16 CLINICAL TRIAL EVALUATING THE EFFECTS OF CASEIN PHOSPHOPEPTIDE- AMORPHOUS CALCIUM PHOSPHATE PASTE ON WHITE SPOT LESIONS

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AIM: To investigate the effect of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) paste on the evolution of white spot lesions in orthodontic patients, 4 months after the removal of fixed appliances.
SUBJECTS AND METHOD: A prospective, randomized, single-blind study with 19 patients (7 females, 12 males, average age 16 years 1 month; drop outs four). Group A (n = 10) used CPP-ACP paste once daily during 4 months while group C (n = 9) did not use any extra fluoride products beside a normal fluoride toothpaste. The Plaque Index (PI), Gingival Index (GI), surface area of the white spots and the white spot lesion (WSL) index were recorded for all teeth in the upper and lower

arches from the left to the right first premolar at three time points. The GI and PI were evaluated with a Cochran Q-test for the surface area, and for the WSL index a *t*-test was used.
RESULTS: An improvement in the WSL index was observed in both groups but was statistically significant only in group A. The surface area decreased significantly in both groups during the observation period but was not clinically significant.
CONCLUSION: The use of CPP-ACP paste after removal of fixed appliances improves the clinical appearance of white spots and makes them less noticeable. CPP-ACP paste decreases the surface area of a WSL, but this is not clinically significant.

17 STABILITY OF SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION WITH A BONE-BORNE DISTRACTOR

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AIM: Tooth-borne surgically assisted rapid maxillary expansion (SARME) is widely used treatment modality in adolescent and adult patients with maxillary transverse deficiency. To prevent undesired dental side-effects bone-borne expansion devices have been introduced. The aim of the study was to evaluate the stability of maxillary expansion carried out by SARME with a bone-borne distractor.
SUBJECTS AND METHOD: Fifty patients (35 females, 15 males who had undergone SARME because of a bilateral (n=33) or unilateral (n = 13) crossbite, or no crossbite but who required maxillary expansion to facilitate mandibular advancement in a second stage osteotomy (n = 4). The surgical technique involved an osteotomy on the lateral maxillary walls and in the palatal midline. A bone-borne distractor (TPD, surgi-tec, B-Brugge) was secured in the region of the second premolars/first molars. After 5 days the patients activated the appliance once a day, i.e. 0.333 mm/day. The necessary expansion (no over expansion) was determined by clinical need, leading to an activation period of 15-27 days, and a retention period of 12 weeks. Study models were obtained before surgery (T0, n=50, mean age 19.0 years, range 14.6-35.4 years), once expansion and orthodontic treatment were completed (T1, n = 50, mean T0-T1 interval 1.6 years, range 1.3-2 years), and at follow-up (T2, n = 38, mean T0-T2 interval 2.2 years, range 2.0-6.8 years). The models were photographed and transverse distances between the canines and the 1st molars measured gingivally and occlusally on the computer screen.
RESULTS: Mean expansion between the canines was 3.6 mm occlusally and 3.9 mm gingivally, and between the first molars 4.3 and 4.2 mm, respectively. The mean relapse varied between 1.0 and 1.3 mm at T2.
CONCLUSION: Despite the use of bone-borne distractors for SARME, some relapse was found. Therefore, over expansion is still recommended.

18 FACIAL SYMMETRY ANALYSIS IN WELSH ADOLESCENTS USING OPTICAL LASER SURFACE SCANNING

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AIM: Different diagnostic approaches, mainly two-dimensional, have been used for facial symmetry analysis. Recent advances in laser scanning technology provide the opportunity to examine human faces more accurately in three dimensions. The aim of this study was to determine the extent of facial symmetry in healthy adolescents and to explore if there is any difference between the genders.
SUBJECTS AND METHOD: Laser scanning was performed on 270 Welsh adolescents (123 males, 147 females) of Caucasian origin, average age 15.5 years. They were randomly selected from a larger longitudinal study known as ALSPAC. Images were transferred into commercial software, processed and landmarked. Facial symmetry data were collected using an in-house developed subroutine. For each subject, a mirror facial shell was generated and superimposed on the original shell to create a symmetric face and establish a true mid-sagittal plane. A coincidence of the original face to the symmetric face (percentage of symmetry) was measured, with a 0.5 mm tolerance level. In addition, three angular and 14 linear measurements were made.
RESULTS: The average distance of an original shell to a mirror shell was higher in males (0.63 ± 0.16 mm) than in females (0.55 ± 0.13 mm) and statistically significant ($P < 0.01$). There was also a statistically significant difference ($P < 0.01$) in the extent of three-dimensional facial symmetry between males (53.49 ± 10.73%) and females (58.46 ± 10.25%). Two of three angular measurements showed statistically significant differences ($P < 0.01$). None of the 14 linear measurements were statistically different. Point pogonion had the highest deviation from the mid-sagittal plane (1.05 ± 0.9 mm in males and 0.93 ± 0.73 mm in females).

CONCLUSION: Facial symmetry can be analysed accurately using laser scanning. Male faces were less symmetric than those of females.

19 INFLUENCE OF TONGUE POSTURE ON JAW MORPHOLOGY – A THREE-DIMENSIONAL EVALUATION

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AIM: To evaluate the influence of tongue posture on jaw morphology in two groups of untreated patients, one with a Class III (C3) and the other with a Class I malocclusion (control group-CG).
SUBJECTS AND METHOD: Twenty C3 patients (9 males, 11 females, mean age 19.2 ± 4.64 years) and 20 CG patients (6 males, 14 females, mean age 17.4 ± 1.68 years). Intercanine and intermolar transverse widths at the cusp and gingival levels were measured on three-dimensional digital images of study casts. Surface area and volume of the palate and the mouth floor were calculated. Tongue position relative to the palatal contour was assessed on lateral cephalograms. ANOVA was used to calculate the differences between the two groups. Correlation between tongue posture and the morphological characteristics of the jaws was calculated using Spearman's correlation coefficient.
RESULTS: The C3 patients had statistically significantly greater intermolar transverse mandibular widths at the cusp and gingival level ($P = 0.047$ and 0.004 respectively), and a significantly greater surface area and volume of the mouth floor ($P = 0.002$) than the CG subjects. C3 patients had a statistically significantly lower tongue position relative to the palate compared with the CG ($P < 0.001$). However, there were no statistically significant differences between the two groups, either for palatal volume or for palatal surface area ($P > 0.05$). A significant correlation ($P = 0.028$) was found between the surface area and volume of the mouth floor and the tongue position relative to the palatal contour.
CONCLUSION: Tongue posture could influence the morphology of the lower jaw. It is considered to be an important aetiological factor for the transverse dimensions of the lower jaw.

20 CAN PIEZOELECTRIC SURGERY FACILITATE ORTHODONTIC TREATMENT?

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AIM: Intrusion and bodily lower molar distalization are complex orthodontic movements with frequently a low success rate due to biomechanical problems. Various techniques, such as miniscrews, have been proposed to improve system efficiency. The aim of this presentation is to illustrate methods of distalising lower molars and intruding overerupted molars avoiding side-effects.
SUBJECTS AND METHOD: Twenty-five adult patients treated with the support of piezo-microsurgery techniques. One distalization procedure and two parallel horizontal osteotomies are carried out distal to the last molar to be distalized. Two further osteotomies are carried out perpendicular to the previous ones, one distal and the other mesial, 2 mm from the molar. The arches are bonded with the straightwire technique. The distalizing device consists of a 0.016×0.022 inch wire with an open coil spring. A force of 100 g is applied to allow distalization of the molar along the bone defect. 2. Intrusion procedure: two osteotomies are carried out mesial and distal to the overeruped element. Three millimetres apical to the molar two horizontal osteotomies are performed at a distance corresponding to the molar intrusion required, and the cortical bone is removed. The arches are bonded with staightwire technique and at the end of the surgical procedure a 0.016×0.022 or 0.018×0.022 inch Ni-Ti wire is positioned.
RESULTS: Distalization in 15 subjects ranged from 1.5 to 4.5 mm, depending on the amount of distal movement required and was obtained in 16-20 weeks. The required intrusion in 10 patients (from 2.0 to 3.0 mm) was obtained in 12-16 weeks. No side-effects such as anchorage loss, opening of the bite or damage to the periodontal tissues were observed during the procedures.
CONCLUSION: The corticotomy technique reduces treatment time, avoiding the side-effects of traditional methods. The follow-up results appear to confirm the validity and stability of the method obtained in a single sitting of piezo-microsurgery.

21 LONG-TERM EVALUATION OF MAXILLARY EXPANSION AND FACEMASK THERAPY: A CONTROLLED STUDY

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AIM: Long-term data on the effectiveness of maxillary expansion and protraction in Class III patients are lacking. The aim of this study was to evaluate the stability of maxillary expansion and facemask therapy (E/FM) in Class III patients at a long-term observation, compared with the effects of growth in well-matched untreated Class III controls.
SUBJECTS AND METHOD: The treated group (TG) consisted of 21 patients (11 females, 10 males) with dentoskeletal Class III malocclusions treated with a two-phase protocol consisting of E/FM therapy followed by fixed appliance therapy, while the control group (CG) comprised 18 untreated subjects (12 females, 6 males) with similar dentoskeletal Class III features. Lateral cephalograms of both the TG and CG were analyzed at three time points, before treatment (T1); after two-phase treatment (T2); and long term (T3). All patients started treatment (T1) before the pubertal growth spurt (CS1 or 2, mean age 9.5 ± 1.6 years), and had completed active skeletal maturation at T3 (CS6, mean age 18.7 ± 2.1 years).
RESULTS: At T3 the TG exhibited greater values for ANB angle, Wits appraisal, overjet and molar relationship when compared with the CG. No significant difference between the two groups was found for the changes occurring from T2 to T3.
CONCLUSION: Favourable long-term dentoskeletal outcomes were induced by E/FM and fixed appliances in Class III patients. These outcomes remained stable at T3 in 72.5 per cent of the treated subjects. The untreated Class III malocclusion group did not show any tendency toward self-improvement during the post-pubertal interval.

22 DENTAL ARCH RELATIONSHIP IN CHILDREN WITH A CLEFT AFTER ONE- AND THREE-STAGE SURGICAL PROTOCOLS

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AIM: To compare dental arch relationship in patients with complete unilateral cleft lip and palate following one- and three-stage surgical protocols.
MATERIALS AND METHOD: Dental casts of 61 children (mean age 11.2 years, SD 1.7), consecutively treated in the Warsaw Cleft Centre with one-stage closure of the complete cleft at 9.2 months (SD 2.0), were compared with a sample of 97 patients (mean age 8.7 years, SD 0.9) consecutively treated in the Nijmegen Craniofacial Unit with a three-stage protocol including delayed hard palate closure. The dental casts were assigned random numbers to blind their origin. Four raters graded dental arch relationship and palatal morphology using the EUROCRAN Index. The strength of agreement of rating was assessed with kappa statistics. Independent *t*-tests were run to compare the EUROCRAN scores between one- and three-stage samples and Fisher's exact tests were performed to evaluate differences of distribution of the EUROCRAN grades.
RESULTS: Intra- and inter-rater agreement was moderate to very good. Dental arch relationship in the one-stage sample was less favourable than in three-stage group (mean scores 2.58 and 1.97, respectively; $P < 0.000$). Palatal morphology in the one-stage sample was more favourable than in the three-stage group (mean scores 1.79 and 1.96, respectively; $P = 0.047$).
CONCLUSION: The dental arch relationship following one-stage repair was less favourable than the outcome of three-stage repair. Palatal morphology following one-stage repair, however, was more favourable than the outcome of three-stage repair.

23 THE EFFECTS OF PLAYING A WIND INSTRUMENT ON THE OCCLUSION†

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AIM: Dentists and orthodontists are often asked by patients and their parents whether playing a wind instrument may affect the position of their teeth. Indeed, amongst wind instrument players and teachers it has been a popular belief that playing a wind instrument leads to malocclusion. The aim of this study was to investigate the effects of playing a wind instrument on the occlusion
SUBJECTS AND METHOD: This was a cross-sectional observational study. One hundred and seventy professional musicians were selected from 21 classical orchestras and organisations. The subjects were subdivided according to the type of instrument mouthpiece and included: 32 large cup-shaped mouthpiece brass players (group AL), 42 small cup-shaped mouthpiece brass players (group AS), 37 single reed mouthpiece woodwind players (group B) and 59 string and percussion instrument players (control group). Impressions were taken for each subject and various parameters were assessed from the study casts. Statistical analysis was undertaken for interval variables with one-way analysis of variance and for categorical variables with chi-square tests

RESULTS: No statistically significant differences were found in overjet, overbite, crowding, Little's Irregularity Index or prevalence of incisor classification between the wind instrument players and the control group ($P > 0.05$). However, group AL had a significantly higher prevalence of buccal crossbites than all other groups ($P < 0.05$).
CONCLUSION: Playing a wind instrument does not significantly influence the position of the anterior teeth and is not a major aetiological factor in the development of malocclusion. However, playing a brass instrument with a large cup-shaped mouthpiece may predispose to buccal crossbite development.

†Winner of the W J B Houston Oral Research Award

24 ANALYSES OF THE CONDYLAR CARTILAGE AFTER ANTERIOR MANDIBULAR DISPLACEMENT IN JUVENILE PIGS

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AIM: The mandibular condylar cartilage is considered to be a secondary growth centre and represents a joint cartilage different from other cartilage structures. The condylar cartilage shows adaptive and compensatory effects depending on the functional demands and in response to mandibular protrusion after forward displacement. The aim of this study was to investigate histologically and molecularly-biologically the condylar cartilage after anterior mandibular displacement similar to functional orthopaedic treatment.
MATERIALS AND METHOD: Twenty pigs randomly divided into an experimental group and a control group. The experimental animals were provided, bilaterally, with synthetic occlusal build-ups in the posterior area, which induced anterior displacement of the mandible in terminal occlusion. After 4 weeks the temporomandibular structures were removed *en bloc* and the condylar cartilage was analyzed histologically and changes in the mRNA content of genes coding for different collagens (col1, col2, col10), matrix metalloproteinases (MMP8, MMP13) and vascular endothelial growth factor (VEGFA) were measured by real-time polymerase chain reaction.
RESULTS: The experimental animals displayed significantly increased total cartilage thickness of the posterocranial mandibular condyle. The proliferative layer showed a significant increase, whereas significant differences in thickness were absent in the articular layer. Increased cell proliferation was not observed in the experimental group when compared with the controls. mRNA expression of col1 and MMP13 during condylar adaptation coincided with that during natural condylar growth. The amount of the expression of col10 was significantly lower ($P < 0.05$) during condylar adaptation, whereas expression of col2, MMP8 and VEGFA was significantly higher ($P < 0.05$).
CONCLUSION: Condylar adaptation in growing pigs triggered by mandibular forward positioning is not only a passive adaptive but also a growth affected effect. The findings show that mechanical strain produced by mandibular advancement induced remodelling and revascularization in the posteriocranial mandibular condyle. These results were confirmed by histological and histomorphometric analyses.

25 THE MASTICATORY SYSTEM UNDER REDUCED FUNCTIONAL LOAD

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AIM: The ability of the masticatory system to adapt to varying functional requirements enables its normal function under changing environmental conditions. The aim of this research was to investigate adaptive changes in neuromuscular activity and phenotypic properties of jaw muscles and mineralization of mandibular bone in response to reduced functional load.
MATERIALS AND METHOD: Intramuscular electromyograms of the masseter, temporalis and digastric muscles were recorded in male rabbits between 7 and 20 weeks of age. Starting at 8 weeks of age the experimental animals were fed pellets significantly softer than those fed to the controls. At 20 weeks of age the myosin heavy chain (MyHC) composition and the cross-sectional area (CSA) of jaw-muscle fibres were determined using immunohistochemistry. The degree of mineralization of bone (DMB) of the mandible was determined using micro-computed tomography.
RESULTS: Reducing the food hardness significantly decreased the neuromuscular activity of the masseter muscle at activity levels that reflect muscle contractions during chewing. The decrease in neuromuscular activity was accompanied by a decrease in proportion and CSA of fibres expressing slow MyHC isoforms. In contrast, altered food hardness did not influence the activity or fibre properties of the temporalis and digastric muscles. The DMB of the mandible did not differ between experimental and control animals. However, it differed significantly among areas that are loaded directly or indirectly by jaw-muscle contractions in the animals that had been fed soft pellets.

CONCLUSION: Long-term reduction in masticatory functional load contributes to selective disuse resulting in functional and structural adaptation of the masseter muscle. This adaptation is reflected in decreased neuromuscular activity, proportion and CSA of slow fibres. The associated alteration in the loading pattern might induce a more heterogeneous mineral distribution in mandibular bone.

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26 CLINICAL IMPLICATIONS OF CRANIOFACIAL ANATOMY IN CLASS III MALOCCLUSIONS

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AIM: Variations from normal craniofacial anatomy observed in Class III malocclusions include two features unreported to date in the literature, namely clockwise rotation of the palatal plane and a higher position of sella turcica. The aim of this study was to evaluate morphological characteristics of Class III malocclusion, specifically the relationship between anterior crossbite, cant of the palate and anterior cranial base.
MATERIALS AND METHOD: Lateral cephalometric radiographs of a Class III group (80 males; 62 females) and a Class II, division 1 group (41 males, 43 females). The radiographs were analyzed following a standardized method. Cephalometric measurements gauged the overjet, ANB, SN/horizontal, saddle angle, palatal cant to SN and to H. Statistical methods included *t*-tests and analyses of variance for group differences in continuous measurements, Pearson product moment correlation coefficient for associations between various parameters, and linear and multiple regressions for prediction models.
RESULTS: In the Class III sample, the anterior cranial base inclination was more inclined than the average, more in males (5.21 ± 4.3°) than females (7.36 ± 3.43°; $P = 0.002$). The opposite direction was noted in Class II patients, who were compared with a Class III subgroup matched for age. When both malocclusion groups were merged to evaluate the continuum of severity from opposite occlusions, high correlations were noted between overjet and PP/H ($r = –0.82$); SN/H and PP/H ($r = –0.77$), and overjet and SN/H ($r = 0.67$).
CONCLUSION: Development and/or severity of Class III dysmorphology relate to intragrowth orthopaedics a sustained anterior crossbite generates forces against the maxilla causing retrognathism that otherwise may not exist. Maxillary retrognathism is apparently more prevalent than mandibular prognathism in mesioclusion.

27 ALVEOLAR BONE LOSS DURING ORTHODONTIC TREATMENT: FINDINGS WITH CONE BEAM COMPUTED TOMOGRAPHY

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AIM: Cone beam computerised tomography (CBCT) has given orthodontics a new diagnostic dimension. The Department of Orthodontics, Gothenburg, Sweden has an ongoing study for monitoring root resorption during standardized orthodontic treatment in 170 patients with Class I molar relationship. The analyses of hard tissue changes started after 100 patients had finished their treatment. The aim of this study was to determine buccal and lingual/palatal alveolar bone level changes in patients treated with full fixed appliances.
SUBJECTS AND METHOD: CBCT scanning (3D Accuitomo FPD, Morita, Japan) was performed before and after treatment of 101 Angle Class I patients with bimaxillary crowding. The standardised treatment plan included full fixed appliances in both jaws and extraction of four premolars. The buccal and lingual/palatal bone levels were measured for all teeth from first molar to first molar in both jaws and the buccal-lingual root position in the alveolar process was measured. Twenty patients had one or more tooth/teeth displaced out of the alveolar process to the extent that at least half of the root was displaced outside the alveolar process with no detectable bone covering the apical foramen. The most common teeth were the mandibular incisors and, in some patients, the buccal roots of the maxillary molar. The patients with displaced lower incisors were compared with a group of patients with no displaced incisors after treatment.
RESULTS: Statistically significant differences were found in the degree of proclination of the lower incisors that occurred during treatment. The displaced incisors were on average proclined 10 degrees more than the non-displaced incisors.
CONCLUSION: CBCT reveals information in new dimensions and changes that previously were not visible can now be analysed in detail. The clinical significance of these new findings is difficult to quantify as the clinical treatment procedures have remained more or less unchanged for decades.

28 BONE DENSITY OF THE MIDPALATAL SUTURE SEVEN MONTHS AFTER RAPID PALATAL EXPANSION IN ADULTS

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AIMS: To analyze changes in bone density of the midpalatal suture after surgically assisted rapid palatal expansion (SARPE) with the bone-borne Dresden distractor by means of computed tomography (CT), and comparison of pre-surgical findings with a control group.
SUBJECTS AND METHOD: Sixteen adult patients (mean age 24.5 years) who underwent axial CT scans before and 7 months after SARPE. CT image fusion was performed for the bone of the midpalatal suture. Sixty-six controls (mean age 25.7 years) served for comparison of age-related bone density. Bone structure and density were assessed in the coronal plane at the anterior, median and posterior level.
RESULTS: The highest density was found in the posterior part [1046 Hounsfield units (HU)] before expansion. Bone density 7 months after SARPE was only 48 per cent (anterior), 53 per cent (median) and 75 per cent (posterior) in comparison with pre-surgical values. The values in the control group were fairly equal (889 to 900 HU) for all aspects.
CONCLUSION: Seven months after SARPE the density of the midpalatal suture is only half to three-quarters in comparison with pre-treatment values. For preservation of the resistance against the forces from the non-split posterior part, the time for retention should be lengthened.

29 THE QUESTIONABLE ROLE OF PERIODONTAL AND SUPRA-ALVEOLAR COLLAGEN FIBRES IN RELAPSE

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AIM: Relapse is a common problem in orthodontics. Its aetiology is still unresolved, although most authors consider the periodontal and/or the supra-alveolar fibres responsible. Consequently, these fibres should persist in a stretched condition during orthodontic treatment. However, the question whether this is really the case is still unanswered. Therefore, the aim of the present study was to analyze the turnover rate of collagen fibres in different supra-alveolar and periodontal regions.
MATERIALS AND METHOD: Thirty male rats, 2 weeks old, received an intraperitoneal injection of ^{3}H proline 3 times a week for 3 weeks to label all collagen. They were sacrificed at 0, 1, 4, 8, 15, 22, 29, 36, 57, 78, and 113 days after the last injection, and autoradiographs were prepared. Grains were counted in 19 predefined areas in the periodontal ligament and supra-alveolar structures to determine collagen turnover. The grain density was plotted against time, and half-lives were calculated with 95 per cent confidence intervals (CI). Multivariate analyses were performed to compare the half-lives in the different areas.
RESULTS: The half-life values were not different for the mesial and distal sides. However, significant differences were found along the roots. The half-lives were shortest at the top of the interradicular septum (mean = 2.4 days, 95% CI = 2.1–2.6), intermediate halfway along the roots (mean = 4.6 days, 95% CI = 4.3–4.8), and longest in the cervical and supra-alveolar region (mean = 9.6 days, 95% CI = 8.1–11.9).
CONCLUSION: The results point towards a more stable fibre system in the cervical and supra-alveolar regions. However, with a half-life of about 10 days, approximately 99 per cent of all fibres are remodelled within two months. This makes it very unlikely that stretched fibres persist throughout orthodontic therapy, indicating that probably other factors are involved in the aetiology of relapse.

30 LONG-TERM FOLLOW UP IN SAGITTAL SPLIT OSTEOTOMY

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AIM: To investigate whether stability of Class III surgical cases is influenced by factors such as the type of surgery, amount of dentoskeletal correction, vertical pattern, or gender.
SUBJECTS AND METHOD: Dentoskeletal and profile changes were followed up in 50 sagittal split osteotomy patients (34 females, 16 males) until 2.43 years post-treatment. Two subgroups (double and single jaw) were formed according to the type of surgical correction. The mean age of the study group was 20.87 years (double jaw: 20.17, single jaw: 21.58 years). Rigid fixation with triple miniscrews was used in all subjects, while miniplates were used at the maxillary osteotomy site.

Surgery was performed by the same maxillofacial surgeon. Cephalograms were obtained initially, pre- and post-operatively, and at the end of treatment. Ten sagittal, eight vertical, and five soft tissue parameters were analyzed on hand-traced radiographs.
RESULTS: Subgroup comparisons revealed no statistically significant differences in the amount of relapse for any of the parameters. For anteroposterior measurements, no significant relationship was found between dentoskeletal correction and the amount of post-treatment relapse. For vertical and soft tissue measurements, some parameters showed negative correlations between treatment changes and relapse amount. Long, short, and normal faced individuals showed no significant difference in the amount of relapse, except for upper incisor inclination (U1-SN). Gender comparisons revealed statistically significant differences in only two parameters, ANB and lower incisor angle (L1-SN).
CONCLUSION: Inclusion of a Le Fort I osteotomy does not affect the stability of a sagittal split osteotomy. The amount of relapse was found to decrease with the increasing amount of correction in the vertical and soft tissue parameters. Initial vertical pattern and the extent of relapse, however, seem not to be correlated. Gender also does not play a role in the amount of relapse.

31 ROLE OF PERIODONTAL LIGAMENT CELLS IN IMPAIRED TOOTH ERUPTION IN PATIENTS WITH CLEIDOCRANIAL DYSPLASIA***

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AIM: Patients with cleidocranial dysplasia (CCD), which is caused by mutations in the runt related transcription factor 2 (RUNX2) gene, are characterized by anomalies of the clavicles, thorax, spine, pelvis and extremities, and by disturbances in skull and tooth development. Of orthodontic relevance are multiple supernumerary teeth associated with delayed tooth eruption. The present investigation was based on the hypothesis that an altered phenotypic expression of periodontal ligament (PDL) cells from CCD patients and a reduced ability of those cells to support the differentiation of bone resorbing osteoclasts might contribute to delayed tooth eruption.
MATERIALS AND METHOD: PDL cells from healthy donors and from two patients with molecular genetically diagnosed CCD were characterized for the basal and induced expression of osteoblastic marker genes, and the physiological relevance of the findings for the differentiation of osteoclasts was examined in a co-culture model of PDL cells and osteoclastic precursors.
RESULTS: Both CCD patients displayed missense mutations of the RUNX2 gene. *In vitro* experiments revealed an unaltered expression of RUNX2 mRNA as opposed to a reduced basal expression of mRNA for osterix, alkaline phosphatase, osteocalcin and the key regulatory gene for bone remodelling, RANKL, (receptor activator of NF-κB ligand). Furthermore, those factors were less inducible by stimulation of the cultures with 1α,25(OH)2D3 as compared with the control cells from healthy donors. In the co-culture experiment, PDL cells from the CCD patients showed a reduced capacity to induce the differentiation of active osteoclasts.
CONCLUSION: PDL cells from CCD patients express a less differentiated osteoblastic phenotype resulting in an impaired ability to support osteoclastogenesis that might, in part, account for the delayed tooth eruption that can be observed clinically.

32 SECONDARY AUTOGENOUS ALVEOLAR BONE GRAFTING: A PROSPECTIVE AUDIT

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AIM: Secondary bone grafting of the alveolar cleft with autogenous bone is an accepted procedure in oro-facial rehabilitation of cleft lip and palate (CLP) patients. The aim of this research was to re-evaluate the clinical process and success of autogenous secondary alveolar bone grafting (ABG).
MATERIALS AND METHOD: This was a prospective re-audit of medical case notes and radiograph outcome analysis of ABG using the modified Bergland scoring at Addenbrooke's Hospital, Cambridge, UK. Audit Standards 100 per cent availability of records; 100 per cent ABG to be carried out at ideal age; 81 per cent radiographic ABG success. Data collected from 29 consecutive children with a complete unilateral CLP or a complete bilateral CLP who underwent ABG in 2008 were compared with data from consecutive cases in 2007 and 2006. ABG success was defined by modified Bergland scores of 1 and 2. A single oral and maxillofacial surgeon carried out all ABG.
RESULTS: One hundred per cent of notes were available in 2008, 2007 and 2006. The average age at ABG was 10.7 years in 2008, 11.1 years in 2007 and 10.9 years in 2006. Radiograph availability/quality for scoring: 97.1 per cent (34/35) in 2008, 92.7 per cent (38/41) in 2007 and 100 per cent (25/25) in 2006. ABG success of the available sample was 94.1 per cent (32/34) in 2008, 86.8 per cent (33/38) in 2007 and 81.5 per cent (22/27) in 2006.

CONCLUSION: ABG success compares favourably with standards. Prospective audit is important for clinical transparency. Re-audit should be undertaken annually.

33 ALVEOLAR CREST HEIGHT AFTER DISTRACTION OF THE MANDIBULAR ANTERIOR ALVEOLAR SEGMENT

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AIM: To compare anterior alveolar crest height in consecutive patients receiving (i) anterior mandibular alveolar distraction osteogenesis combined with orthodontic treatment (DOG group), (ii) non-extraction orthodontic treatment (non-ex group), and (iii) lower premolar extraction orthodontic treatment (ex group) to resolve mandibular space deficiency.
SUBJECTS AND METHOD: The ex group contained 18 patients, the non-ex group 18 patients and the DOG group 19 subjects. Study casts and lateral cephalograms were retrospectively analysed before (T1) and clinically re-examined at a mean of 3.9 (DOG group), 5.0 (ex group) and 4.6 years (non-ex group) after orthodontic treatment (T4). Cone beam computed tomograms were available only for T4 and were used to measure lower incisor buccal and lingual alveolar crest height.
RESULTS: The DOG group showed a significant lower buccal (ex-group $P = 0.038$) and lingual alveolar crest height (non-ex group $P = 0.013$; ex group $P = 0.005$). No difference regarding alveolar crest height was found between the non-ex and ex groups even though the lower incisors were significantly more proclined in the non-ex group at T4. Age and alveolar process depth were the only variables significantly correlated with lower alveolar crest level in the DOG group while the inclination of lower incisors or the amount of surgical advancement at point B or incision inferior showed no correlation. Age and decrease in alveolar process depth (T4-T1) in the ex group and proclination of the lower incisors at T4 in the non-ex group were significantly correlated with lower buccal alveolar crest level.
CONCLUSION: Lingual and buccal alveolar bone loss as a long-term consequence of DOG treatment cannot be excluded, but increased age in combination with pre-existing periodontal problems should be considered as the main source for alveolar bone loss. A smaller depth of the alveolar process resulted in more alveolar bone dehiscence on the lingual and buccal side in the DOG group.

34 THE INFLUENCE OF THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS ON HUMAN CRANIOFACIAL DEVELOPMENT

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AIM: Close developmental interrelationship between the central (CNS) and peripheral (PNS) nervous system has been demonstrated in human embryological and foetal pathological material (Kjær, 1998). Several research projects have since been performed, elucidating this interrelationship in the postnatal craniofacial area. This presentation is an overview of these results and demonstrates the interrelationship between the human CNS/neurocranium and CNS/PNS/dentition.
SUBJECTS AND METHOD: CNS/neurocranium: Profile radiographs of children/adults with different CNS disorders (lumbosacral myeloningocele, Cri-du-Chat syndrome, Down syndrome, Fragile X syndrome, solitary median maxillary central incisor). In several cases the CNS diagnoses were based on magnetic resonance analyses and cephalometry and visual evaluation of sella turcica morphology. CNS/PNS/dentition: Dental pantomographs of mentally normal children. Histological sections of the permanent teeth. Evaluation of tooth formation and eruption. Histological localization of innervation.
RESULTS: CNS/neurocranium: Deviations in the cranial dimensions and morphology of sella turcica showed that disorders in the hemispheres were associated with deviations in the anterior wall of sella turcica and a short nasion-sella distance, while a deviation in the posterior wall was associated with disorders in the cerebellum. CNS/PNS/dentition: Agenesis and arrested eruption caused by inborn or acquired innervations were documented. Peripheral nerves were localized in the periodontal membrane. Furthermore, immunohistochemical analysis of osteoblasts indicated that compensatory and dysplastic craniofacial growth is under the control of peripheral nerves (Kjær and Nolting, 2008).
CONCLUSION: There is a close interrelationship between CNS/PNS and the craniofacial area. This should be considered in future studies and, if available.

Kjær I 1998 Neuro-osteology. Critical Reviews in Reviews in Oral Biology and Medicine 9: 224–244
Kjær I, Nolting D 2008 Immunohistochemical PGP 9.5 positivity in human osteoblasts may indicate that compensatory and dysplastic craniofacial growth are under control by peripheral nerves. Orthodontics and Craniofacial Research 66:342–200

35 ASSOCIATION BETWEEN CONDYLAR MORPHOLOGY AND INFLAMMATION IN EXPERIMENTAL TEMPOROMANDIBULAR JOINT ARTHRITIS

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AIM: In juvenile idiopathic arthritis involvement of the temporomandibular joints (TMJs) is often associated with severe mandibular growth deviations. The relationship between condylar growth deviations, inflammation severity, the micro-architectural composition, and bone quality has not previously been investigated. The aim of this study was to determine the effects of antigen-induced arthritis on the bony structures in rabbit mandibular condylar development, in particular the morphological changes and bone micro-architecture.
MATERIALS AND METHOD: Juvenile rabbits with ovalbumin-induced TMJ arthritis treated with intra-articular saline, intra-articular etanercept (an anti-TNF-α drug) or subcutaneous etanercept. One TMJ from each animal was scanned using micro-computed tomography and structural parameters were calculated. Three-dimensional reconstructions of the mandibular condyle were scored blindly by two independent observers as 'normal' or 'abnormal'. The TMJs were stratified for condylar morphology and evaluated against data on inflammation, trabecular structural parameters, and overall mandibular growth. Mineral apposition rate was measured using fluorochrome labelling.
RESULTS: Abnormal morphology was seen in 15 of 32 animals available for data analysis and was strongly related to the degree of inflammation. However, no differences in trabecular structural parameters or mineral apposition rate were seen according to treatment. Erosions were an uncommon finding. Abnormal condylar morphology was not associated with overall mandibular growth.
CONCLUSION: Severe inflammation in the TMJs during mandibular development is associated with morphological changes of the mandibular condyle. Morphological changes may occur because of deficient development of condylar cartilage and not because of resorptions during times of active inflammation, and is hence a temporary phenomenon.

36 STABILITY OF DEEP OVERBITE CORRECTION IN CLASS II DIVISION 1 ADULTS WITH AND WITHOUT OSTEOTOMY

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AIM: Comparison of the stability of overbite correction after surgical and non-surgical correction of Class II division 1 malocclusions with deep bite, hypothesizing more stability after surgical correction.
SUBJECTS AND METHOD: Fifty-three adults with Class II division 1 malocclusions and with increased overbite ranging 3.5–11.5 mm, 25 underwent orthodontic treatment only and 28 had surgical-orthodontic treatment including a bilateral sagittal split osteotomy. Pre- and post-treatment and long-term cephalograms eight years after treatment were analyzed by measuring dental and skeletal variables.
RESULTS: Pre-treatment overbite was larger in the surgery group. Post-treatment and long-term no differences in overbite were found between the groups, however during treatment the non-surgery group showed significantly less correction and post-treatment significantly more overbite relapse (57 versus 21 per cent in the surgery group). Both groups showed post-treatment overbite changes between –2.0 and +4.0 mm. The non-surgery group showed stability in 33 per cent, relapse in 60 per cent, and a decrease in 7 per cent. In the surgery group these were 30, 56 and 14 per cent, respectively. No variables showed significant differences between post-treatment changes. The non-surgery group showed significant uprighting of the upper and lower incisors and a decrease in interalveolar distance. During treatment both groups showed similar proclination of the upper and lower incisors and a similar increase of the interalveolar distance, suggesting more stability in the surgery group. Correlation analyses in the non-surgery group did not show any relationship between post-treatment overbite changes and changes in other variables during or after treatment, or with any variable before or after treatment. Post-treatment overbite changes in the surgery group were mainly correlated with vertical skeletal changes during and after treatment
CONCLUSION: Surgical-orthodontic treatment seems to provide somewhat better overbite stability after correction of a Class II division 1 deep bite.

37 CRITICAL APICAL DIAMETER AND AUTOTRANSPLANTATION: A HISTOLOGICAL STUDY

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AIM: Autotransplantation of immature teeth is an evidence-based procedure and a valuable treatment option when making an orthodontic treatment plan. It has a high success rate when performed under ideal circumstances. This also means it has a restricted indication area and is age-related. The recovery of pulp tissue after transplantation of mature teeth is only 15 per cent. Expanding the indication area is possible by opening the apical foramen by apicoectomy of mature teeth. A critical diameter for the apical foramen is described in this literature. This critical diameter is measured on two-dimensional radiograph of immature teeth. Beneath this diameter of 1 mm the possibility of revascularisation after transplantation decreases. The aim of this study was to find histological evidence of this critical diameter.
MATERIALS AND METHOD: Fifteen single rooted mature teeth from three adult dogs were extracted, apicoectomized, the apical foramen digitally photographed and transplanted in infra-occlusion. The foramina varied from 0.24 to 1.09 mm. The observation period was 90 days post-transplantation. The histological slices were stained with haematoxylin and eosin.
RESULTS: Twelve of the teeth (80%) had new blood vessels filled with erythrocytes in at least one-third of the pulp chamber. Six of the teeth (40%) had new blood vessels up to the pulp horn. The apical foramina ranged from 0.31 to 1.09 mm at their widest.
CONCLUSION: Mature apicoectomized teeth with an apical foramen smaller than 1 mm can revascularise after autotransplantation with considerable success. If there exists a critical diameter for the apical foramen to allow revascularisation after transplantation, then it is smaller than 1 mm. Other factors such as occlusion (infra-occlusion after transplantation) may be more important than the size of the apical foramen when considering revascularisation of mature teeth after transplantation.

38 AIRWAY OBSTRUCTION: NEW DATA ON MORPHOLOGICAL CHANGES INDICATE EARLIER INTERVENTION

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AIM: Airway blockage leads to dentofacial changes culminating in the long-face syndrome or ‘adenoid facies’, which is difficult to treat to the normal skeletal morphology. The aim of this study was to evaluate dentofacial changes following nasal obstruction and determine indicators for optimal timing of adenoidotonsillectomy that would avoid or minimize dentofacial alterations.
MATERIALS AND METHOD: Cephalographs of 200 Caucasian children (ages: 1.71–12.62 years) referred for evaluation of airway obstruction. Conventional angular and linear cephalometric measurements were used to determine relationships among cranial base, maxilla, and mandible. The distances from the soft palate, shortest to the adenoid (SAD), and to the most convex point on the adenoid (CAD) measured airway clearance, also graded (1–3) independently through a common rating system of the adenoid blocking various percentages of the airway. The occlusal relationships were noted. Statistical analyses included *t*-tests and analyses of variance for differences in continuous measurements between groups (by age or comparisons with available Caucasian norms); the Pearson product moment correlation coefficient for associations between various parameters and linear and multiple regressions for associations and prediction models.
RESULTS: Dysmorphology compensatory to nasal obstruction as early as age 1.7 years, the maxilla often affected first with a postero-inferior tilt of the palatal plane to the horizontal (PP/H –7.7 ± 3.4°), greatest (For all subjects a negative overjet, mesioclusion, immature swallowing pattern and incorrect tongue posture on the mouth floor were diagnosed at baseline. A Class III facial appearance was also observed (8.90 ± 3.6°) between 4-5 years of age. Other changes occurred separately or together: mandibular antegonial notching, steeper mandibular plane, anterior symphyseal reduction, increased lower face height. Malocclusions included: increased overjet with normal or distoclusion, open bite, anterior and posterior crossbite. SAD and airway grading were highly correlated (r = 0.92). SAD in combination with maxillary length (ANS-PNS) and inclination (PP/H) accounted for nearly 65 and 60 per cent of the variation in mandibular size, respectively.
CONCLUSION: The upper airway is more likely to be blocked by adenoid hypertrophy when SAD measures 0-2 mm. Adenoid removal is recommended early (age 2–3 years) to arrest or reverse long-face development.

39 ASSESSMENT OF TONGUE POSTURE AND FUNCTION IN CLINICAL ORTHODONTICS – IS IT RELIABLE?

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AIM: To assess the reliability of clinically diagnosing tongue posture and tongue function using ultrasonography.
SUBJECTS AND METHOD: Tongue posture and swallowing pattern were clinically assessed in 26 children (14 girls, 12 boys; mean age 5.5 years) with a unilateral posterior crossbite by an orthodontist (O) and an otolaryngologist (ENT). Ultrasound (US) analysis of tongue posture and swallowing pattern was carried out for all children using the Voluson 730 Expert US system with a 3D convex transducer RAB 2-5 MHz. The data were statistically analysed using the Wilcoxon signed ranks test.
RESULTS: O and ENT clinical assessments of tongue posture were statistically significantly different from the results of the US analysis ($P = 0.002$ and $P = 0.05$, respectively). Assessment of swallowing pattern by the O showed similar results to the US analysis ($P = 0.527$), while the assessment of the swallowing pattern by the ENT was statistically significantly different from the results of US analysis ($P = 0.001$).
CONCLUSION: Clinical assessment of tongue posture and function is not reliable in children in the primary dentition period. Assessment of tongue posture and function during clinical examination in small growing children is unreliable. A reliable, non-invasive, objective, quick and easy method for observation of tongue posture and function could, therefore, become an important diagnostic tool.

40 A NEW METHOD FOR AUTOMATIC LOCALIZATION OF CEPHALOMETRIC LANDMARKS ON DIGITAL IMAGES

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AIM: Efforts have been made to completely automate cephalometric analysis by automatic landmarking. However, the accuracy obtained was poorer than manual identification. Analogue-to-digital conversion of radiographs has been reported to be the main problem. Therefore the aim of this investigation was to evaluate the accuracy of the Cellular Neural Networks approach for automatic location of cephalometric landmarks on soft copies of direct digital cephalometric radiographs.
MATERIALS AND METHOD: Forty-one, direct digital lateral cephalometric radiographs were obtained with a Siemens Orthophos DS cephalostat. Ten landmarks (N, point A, Ba, Po, Pt, point B, Pg, PM, UIE, LIE) were the object of automatic landmark identification. The mean errors and standard deviations from the best estimate of cephalometric points were calculated for each landmark. Differences in the mean errors of automatic and manual landmarking were compared with one-way analysis of variance.
RESULTS: Statistical analysis indicated that the differences were very small, and they were found at most within 0.59 mm. While a few of these differences were statistically significant, they were so small as to be, in most instances, clinically meaningless.
CONCLUSION: The use of radiographic files with respect to scanned radiographs improves landmark accuracy of automatic detection. Investigations on soft copies of digital cephalograms, to search for more landmarks in order to enable complete automatic cephalometric analysis are necessary.

41 ASSOCIATED PAX9 AND FIBROBLAST GROWTH FACTOR RECEPTOR 4 VARIANTS IN CLEFT LIP AND PALATE PATIENTS WITH OLIGODONTIA

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AIM: Oral clefting is a common congenital malformation (1/700 lives), often associated with disturbed tooth development, as a result of misexpression of critical molecular actors involved in craniofacial development. Combined genetic and/or environmental factors are consensually used to explain their aetiology, and the roles of several genes in these defects have been documented both by mutant animal-model phenotypes and by direct identification of causative mutations that affect candidate-genes isolated from human patients. The aim of this investigation was to determine in patients presenting with hypodontia or oligodontia within a NSCLP cohort, the existence of specific allelic variant or mutant in selected genes.

SUBJECTS AND METHOD: The entire regional sample cohort comprised 50 cleft individuals and 50 unrelated controls. For each patient genomic DNA was extracted either from blood samples or from tissues obtained during surgery. Genotyping was carried out using polymerase chain reaction amplification on selected genes followed by direct sequencing.
RESULTS: Sequence variants in MSX1, MSX2, PAX9, DLX5, DLX6 and FGFRs were identified. In seven patients who presented with hypodontia/oligodontia, a new association between the Ala240Pro-PAX9 and the Gly388Arg-FGFR4 variants was observed.
CONCLUSION: The combination of apparently minor polymorphisms in several proteins resulting in slightly imbalanced molecular pathways, might account for some causative mutations in developmental anomalies with a wide spectrum such as oral clefts.

42 THREE-DIMENSIONAL EVALUATION OF TOOTH- AND BONE-BORNE SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION

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AIM: Dentoalveolar changes following surgically assisted rapid maxillary expansion (SARME) are particularly challenging to assess on frontal radiographs. Previous studies have generally relied on dental models, which provided information about the dentition rather than the alveolar bone. Cone beam computed tomography (CBCT) scans may allow a more detailed evaluation of dental and alveolar changes following maxillary expansion using bone-borne compared with tooth-borne expansion devices. The aim of this study was to evaluate three-dimensionally changes in dentoalveolar structures following SARME using a tooth-(Hyrax) or a bone- [Transpalatal distractor (TPD)] borne expansion device.
SUBJECTS AND METHOD: The study design was a prospective two group controlled clinical trial. Thirty skeletally mature patients with transverse maxillary hypoplasia undergoing SARME were included. In group A, expansion was performed using a Hyrax expander with bands on the first premolars and molars, while for group B a TPD was used. CBCT scans were obtained before treatment and 19 (±5) months later, at the end of fixed appliance treatment. Three-dimensional (3D) models were constructed from the CBCT data and superimposed using voxel based matching. Distance maps between the superimposed models were used to evaluate maxillary alveolar changes. Dental linear measurements such as intermolar, interpremolar and intercanine width were also measured on the 3D CBCT models.
RESULTS: There was a statistically significant positive correlation between the amount of alveolar change measured on the superimposed models and dental expansion in both groups ($P = 0.007$). There was no statistically significant difference between the Hyrax and TPD in either parameter ($P > 0.05$).
CONCLUSION: After a period of fixed appliance therapy, dentoalveolar changes produced by SARME are comparable when using either a tooth- or bone-borne expansion device.

43 INTERCEPTIVE TREATMENT OF PALATALLY DISPLACED CANINES - A RANDOMIZED CLINICAL STUDY

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AIM: Interceptive treatment of palatally displaced canines (PDC) has, from an evidence-based point of view, not been sufficiently evaluated. The aim of this study was to evaluate and analyse the effect of extracting the primary canine to intercept the palatal displacement of maxillary canines.
SUBJECTS AND METHOD: Twenty-four consecutive patients, out of 60 scheduled, participated in the study. The patients were referred from 22 general dental practices. All met the following inclusion criteria: 10-13 years of age, uni- and/or bilateral PDC(s), no previous orthodontic treatment, no crowding in the posterior part of the maxilla, no resorption of the incisor(s) or lateral(s). The patients were randomized into two groups with either extraction or non-extraction of the primary canine. Four girls and five boys had unilaterally displaced canines, and in seven girls and eight boys, the canines were bilaterally displaced. In the latter group, the right or left primary canine was randomized to either extraction or non-extraction. The outcome measures that were assessed were: changes in the angulation of the permanent canine to the vertical plane from the frontal and sagittal view, and the amount of eruption vertically and buccally. All measurements were performed with a cone beam computed tomograph (3D Accuitomo FPD) at baseline and after six and 12 months.

In this preliminary evaluation, the results from the six month control are presented. Two-way ANOVA was used for statistical comparison of the groups.
RESULTS: There was a statistical improvement in the angulation from a frontal view and the amount of eruption buccally was seen in the extraction group compared with the control group.
CONCLUSION: Extraction of the primary canine to intercept a PDC is effective in creating a favourable eruption path. The 15 bilateral cases showed uniform results – only improvement of the palatal position on the extraction side.

44 ROOT RESORPTION FOLLOWING 15 DEGREES TIP, 15 DEGREES TORQUE AND A ROTATING FORCE OF 225 GRAMS – A MICRO-COMPUTED TOMOGRAPHIC STUDY

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AIM: To investigate and compare the amount of root resorption following the application of 15 degrees tipping, 15 degrees torque and 225 g rotating orthodontic forces using micro-computed tomography (μCT).
SUBJECTS AND METHOD: Thirty patients who required bilateral extractions of maxillary first premolars divided into three equal groups. In group TQ, the maxillary first premolar on one side of each patient had 15 degrees of distal root tipping force applied while the contralateral side was subjected to 15 degrees buccal root torque. In group TR, the maxillary first premolar of each patient had 15 degrees of distal root tipping force applied to one side and 225 g of rotating force to the other side. In group QR, the maxillary first premolar tooth on one side of each patient was subjected to 15 degrees of buccal root torque and the contralateral side to 225 g of rotating force. After four weeks the premolar teeth were extracted. The volume of root resorption craters was analyzed using μCT and measured utilizing specially designed software. Univariate analysis of variance (ANOVA) was performed.
RESULTS: There was a statistically significant difference in the extent of root resorption following tipping, torquing and rotational movement ($P = 0.002$). In a pairwise comparison there was a significant difference between rotation and torque ($P = 0.001$), torque and tip ($P = 0.044$) but not between tip and rotation ($P = 0.082$). The location of root resorption differed following the different tooth movements. Age and gender had no significant effect on the amount of root resorption.
CONCLUSION: (1) 225 g of rotating force causes more root resorption than 15 degrees torquing force (2) A 15 degree tipping force causes greater amounts of root resorption than 15 degrees torquing force (3) 225 g of rotating force causes similar amounts of root resorption as 15 degrees of tipping force (4) Overall, root resorption is found in areas of periodontal ligament compression while minimal resorption is found in areas of tension.

45 THREE-DIMENSIONAL ASSESSMENT OF MAXILLARY AND MANDIBULAR CHANGES WITH BONE-ANCHORED MAXILLARY PROTRACTION

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AIM: Conventional treatment for young Class III patients involve extra-oral devices designed to either protract the maxilla or restrain mandibular growth. These methodologies have limited success because the treatment change is primarily dentoalveolar rather than skeletal. The use of skeletal anchorage offers a promising alternative to obtain orthopaedic results with less dental compensations. The aim of this study was to evaluate three-dimensional (3D) changes in the maxilla and mandible of Class III patients treated with bone-anchored maxillary protraction (BAMP).
SUBJECTS AND METHOD: Twenty consecutive skeletal Class III patients between the ages of 9 and 13 years (mean: 11.10 ± 1.1 years) treated using Class III intermaxillary elastics and bilateral miniplates (two in the infra-zygomatic crests of the maxilla and two in the anterior mandible). The patients had cone beam computed tomograms (CBCTs) taken before initial loading (T1), and one year following treatment (T2). 3D models were generated from the CBCTs, registered on the anterior cranial base and analyzed using colour-maps.
RESULTS: Sagittal changes in the maxilla, zygoma and mandible were observed in all patients. An average maxillary protraction of 3.75 mm (SD ± 1.20) with infra-orbital changes of 3.11 mm (SD ± 0.79) was observed in the BAMP treated patients. Posterior displacement of the mandible at T2 was observed for all subjects (mean 2.9 mm (SD ± 0.86) for posterior ramus, 2.0 mm (SD ± 0.79) for the condyles and 0.56 mm (SD ± 1.55) for the chin. Remodelling of the glenoid fossa at the anterior eminence (0.89 ± 1.38 mm) apposition and resorption at the posterior wall (0.72 ± 0.45 mm) was observed in most patients.
CONCLUSION: This new treatment approach offers a promising protraction alternative for maxillary deficient patients as well as restraint of mandibular growth for Class III patients with a component of mandibular prognathism. Future studies

with long-term follow-up and comparisons to facemask and chincup therapies are needed to better understand the treatment effects.

46 CAN CONE BEAM COMPUTED TOMOGRAPHY PREDICT THE DIAMETER OF UNERUPTED TEETH?

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AIMS: To test the accuracy and reproducibly of cone beam computed tomography (CBCT) in predicting the mesiodistal diameter (MDD) of unerupted teeth. A secondary aim was to determine the accuracy and reproducibility of three different viewing methods using two different CBCT softwares, InVivo dental 4.0 (Anatomage, San Jose, California) and CBWorks 3.0, (CyberMed Inc., Seoul, Korea). in measuring the MDD of teeth in models simulating unerupted teeth.
MATERIALS AND METHOD: CBCT data was collected on the CB MercuRay™ (Hitachi Medico Technology, Tokyo, Japan). Models of unerupted teeth (n = 25) created by embedding 25 samples into a polydimethylsiloxane polymer with similar density to tissues surrounding teeth, were scanned and measured by two investigators. Repeated MDD measurements of each sample were made using three CBCT viewing methods; InVivo sections view, InVivo volume render and CBWorks 3.0 volume render. These measurements were then compared with the MDD physically measured using a digital calliper before the teeth were embedded and scanned.
RESULTS: All three of the new methods had mean measurements that were statistically significantly less ($P < 0.001$) than the physical method, adjusting for investigator and tooth effects. Specifically, InVivo sections view measurements were 0.273 (95% CI –0.36, –0.18) less than calliper measurements, InVivo volume render measurements were 0.49 less (95% CI –0.58, –0.40) than with the calliper, and CBWorks volume render measurements were 0.36 less (95% CI –0.24, –0.11) than calliper measurements.
CONCLUSION: Overall, there were high correlations amongst the three viewing methods indicating that CBCT can be used to measure the MDD of unerupted teeth. The InVivo section view method had the largest correlation with the calliper method.

47 CHANGES IN NASAL CAVITY VOLUME FOLLOWING RAPID MAXILLARY EXPANSION – A THREE-DIMENSIONAL EVALUATION

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AIM: To evaluate the permanence of the changes in nasal cavity volume induced by rapid maxillary expansion (RME) one year after completion of the retention phase of expansion, using three-dimensional (3D) models obtained from computed tomographs (CT).
SUBJECTS AND METHOD: Twenty-seven subjects (11 males, 16 females) aged between 11 and 17 years (mean 14.6 years). All patients presented with transverse maxillary deficiency and a bilateral posterior crossbite. The RME procedure was carried out with an acrylic cap splint type Hyrax appliance. Routine orthodontic records, as well as axial tomograms, were obtained before expansion, at the end of the 3 month retention period after active expansion was completed, and one year after the retention period. CT were assessed and analyzed using Mimics 10.11 software by reconstructing 3D images of the nasal cavities in order to calculate volume changes following RME.
RESULTS: A significant difference was found between the mean pre-expansion, post-expansion and 1-year follow-up measurements. There was a significant increase of 11.3 per cent in the volume of the nasal cavity due to RME as measured at the end of the 3 month retention period. However follow-up results after 1 year showed that there was a significant decrease in the volume of the nasal cavity compared with the post-expansion measurements. Nevertheless, when compared with the pre-expansion values, there was still a significant ($P < 0.05$) increase in the volume of the nasal cavity 1 year after RME.
CONCLUSION: Taking significant relapse into consideration, RME should not be undertaken with the sole purpose of improving nasal respiration, without the presence of a transverse maxillary deficiency.

48 DOES CONE BEAM COMPUTED TOMOGRAPHY DEPICT THE ANATOMICAL TRUTH? A COMPARATIVE STUDY ON LOWER ANTERIOR ALVEOLAR BONE

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AIMS: To determine the accuracy of cone beam computed tomography (CBCT) by measuring the alveolar bone covering the lower anterior teeth, and to compare radiographic with physical measurements.
MATERIALS AND METHOD: CBCT in two resolutions (0.125 and 0.4 mm Voxel) and analogue lateral cephalograms were obtained of eight decapitated heads. A digital calliper was used to measure the width of the attached gingiva on all lower anterior teeth (n = 51). After removing the gingiva, the vertical position of the anterior alveolar bone margin (ABM) was measured. Additionally, two sites per tooth were selected to determine the thickness of the alveolar bone. The physical bony measurements were compared with the CBCT measurements and with the ABM identified on the lateral cephalograms. The data was evaluated using the Bland-Altman method and independent *t*-tests. Spearman's correlation was used to compare the physical findings (bone and gingiva) and the cephalometric data.
RESULTS: Measurements obtained with CBCT differed only slightly from the physical findings with a mean difference of 0.37 mm (high resolution, CI 99% 0.22–0.55 mm) and 0.7 mm (low resolution, IC 99% 0.37–1.01 mm). These differences were, however, not statistically significant. The identified ABM on the lateral cephalogram did not correlate with the physical measurements ($P = 0.65$). The vertical position of the ABM was highly significantly correlated with the vertical localization of the mucogingival junction ($P < 0.001$). On average, this line was 1.6 mm more apical than the ABM (CI 95% 1.35–1.97 mm).
CONCLUSION: Both CBCT resolutions provided highly accurate data and reliably depict the anatomical truth. The identified ABM on the lateral cephalogram does not seem to correspond with the physical measurements. The mucogingival junction is a good landmark to ascertain correct localization of the ABM.

49 GINGIVAL CREVICULAR FLUID ALKALINE PHOSPHATE ACTIVITY AS A MARKER OF SKELETAL MATURATION

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AIM: Treatment timing plays a significant role in the outcome of orthopaedic treatment of dentoskeletal disharmonies in growing patients. Therefore, correct identification of the different phases in skeletal maturation represents a crucial issue in orthodontic diagnosis and treatment planning. The present study aimed to evaluate gingival crevicular fluid (GCF) alkaline phosphatase activity, a key enzyme in bone mineralization, in growing subjects in relation to chronological age, phase of the dentition, and stage in individual skeletal growth.
SUBJECTS AND METHOD: Forty-nine healthy subjects (30 females, 19 males, 7.8–17.0 years of age). After appraisal of the dentition phase and skeletal maturation using the cervical vertebral method. GFC was collected at both the maxilla and the mandible at periodontally healthy sites around the central incisors. Enzymatic activity was determined spectrophotometrically.
RESULTS: GCF alkaline phosphatase activity when collected from the mandible was correlated with the cervical vertebral stages. In particular, a peak in enzyme activity was seen at the pubertal stage CS 3. On the contrary, phases of the dentition and chronological age showed either no significant or very low correlations, respectively, with enzyme activity. The pubertal increase in the enzyme activity from the mandible may have clinical value when planning orthodontic treatment in growing subjects with dentoskeletal disharmonies.
CONCLUSION: GCF alkaline phosphatase activity may be a valid candidate as a new, biochemical and non-invasive, marker of skeletal maturation, i.e. mandibular growth spurt, in periodontally healthy subjects scheduled for orthodontic treatment during adolescence.

50 IMPORTANCE OF AGE IN ORTHODONTICS; A STUDY OF CRANIOFACIAL MUSCLE MATURATION

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AIM: Several treatment modalities currently employed to correct malocclusion and facial deformity incite an adaptive response in the muscles of the face and jaws. An understanding of the mechanisms involved in the adaptive response of the muscles is therefore important. Included in this is an appreciation of whether muscle response varies with age. Clinically, this could influence the choice of specific treatment approaches in patients of differing age. The aim of this study was to investigate the effect of age on the response of rabbit masseter muscle derived cells within a three-dimensional environment (3D).
MATERIALS AND METHOD: Myogenic muscle precursor cells (MPCs) were obtained from masseter muscle explants of four 10 month old, female, New Zealand white rabbits. A known number of cells (4×106) were placed in a 3D collagen gel model anchored by metal floatation bars suspended in a chamber slide. As the MPCs proliferated and matured into myotubes

(primitive muscle fibres), the development of the muscle contractile apparatus caused increased tension within the model, resulting in bowing of the gel. The degree of bowing of the respective gels was measured daily over a 14 day period and compared using a Mann Whitney test. MPCs derived from the same explants were also observed in a two-dimensional milieu over a similar time period to check the corresponding level of muscle differentiation.
RESULTS: The mean bowing of the gel based on young MPCs was statistically significantly higher ($P < 0.001$) than that of mature MPCs at all times.
CONCLUSION: There are statistically significant differences in the behaviour of young and mature masseter muscle-derived cells, which may have clinical implications.

51 CRANIOFACIAL STABILITY IN CROUZON AND APERT PATIENTS ONE YEAR POST LE FORT III DISTRACTION

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AIM: Le Fort III external distraction osteogenesis (DO) is currently used as a technique for the correction of midface hypoplasia. The technique has been applied in craniofacial surgery of Crouzon and Apert patients. The prevalence of Crouzon syndrome is very low, with about 16 per one million live births and is even lower for Apert syndrome. The aim of this study was to evaluate the post-operative stability of Le Fort III external DO in Crouzon and Apert patients.
SUBJECTS AND METHOD: Seven Apert and six Crouzon consecutive patients. Surgery was undertaken between 2003 and 2008. Cephalometric measurements were taken from lateral cephalograms shortly before surgery (T1), at removal of the distraction device, 4 months after surgery (T2), and 1 year after removal of the distraction device (T3). Statistical analysis using a *Z*-test was performed to compare the syndromic patients with control subjects (n = 482) from the Nijmegen Growth Study.
RESULT: At T1, the syndromic patients and control subjects differed significantly for horizontal and vertical measurements. Treatment changes (T1-T2) were significant for all sagittal measurements, with no differences between the Apert and Crouzon patients. The increased vertical values before treatment did not change during DO or at T3. Treatment (T1-T3) showed a significant increase for sagittal measurements; the vertical measurements changes that occurred were not significantly different from control values.
CONCLUSION: A Le Fort III external DO in Crouzon and Apert patients seems stable in the sagittal direction at 4 months and one year post-operatively. It appears that for both syndromes the vertical dimensions did not change during treatment.

52 OPEN BITE TREATMENT WITH ZYGOMATIC ANCHORAGE

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AIM: To evaluate the dentoalveolar and skeletal effects of open bite treatment with zygomatic anchorage.
SUBJECTS AND METHOD: Two groups were matched, a treatment and a control. Each group comprised 20 patients. The mean chronological age for the treatment group was 16.68 ± 2.80 years and for the control group 16.63 ± 2.83 years. The mean treatment period was 1.00 ± 0.31 years. The subjects in control group were observed for 0.95 ± 0.14 years. The study was carried out on 80 lateral cephalometric radiographs and dental casts taken before and at the end of the treatment or observation. Titanium integrated miniplates were placed on the lower contours of each zygomatic process using a minor surgical procedure. Nickel titanium closed coil springs were applied from the miniplates to the posterior teeth for intrusion force. A rigid hyrax screw was used for transverse control of the posterior teeth.
RESULTS: Anterior open bite closure was achieved in all patients. The amount of intrusion was 3.59 ± 1.34 mm at the first maxillary molars ($P < 0.001$). The overbite increased 4.82 ± 1.53 mm ($P < 0.001$). A closure of 2.25 ± 1.91 degrees was determined for the mandibular plane angle (Go-Gn-SN) ($P < 0.001$). Anterior face heights decreased as the mandible closed.
CONCLUSION: Zygomatic anchorage can be used effectively for open bite correction through posterior dentoalveolar intrusion.

53 SELF-ESTEEM AND CURRENT WELL-BEING OF PATIENTS WITH CLASS III PROFILES

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AIM: The degree of satisfaction with one's facial or body image may depend on perceptual, developmental and socio-cultural influences, as well as self-esteem. This study addressed the influence of a Class III profile on a patient's facial or body image in randomly selected participants. The objective was to determine whether a Class III profile is associated with an increased likelihood of having a negative facial or body image, impaired well-being and social functioning and a greater willingness to undergo aesthetic surgery in comparison with subjects with Class I or Class II profiles.
SUBJECTS AND METHOD: Three hundred and twenty five subjects (162 females, 163 males, 18–30 years) were photographed, asked to complete an adjective mood scale (AMS) and to rate 46 statements regarding their own appearance and their impact on social functioning as well as their willingness to undergo aesthetic surgery on a visual analogue scale. The subjects were separated into three groups, according to their profile type.
RESULTS: The average ratings of one's appearance were shown to be more positive in subjects with a Class I profile as compared with those with Class II or Class III profiles. Items regarding the impact of one's appearance on social functioning were answered more negatively in subjects with impaired well-being as compared with those with normal well being; this was not dependent on profile type. A Class III profile did not influence the well-being of the subjects. Subjects with a Class III profile did not show an increased willingness to undergo aesthetic surgery.
CONCLUSION: A Class III profile may cause an impaired facial image even if well-being is normal. Willingness to undergo aesthetic surgery was the same in subjects with Class I, II or III profiles.

54 SIMULATION OF ORTHOGNATHIC SURGERY USING CONE BEAM COMPUTER TOMOGRAPHY AND DIGITAL MODELS

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AIM: To develop a routine by which orthognathic surgery can be simulated and the necessary wafers produced by integrating cone beam computer tomography (CBCT) with digital models.
MATERIALS AND METHOD: CBCT images and O3DM® virtual models (Ortolab, Czetochowa, Poland) in STL format of patients being prepared by means of orthodontics for orthognathic surgery visualized in Mimics (Materialise, Leuven, Belgium). Alginate impressions served as the basis for generation of the virtual models and the data were converted to STL format and merged with the three-dimensional (3D) CBCT image dataset of the craniofacial skeleton. This was done by superimposing tooth structures from the CBCT on those from the virtual model using a minimum of eight points on both models. The planned surgical intervention (simulating a bilateral sagittal split osteotomy and Le Fort I surgery) was performed using the simulation tools of Mimics in such a way that the desired dental relationship was obtained. Minor occlusal adjustments were corrected using 3D software. Space was generated for the wafer by rotating the mandible around a centre corresponding to the condyle as in an individual articulator. The wafer could then be produced with computer controlled milling or a 3D printing process.
RESULTS: The combination of CBCT and the virtual models resolved the scattering artefacts of teeth with fillings or brackets in the CBCT images, visualised necessary tooth movement in the upper and lower arch, and allowed for an iterative process of 3D simulation of the surgery mimicking cuttings in the anatomically correct positions.
CONCLUSION: A method allowing for optimal utilization of the information from 3D images of both the face and model was developed. The high resolution of the 3D models allows for satisfactory precision in the production of the surgical wafer.

56 MANDIBULAR INCISOR ALIGNMENT AND DENTAL ARCH CHANGES AFTER EXTRACTION OF PRIMARY CANINES

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AIM: To investigate the early effects on mandibular incisor alignment and changes in dental arch dimensions after extraction of the primary canines.
SUBJECTS AND METHOD: Seventy-three Swedish children in the early mixed dentition, were randomized into one extraction (n = 32) and one control (n = 41) group. Impressions for dental casts were taken at baseline (T0) and after 1 year (T1). Changes over time and between groups were investigated for mandibular incisor irregularity index, rotation and maxillary and mandibular arch dimensions (arch width, length and circumference), overjet and overbite.
RESULTS: Mandibular incisor irregularity decreased more in the extraction group than in the control group (1.2 versus 0.7 mm; $P < 0.01$), although with a wide range for both groups. A 50 per cent reduction or more of irregularity was recorded for

10/32 children in the extraction group and 1/41 in the control group. Changes in rotation >10 degrees for the lateral incisors were twice as common in the extraction group (42 versus 20%; $P < 0.01$), while the central incisors showed minor changes between groups ($P = 0.02$). A significant decrease ($P < 0.01$) in maxillary and mandibular arch length and arch circumference from T0 to T1 was recorded in the extraction group along with a significant increase in maxillary and mandibular arch circumference and mandibular arch width in the control group. Subjective assessment of alignment in the extraction group revealed that 84 per cent improved while 16 per cent showed no change. However, the association with objective assessment of changes in rotation was only moderate.
CONCLUSION: Extraction of the primary canines gave significant but small improvements in mandibular incisor alignment after 1 year. However arch length and circumference were reduced leading to a decrease in available space for the permanent dentition.

57 THREE-DIMENSIONAL AIRWAY VOLUME CHANGES IN ORTHOGNATHIC SURGERY PATIENTS

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AIM: Treating patients with dentofacial deformities commonly requires combined orthodontic-surgical treatment. Skeletal tissue movements within orthognathic surgery influence the shape and dimensions of the surrounding soft tissues and upper airways. The purpose of this study was to evaluate oropharyngeal (OP) airway volume changes in patients treated with either mandibular setback, or mandibular advancement surgery.
MATERIALS AND METHOD: Cone beam computed tomographic (CBCT) images of seven patients who underwent mandibular advancement (group A) and five patients who underwent mandibular setback surgery (group B). CBCT scans were taken before and after surgery using the CB MercuRay scanner (Hitachi Medical, Tokyo, Japan), with an average of one month between the two scans. DICOM images were analyzed using InVivo Dental Software (Anatomage Inc., San Jose, California, USA). For OP airway calculation, the palatal plane was used as the superior border, and the most anteroinferior point of the second cervical vertebrae as the inferior border. Volumes were calculated by a single operator, using automatic segmentation. All measurements were repeated for reliability tests. The Statistical Package for Social Sciences, version 17.0 (SPSS Inc., Chicago, Illinois, USA) was used for statistical analysis. Differences between the pre- and post-surgical groups were tested using a paired samples *t*-test, considering a significance of $P < 0.05$.
RESULTS: Intraoperator results showed good reproducibility. Data analysis showed an increase in OP volume in group A, and a decrease in group B. Comparative statistical analysis showed the change in group A was statistically significant ($P < 0.05$), while those in group B were not ($P > 0.05$).
CONCLUSION: Changes in OP airway volume occur after mandibular surgery. However, further investigation is required to determine the significance and amount of airway volume change in relation to mandibular movement. The change in airway volume may be an important factor to consider when planning mandibular antero-posterior skeletal movement.

58 SKELETAL AND DENTAL EFFECTS OF A NEW MAGNETIC FUNCTIONAL APPLIANCE IN CLASS II CORRECTION

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AIM: To evaluate the skeletal and dental effects of a new magnetic fixed functional appliance (Magnoglide) compared with an untreated control group.
SUBJECTS AND METHOD: A prospective study of 42 consecutive Class II division 1 subjects treated with the Magnoglide compared with 30 untreated Class II controls matched for age gender and cervical vertebral maturation stage (CS 3-4). Lateral cephalograms were obtained prior to the start of treatment (T1) and at the end of the functional appliance stage (T2). Cephalometric analysis was undertaken using the SO analysis of Pancherz, and linear and angular measurements.
RESULTS: There was no statistical difference between the two groups at T1. Class II correction was achieved in all 42 subjects. Pancherz's analysis showed that, on average, overjet correction of 4 mm was achieved. The correction can be attributed to 2.5 mm (62.5%) mandibular change and 1.5 mm (37.5%) maxillary change. The mandibular changes consisted of 2.2 mm (55%) skeletal advancement the chin level and 0.4 mm (10%) of lower incisor advancement. The maxillary changes consisted of 0.5 mm (15%) of restrained growth and 0.9 mm (22.5%) incisor retraction. There was a significant gain in mandibular length as measured by the change in Co-Gn with the treatment group showing 3.3 mm more increase in mandibular length than the control group, as well as a reduction in ANB angle of 1.4 degrees as opposed to an increase of 0.3 degrees in the untreated controls. Changes in lower incisor angulation were statistically insignificant.

CONCLUSION: The new magnetic functional appliance (Magnoglide) is effective in orthopaedic Class II treatment with minimal dental side-effects.

59 SKELETAL RESPONSE TO EARLY MAXILLARY PROTRACTION IN PATIENTS WITH CLEFT LIP AND PALATE

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AIM: During the last 30 years CLP patients with maxillary deficiency had an interceptive orthopaedic treatment phase to correct anterior and/or lateral crossbites in the primary and early mixed dentition periods. The objective of this study was to evaluate dentofacial growth and development after maxillary protraction before 10 years of ages
SUBJECTS AND METHOD: Seventy-two subjects with various types of cleft types and an anterior crossbite, treated to an acceptable normal occlusion by maxillary protraction using a Delaire facemask. Standardized records, including lateral cephalograms and plaster models, were collected immediately before and after the active treatment period, and at 15 years of age. Two cephalometric variables were chosen for evaluation of the sagittal skeletal effect 1) ANB angle representing the combined maxillo-mandibular change and 2) forward movement of the maxilla represented by an increase in the distance NSP-maxp parallel to the nasion-sella-line. A numerical change greater than or equal to 1.5 (degrees/mm respectively was classified as a 'fair response' versus a 'poor response' by a change of less than 1.5.
RESULTS: During protraction the sagittal intermaxillary relationship showed a mean increase of ANB of +2.5 degrees, however with a range from 0.5 to 7.5 degrees. A fair response was found in 63 per cent of the cases. A fair response of forward movement of the maxilla was found in 44 per cent, with a linear increase of 4.1 mm versus 0.4 mm in the poor response group. There was a close relationship between soft tissue lip changes and the underlying hard tissue changes.
CONCLUSION: The skeletal effect of early maxillary protraction is favourable in most cases, but highly individual.

60 CATEGORIZATION OF FACIAL FORM

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AIM: To characterize normal variation of facial morphology in a young population based on three-dimensional (3D) analysis of facial soft tissue landmarks.
SUBJECTS AND METHOD: Three hundred and fifty British-Caucasian children (166 females, 184 males) aged 15½ years were recruited from the Avon Longitudinal Study of Parents and Children. 3D facial images were obtained for each individual using two high-resolution Konica/Minolta laser scanners. Twenty-one reproducible facial landmarks were identified on each image resulting in 63 *X*, *Y*, and *Z* coordinates. Generalized Procrustes analysis was used to provide the best fit of the 21 facial landmarks, considering both size and shape variations, equally important for 3D analysis of facial morphology. Principal component analysis was used to highlight important components that describe normal variation of facial morphology.
RESULTS: Thirteen principal components were identified that describe facial variation within the population, with the first three components explaining 46.6 per cent of the total variance in facial form.
CONCLUSION: The findings challenge traditional categorisations of facial morphology. Facial variation can be considered as a continuum. This method of facial assessment may be useful to identify and classify faces and facial changes that occur as a result of growth, and inform clinicians of appropriate healthcare interventions for specific facial types.

61 BONE MARROW-DERIVED STEM CELLS IN PALATAL WOUND HEALING

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AIM: Myofibroblasts are responsible for contraction and scarring after cleft palate repair. This may lead to growth disturbances in the upper jaw. The hypothesis tested was that circulating stem cells originating from the bone marrow are recruited to palatal wounds and differentiate into myofibroblasts. If confirmed, this might offer new opportunities for anti-scarring therapy in cleft palate surgery, by preventing the recruitment of specific myofibroblast precursors. The aim of this

study was to investigate the contribution of bone marrow-derived stem cells (BMDSCs) to the myofibroblast population in experimental wounds in the palate.
MATERIALS AND METHOD: Bone marrow from five green fluorescent protein (GFP)-transgenic Sprague-Dawley rats was transplanted into 10 lethally irradiated wild-type rats. Five weeks later, 89 ± 8.9 per cent of the mononuclear cells in the blood of the recipient rats were GFP-positive. Seven weeks after the bone marrow transplantation, 4 mm experimental wounds were made in the palatal mucoperiosteum. Wound and adjacent control tissue was harvested with a 5 mm biopsy punch. The tissue samples were fixed in 4 per cent paraformaldehyde for 24 hours, and embedded in paraffin. The contribution of GFP expressing BMDSCs to the myofibroblast population in both the wound and control areas was investigated by immunostaining. In addition, the contribution of BMDSCs to other cell populations was estimated with specific markers.
RESULTS: At two weeks post-wounding, 8.4 ± 7.4 per cent of all cells in the wound area were GFP-positive and 5.0 ± 4.0 per cent of the myofibroblasts, which was significantly higher than in the control area. Similar percentages were found for activated fibroblasts and endothelial cells, but for myeloid cells it was considerably higher (22 ± 9%).
CONCLUSION: BMDSCs contribute to palatal wound healing, but are not the main source of myofibroblasts. In small wounds, local precursor cells are probably sufficient to replenish the defect.

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62 LEVELS OF INTERLEUKIN-1ß IN ADULTS WITH PERIODONTITIS DURING ORTHODONTIC TREATMENT

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AIM: Remodelling of the bone matrix is reflected by cytokine-expression in the gingival crevicular fluid (GCF). The total amount of mediators expressed corresponds to the amount of tooth movement. An increased problem in adults is the occurrence of periodontitis. In humans with severe periodontal disease significantly higher levels of interleukin (IL)-1 were found compared with controls. The purpose of this study was to examine GCF levels of IL-1ß during adult human orthodontic tooth movement.
SUBJECTS AND METHOD: Eight patients, four with a healthy periodontium and four with a history of periodontal disease. All four molars had bonded molar tubes and were uprighted continuously with a 0.017 × 0.025 TMA uprighting spring using a force of 30 cN. GCF was sampled at all pressure sites twice within two weeks of separation as observation/control before activation and at 1, 7, 14 and 21 days. IL-1 ß levels were determined with enzyme-linked immunosorbent assay.
RESULTS: IL-1ß can be detected in the GCF of healthy adult patients and in those with a history of periodontitis. The increased GCF volume of adult patients with a history of periodontitis could either be a marker for subclinical periodontitis or for a genetic predisposition for IL-1ß expression. The low mechanical force used might explain why IL-1ß remained unaffected.
CONCLUSION: Patients with history of periodontitis displayed a higher amount of fluid volume and a higher concentration of IL-1ß without significant changes being induced through orthodontic movement. The mechanical stimulation of 30 cN seems to be too low to stimulate IL-1ß production. The overall mean total amount of IL-1ß remained stable over time, and also when compared with the antagonistic teeth. The findings of this pilot study suggests for future research the inclusion of a greater number of patients, the use of a higher mechanical force, refinement of the GCF sampling and to use as control baseline cytokine levels at experimental teeth.

63 ULTRASOUND EVALUATION OF TONGUE FUNCTION AND POSTURE IN CLASS III MALOCCLUSION

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AIM: To compare tongue function during swallowing and tongue posture among children with a Class III (CLIII) malocclusion and those with a normal dentition (ND) using two- and three-dimensional (3D) ultrasonography.
SUBJECTS AND METHOD: Swallowing cycles of 13 children with CIII (mean age: 7 ± 1 years) and 14 children with ND (mean age: 7.1 ± 0.3 years), were recorded three times using B- and M-mode ultrasound (US) techniques (SSA-770A with a convex transducer). The scan line was set through the middle of the tongue for the first two swallowing cycles and through the tip of the tongue in the last cycle. The duration of tongue movements of the middle third of the tongue were compared within each subphase and during the entire cycle between the CIII and the ND group, and the swallowing pattern for each

child was assessed according to the action of the tip of the tongue. Voluson 730 Expert with a 3D convex transducer was used to obtain two 3D US images of the tongue in each child in both groups. Referential 3D US reconstructions were used for assessment of the tongue posture in each child.
RESULTS: The duration of the entire swallowing cycle ($P < 0.001$) and of phase IIb ($P < 0.01$) was prolonged in the CIII group. Sixty-nine per cent of the CIII children and 43 per cent of the ND children had a visceral swallowing pattern (Fisher exact test, $P = 0.161$). Eighty-five per cent of the CIII children but only 36 per cent of the ND children demonstrated a tongue posture on the mouth floor according to the 3D US reconstructions ($P < 0.001$).
CONCLUSION: There were significant differences in the duration of tongue movements between both groups of children. The tongues of the CLIII children were, to a greater extent, postured on the mouth floor compared with children with ND.

64 HO2 MODULATES WOUND CONTRACTION AND INFLAMMATION: IMPLICATIONS FOR CLEFT PALATE PATIENTS

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AIM: Cleft palate patients undergo several surgical interventions, resulting in the formation of scars, and increased morbidity in these patients. Following dermal wounding, the severity of scar formation is inversely related to the speed of wound contraction. Therefore, the aim of this study was to identify novel factors that are involved in dermal wound contraction.
MATERIALS AND METHOD: It has previously been demonstrated that heme oxygenase (HO)-activity, via generation of carbon monoxide and bilirubin, modulate wound contraction *in vitro*. In this research HO was studied in more detail using *in vivo* models of wound contraction. Four excisional wounds (4 mm) were made on the dorsal skin of HO2 knock-out (KO) mice and wild type controls (WT), and additionally, wounds were made in hyperbilirubinemic Gunn-UDPTGTJ and WT Gunn-UDPTGT+ rats. Wound size was photographically documented daily up to day 7.
RESULTS: In HO2 KO mice wound contraction was significantly slower on days 1, 2, 5 and 7 compared with WT. In contrast, in hyperbilirubinemic rats wound contraction was significantly faster than in WT rats in the early phases of wound healing, suggesting that HO-effector molecules can also modulate wound contraction *in vivo*. Leukocyte infiltration and HO1 expression in the wound area were significantly higher in HO2 KO animals compared with WT at day 7 following wounding. Serum bilirubin levels in HO2 KO mice were significantly higher at baseline than in WT controls and also HO1 mRNA levels on day 2 were significantly increased when compared with WT. Since abrogation of HO2 results in delayed dermal wound closure and hampers resolution of inflammation despite increased HO1 expression, the data suggest that not only HO1, but also HO2 proteins are crucial in the resolution of inflammation.
CONCLUSION: Both HO isoforms and their effector molecules are involved in dermal wound contraction and therefore most likely in the process of scar formation.

65 CURRENT REMARKS ON BOLTON ANALYSIS – A METRIC STUDY

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AIM: To re-evaluate the results of Bolton's tooth size discrepancy (TSD) analysis and to find the factors influencing TSD.
MATERIALS AND METHOD: At the start and the end of orthodontic treatment, the tooth widths of 200 consecutive patients were measured using model casts and a digital calliper. Patients with missing teeth, prosthetic restoration or fillings in the interdental area were excluded. The Peer Assessment Rating (PAR) index was measured and calculated. Statistical analysis (descriptive, Pearson's correlation) was undertaken using the Statistical Package for Social Sciences, version 17.0 (SPSS Inc., Chicago, Illinois, USA).
RESULTS: Compared with the original Bolton standards (overall 91.3 ± 1.91%; anterior 77.2 ± 1.65%) slightly higher values were found: overall 91.98 ± 1.79 per cent; anterior 78.06 ± 2.15 per cent. The new values for anterior ratio showed better correspondence with the curve according to Gauß, while using the original Bolton standards more patients were found in the category >2 SD. A group of 63 patients, who had a PAR Index = 0 at the end of treatment, showed values for overall ratio of = 91.95 ± 1.76 per cent and of anterior ratio = 78.01 ± 1.94 per cent. For 50 patients who had tooth shaping or composite build-up during treatment their values for overall ratio changed from 92.10 ± 1.87 per cent to 91.50 ± 1.94 per cent, and anterior ratio from 78.17 ± 2.40 per cent to 77.12 ± 2.35 per cent. The widths of the upper lateral incisors, lower second premolars and the lower first molars had an influence on the values of anterior and overall ratio.
CONCLUSION: TSD standards vary at different times and between different populations. Narrow upper incisors are the reason for new standards, especially the anterior ratio. In addition to the Tonn relationship, the width of the lower first molars

can be an indicator for TSD. Treatment outcome of PAR = 0 seems to be influenced more by other factors than Bolton standards.

66 EFFECTS OF VASCULAR ENDOTHELIAL GROWTH FACTOR AND DANSHEN ON OSTEOBLASTIC CELL ACTIVITIES

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AIM: The search for an ideal bone grafting material remains a challenge in modern surgery. Sufficient bone support is essential for effective orthodontic tooth movement. Osteogenesis and angiogenesis are closely correlated. This study aimed to investigate the effects of vascular endothelial growth factor (VEGF) and the medicinal herb, Danshen, on osteoblastic cell activities.
MATERIALS AND METHOD: An osteoblastic cell line, MC3T3-E1, was cultured *in* vitro with or without VEGF and Danshen. The cells in both control and test groups were collected at different culture time points of 24, 48 and 72 hours. Real-time polymerase chain reaction was carried out to quantify the expression of VEGF, alkaline phosphatase (ALP), osteopontin (OPN), osteocalcin (OCN), osteoprotegerin (OPG) and the receptor activator of nuclear factor kappa B ligand (RANKL) at the mRNA level.
RESULTS: The expression of VEGF was down-regulated by extrinsic VEGF ($P < 0.05$), while upregulated by extrinsic Danshen ($P < 0.05$). The expression of ALP was upregulated by both VEGF and Danshen ($P < 0.05$), but Danshen showed a more continuous effect. Both VEGF and Danshen upregulated the expression of OPN and OCN ($P < 0.05$), but the effect of Danshen appeared earlier than that of VEGF. Both VEGF and Danshen regulated the expression of OPG, while only Danshen regulated the expression of RANKL.
CONCLUSION: Danshen enhances expression of VEGF in osteoblastic cells, but VEGF shows negative feedback of auto-regulation. Both VEGF and Danshen promote bone remodelling by direct effects on osteoblastic cells via regulating gene expression of ALP, OPN, OCN and OPG.

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Posters

67 ORAL HYGIENE INDEX IN MALE AND FEMALE PATIENTS BEFORE ORTHODONTIC TREATMENT

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AIM: Fixed and removable appliances present a risk of plaque accumulation, white spot lesions and gingival irritation. The patients must be able to maintain adequate oral hygiene during the period of orthodontic treatment and retention. The aim of this study was to establish the level of oral hygiene of patients before orthodontic treatment.
SUBJECTS AND METHOD: Sixty-two patients (34 males, 28 females), aged 8–37 years, were screened for oral hygiene at three successive controls before orthodontic treatment. Erytrozyne dye was applied to all tooth surfaces and the oral hygiene index (OHI) was then calculated.
RESULTS: Total average OHI was 26 per cent (males 28%, females 24%). Average OHI at the first control in males was 43 per cent and in females in 41 per cent. At the second control it was 28 per cent in males and 19 per cent in females. Average OHI at the third control for males and females was 12 and 10 per cent, respectively.
CONCLUSION: OHI evaluation is an important part of diagnosis before treatment in orthodontic patients. Although differences in the OHI assessment between genders occasionally reached statistical significance, interpretation of the results should be treated with caution due to the large age differences of the patients.

68 SURGERY-FIRST APPROACH IN SKELETAL CLASS III MALOCCLUSION TREATED WITH TWO-JAW SURGERY

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AIM: To evaluate surgical movement and post-operative orthodontic treatment (POT) of the surgery-first approach for the correction of a skeletal Class III malocclusion (SCIII).

SUBJECTS AND METHOD: Eleven SCIII patients who underwent non-extraction treatment and two-jaw surgery [Le Fort I osteotomy impaction of the posterior maxilla (IPM); bilateral sagittal split ramus osteotomy (BSSRO) setback of the mandible (BSM)]. The wafer was removed 4 weeks after surgery. The durations of POT and total treatment time were 8.91 ± 3.14 months and 12.18 ± 3.57 months, respectively. Lateral cephalograms were taken during the initial examination (T0), immediately after surgery (T1), and after debonding (T2). Sixteen variables were measured. A paired *t*-test was used for statistical analysis.
RESULTS: The maxilla rotated clockwise and the nasolabial angle increased with IPM (FH-palatal plane angle, FH-occlusal plane angle, $P < 0.01$; nasolabial angle, $P < 0.05$) and was well maintained during POT. The mandible was repositioned backward by BSM (SNB, Pog-N perp, $P < 0.001$) and relapsed forward during POT (SNB, $P < 0.01$; Pog-N perp, $P < 0.05$). U1-SN decreased with IPM ($P < 0.001$) and relapsed labially as a result of the Class III mechanics during POT ($P < 0.01$), eventually no significant difference was found between T0-T2. Although IMPA increased with POT, there was no significant difference between T0-T2. The mandible seemed to relapse forward immediately after wafer removal and prior to labioversion of the lower incisors.
CONCLUSION: Accurate prediction of POT is crucial in controlling dental alignment, incisor decompensation, arch coordination, and occlusal settling. Long-term wear and selective grinding of the wafer for labioversion of the lower incisors and use of miniplates/miniscrews to control the inclination of the upper incisor are necessary to prevent relapse of the mandible.

69 SKELETAL MATURATION IN CHILDREN WITH A CLEFT LIP AND PALATE

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AIMS: To investigate the correlations between chronological age and skeletal age in subjects with a cleft lip and palate (CLP) and to compare it with a Class I control group, according to hand-wrist skeletal maturity indicators.
MATERIALS AND METHOD: Hand wrist films of 45 subjects with a CLP (16 males, 29 females, age range 6–17 years) and 45 Class I subjects (17 males, 28 females, age range 8–16 years). In each case skeletal age was determined on the basis of the Greulich–Pyle atlas method using gender specific hand wrist radiographs standardised by age, by one experienced examiner. Statistical evaluation was performed with the Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA) using analysis of variance (ANOVA), Duncan's test and Pearson correlation analysis.
RESULTS: In the overall study group (n = 90) a high correlation was observed between skeletal and chronological age (0.94, $P < 0.01$). In the CLP subjects, skeletal age was retarded (11.4 years) when compared with chronological age (12.3 years), although it was statistically insignificant. However, in the control group skeletal age was similar to chronological age (13.6 versus 13.1 years). In both groups, skeletal age was ahead of chronological age in female subjects when compared with males, while in the male group, skeletal age was behind chronological age (11.7 versus 12.2 years). Skeletal age was retarded in the CLP group when compared with chronological age, both in male (n = 41, 10.8 versus 13.2 years) and female (n = 49, 12.2 versus 13.9 years) subjects.
CONCLUSION: As CLP subjects may have a skeletal age behind chronological age, hand wrist evaluation should be considered rather than the chronological age for the timing of orthodontic/orthopaedic treatment.

70 A SURVEY OF LEVELS OF DENTAL ANXIETY AMONGST INDIVIDUALS WITH CLEFT LIP AND PALATE

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AIM: Dental fear is common in the general population and related to early experience of traumatic dental treatment. The prevalence of dental fear in cleft lip and palate (CLP) subjects is unknown but might be hypothesized to be elevated given the increased likelihood of dental or surgical treatment. The aim of this study was to assess the level of dental and medical setting anxiety among children with CLP.
SUBJECTS AND METHOD: One hundred and eighty two individuals with a CLP drawn from the South Thames Cleft Service Database were compared with a control group of 150 healthy individuals attending the Orthodontic Department, Guy's Hospital. The participants were identified at three ages: 5–10, 11–15 and 16–20 years. A postal questionnaire survey was undertaken for the individuals with CLP, while the questionnaires were completed by the healthy individuals at the orthodontic department. The questionnaires used were the Facial Image Scale (FIS) (Buchanan and Niven, 2002) and the Modified Dental Anxiety Scale (MDAS) (Wong *et al*., 1998).

RESULTS: For all age groups, dental fear scores were higher for individuals with a CLP than for the control group: 5-10 year-old, mean FIS CLP = 2.17 (SD 1.04), controls = 1.39 (SD=0.53), $P < 0.001$; 11-15 year-old, mean MDAS CLP = 21.56 (SD 6.80), controls = 16.40 (SD 4.35) $P < 0.001$; and 16-20 year-old, mean MDAS CLP = 22.08 (SD 8.68), controls = 13.44 (SD 2.89) $P < 0.001$.
CONCLUSION: Individuals with a CLP have high levels of dental fear in comparison with their age-matched peers. Interventions should focus on prevention and management of fear in this group of patients.

71 STEM CELL DIFFERENTIATION INTO ANGIOGENESIS LINEAGE

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AIM: Fibroblast or fibroblast growth factors (FGFs), are a family of growth factors involved in angiogenesis, which is an important process in growth and development, as well as in wound healing. The aim of this study was to evaluate the possibility to differentiate human dental pulp mesenchymal stem cells into angiogenesis lineage. Their differentiation ability was evaluated with an inducer, human FGF1 transfection.
MATERIALS AND METHOD: A strain of stem cell was isolated from dental pulp, expanded and further characterized. Human FGF1 was chosen to trigger it to differentiate to angiogenesis. The gene was cloned and recombinant as pcDNA3.1/V5-His-TOPO-FGF1 vector. pcDNA3. 1/V5-His-TOPO-FGF1 vector was transfected into stem cell as well as three different negative controls, blank cell without transfection, empty vector and non-related green florescent protein (GFP) vector. After 48 hours, the mRNA level of both hepatocyte growth factor (HGF) and urokinase-type plasminogen activator (uPA) were measured by real-time polymerase chain reaction for confirm angiogenesis differentiation.
RESULTS: The transcription levels of HGF and uPA mRNA were significantly higher than all three negative controls after 48 hours transfection. The relative levels of HGF mRNA were 4.078 for blank cell, 12.58 for empty vector, 17.97 for non- related GFP vector and 48.59 for pcDNA3.1/V5-His-TOPO-FGF1 vector. The relative transcription levels of uPA were significantly higher than all three negative controls. The relative levels of uPA mRNA were 0.171 for the blank cell, 3.088 for the empty vector, 3.762 for the non-related GFP vector and 10.15 for the pcDNA3.1/V5-His- TOPO-FGF1 vector.
CONCLUSION: The expression of markers of angiogenesis HGF and uPA is an indication of successful differentiation of human pulp stem cells to the angiogenic lineage. The protocol presented above is effective to trigger angiogenesis from dental pulp stem cells.

72 VITAMINS B6, B12 AND HOMOCYSTEINE IN CLEFT LIP AND PALATE: BIOCHEMICAL ANALYSIS

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AIM: The vitamins B6 and B12 are essentially involved in the methylation cycle. Homocysteine is also an important metabolic parameter in the methylation cycle whose increase in tissue indicates a reduced methylation rate. A lack or deficiency of B6 and B12 and elevated homocysteine levels are thus considered a cause of malformations. However, evidence linking low levels of B group vitamins and oral clefting is presently equivocal. The aim of this pilot study was to investigate associations between non-syndromic oral clefts and biochemical measures of B6 (pyridoxine hydrochloride), B12 (cyanocobalamin) and homocysteine status.
SUBJECTS AND METHOD: A consecutive sample of 37 children (8 girls, 29 boys) born with non-syndromic cleft lip, with or without a cleft palate. Homocysteine, B6 and B12 concentrations in the blood were analyzed. They were studied with high-performance liquid chromatography and electro-chemiluminescence immunoassay.
RESULTS: According to age-adjusted ranges, 20 patients had increased, six decreased and 11 normal ranges of homocysteine. In one patient, B6 was decreased and in another B12 was decreased. Ten patients had B12 values close to the lower border of the normal range. Eighteen subjects had increased B6 values.
CONCLUSION: Due to the limited number of cleft patients included in the present study, no significant decrease in the levels of B6 and B12 was observed in blood. A slight lack of B12 in conjunction with an increase in homocysteine levels could be considered as a risk factor for non-syndromic orofacial clefting. As an increase in B group vitamins has been proven to cause a decrease in homocysteine levels, pregnant women should be informed about vitamin supplements and a well-balanced diet.

73 CHANGES IN ARCH FORM AND DENTITION WITH DIFFERENT RETAINERS AFTER ORTHODONTIC TREATMENT

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AIM: To evaluate the long-term change in the dentition and dental arch form 5 years after fixed orthodontic treatment using different retention devices.
MATERIALS AND METHOD: In group 1 (fixed retainer group) a multistranded wire retainer was bonded to the lingual surface of the anterior segment with removable type retainers fitted after debonding (n = 54). In group 2 (removable retainer group) a removable type retainer (circumferential type) was fitted after debonding (n = 32). Study models were taken before treatment, after debonding, and 5 years after treatment. Changes in intercanine width, intermolar width, arch length and irregularity index were measured.
RESULTS: The irregularity index of the upper and lower incisors significantly increased in both groups, but the amount of increase was significantly greater in the removable retainer group ($P < 0.05$) Intercanine width and arch length significantly decreased 5 years after orthodontic treatment in the removable retainer group ($P < 0.05$). There was no significant change in the fixed retainer group for the same variables ($P > 0.05$). Intercanine width and anterior irregularity index showed a significant correlation during the retention period (upper r = 0.27, $P < 0.05$, lower r = –0.30, $P < 0.05$). There was no significant correlation between arch length change and anterior irregularity index during the retention period ($P > 0.05$). There was no significant difference in intercanine width, intermolar width and arch length between the extraction and non-extraction cases.
CONCLUSION: Post-treatment changes in arch form and dentition are significantly less with fixed than removable retainers.

74 EARLY TREATMENT OF PSEUDO CLASS III MALOCCLUSION – A 10-YEAR FOLLOW-UP STUDY

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AIM: Pseudo Class III malocclusion subjects have anterior crossbite, and are defined as a functional forward displacement of the mandible due to retroclined maxillary incisors. About 5 per cent of the Chinese population is affected by a Class III malocclusion, and more than half are pseudo-Class III. Early treatment of pseudo Class III malocclusions has a number of advantages: it facilitates the eruption of canines and premolars into a Class I occlusion; it eliminates traumatic occlusion to the incisors; provides a normal environment for growth of the maxilla; and often improves the child's self esteem. The aim of this study was to investigate the long-term outcome of simple fixed appliance treatment of a pseudo Class III malocclusion.
MATERIALS AND METHOD: Lateral cephalograms of 27 consecutive young patients obtained before and after active treatment with a 2×4 appliance, and at the 10-year follow-up.
RESULTS: Eighteen patients successfully recalled for the 10-year follow-up had an average pre-treatment overjet of –1.7 mm. Immediately following treatment the average overjet was 3.2 mm, which reduced to 2.2 mm at the 10-year follow-up. Only one patient presented with a reverse overjet.
CONCLUSION: The majority of pseudo-Class III patients who receive early intervention with a 2×4 appliance, will be stable in the long term and will not need further orthodontic treatment. It is recommended though that treatment of an anterior crossbite at an early age should be approached cautiously.

75 DEGREE OF MANDIBULAR MOLAR ROOT DEVELOPMENT IN RELATION TO CRANIOFACIAL GROWTH TYPE

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AIM: As there is a direct relationship between growth of the body and face, it is possible to indirectly determine the stage of facial growth. The position and development of the mandibular molars are important for normal growth and development. The aim of this study was to determine the degree of mandibular molar root development in relation to craniofacial growth type.
SUBJECTS AND METHOD: Five hundred and thirty eight (238 males, 300 females) aged 13 to 18 years of age who were orthodontically treated. The children had all teeth as expected with normal growth and development for their age. Development of the mandibular molars was studied on dental pantomographs. The following 10 stage development classification (Demirjian) was used.
RESULTS: For all males examined, 48 had horizontal growth, 58 neutral growth and 132 vertical growth. For females, 74 had horizontal growth, 64 neutral growth and 162 vertical growth.

CONCLUSION: There was a statistically significant difference between subjects with neutral and vertical growth type. There was no statistically significant difference in mandibular third molar development between subjects with different growth types.

76 PREDICTIVE VALUE OF MOLAR BITE FORCE ON CLASS II FUNCTIONAL APPLIANCE TREATMENT OUTCOMES

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AIMS: Sagittal intermaxillary changes using functional appliances are unpredictable, showing large interindividual variation. One factor for these differences may be the masticatory musculature and its functional capacity, which varies widely between growing individuals. The aims of this research were to investigate changes in maximal molar bite force during functional appliance treatment, and to assess the influence of pre-treatment maximal molar bite force on treatment outcomes with functional appliances used in Class II malocclusion children.
SUBJECTS AND METHOD: Twenty-five children, aged 9–13 years, with a skeletal and dental Class II relationship and increased overjet were treated with functional appliances for 1–2 years. Dental casts, lateral cephalograms, maximal molar bite force, and finger force measurements were performed before and after treatment. These same measurements were also performed 1–2 years before treatment; the intermediate period before starting treatment serving as a control. Multiple regression analysis was used to determine possible correlations between initial maximal molar bite force and dental or cephalometric changes during treatment.
RESULTS: Maximal molar bite force increased pre-treatment, but decreased during functional appliance treatment. Children treated with functional appliances who had a weaker pre-treatment maximal molar bite force showed a larger overjet reduction, greater improvement in molar relationship, a greater reduction in the ANB angle, and a greater augmentation in SNB angle during treatment.
CONCLUSION: Treatment of a dental Class II relationship with functional appliances seems to lead to more favourable treatment outcomes in children with a weaker maximal molar bite force. This is observed both as regards improvements in the dental sagittal relationships, namely overjet and molar Class, as well as skeletal changes detected by a decrease in ANB and an increase in SNB angle.

77 VACUUM RETAINER TECHNIQUE IN THE TREATMENT OF ANTERIOR CROSSBITE

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AIM: Invisalign treatment is gaining wider applications in the treatment of different malocclusions; not only for simple arches alignment. The purpose of this study was to evaluate the efficacy of the Invisalign system in the treatment of anterior crossbite.
SUBJECTS AND METHOD: Twelve adult patients (mean age 21.9 ± 1.42 years) with skeletal pseudo-Class III malocclusions, a Class III molar and canine relationship, normal skeletal pattern and a negative overjet (–2 mm). Orthodontic treatment was carried out avoiding extractions and by means of interproximal reduction in the mandibular arch and expansion in the maxillary arch in order to achieve anterior crossbite correction. All patients were instructed to use Class III intermaxillary elastics from the attachment on the first maxillary molars to those on the lower canines. To simplify connection of the elastics, the attachment was left empty and partially modified. Cephalometric superimposition was carried out on lateral radiographs obtained at the beginning and end of treatment.
RESULTS: A normal overjet relationship was achieved in all patients with a Class I molar and canine relationship. Cephalometric superimposition showed a favourable change in maxillary (1/ANS-PNS mean variation, 9°) and mandibular incisor inclination (1/GoGn mean variation: –3°).
CONCLUSION: The Invisalign technique proved to be an efficient option for the treatment of anterior crossbite in skeletal pseudo-Class III malocclusion subjects.

78 CEPHALOMETRIC VALUES FOR A MOROCCAN POPULATION COMPARED WITH CAUCASIAN NORMS***

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AIMS: To compare cephalometric values of the Moroccan population with the norms of Caucasians, and evaluate the need for specific norms for this population.
MATERIALS AND METHOD: Pre-treatment lateral cephalometric radiographs of 40 Moroccan adults attending the Dental Depatment of Erasme Hospital (31 females, 9 males, mean age 29.5 ± 7.8 years), with no history of orthodontic treatment. Eight cephalometric parameters were measured and compared with Caucasian norms (Tweed, Steiner). The parameters measured were FMA, SNA, SNB, ANB, AoBo, I/F, IMPA and facial index.
RESULTS: FMA was greater (mean 30.3 ± 7.3) when compared with Caucasians. The mean SNB (76.5 ± 4.6) showed that this Moroccan population had mandibular retrognathism relative to the cranial base. They also had proclined upper incisors (113.5 ± 7.5). The other parameters, Wits appraisal (–1.9 ± 5.3), SNA (79.9 ± 4.4), ANB (3.4 ± 3.3), IMPA (90.4 ± 8.4) and facial index (0.66 ± 0.10) were within the normal Caucasian ranges.
CONCLUSION: The findings emphasize the necessity of, not only describe group-specific norms, but above all to be aware of individual specificities. Individual variations found within the same population are more relevant than mean values.

79 A PROTOCOL FOR IMPROVED STABILITY WITH HERBST APPLIANCE TREATMENT

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AIM: To present a treatment protocol that leads to increased stability in the long term by comparing the published data on the short- and long- term effects of Herbst appliance treatment with single or multiple step mandibular advancement.
SUBJECTS AND METHOD: Sixteen Class II division 1 adults treated with Herbst appliances for 12 months with stepwise advancement, followed by fixed appliance. Lateral cephalograms were taken pre-treatment, after Herbst appliance treatment, after fixed appliance treatment and at the 3 year follow-up after debond. The results were compared with 16 Class II division 1 adolescents treated with a Herbst appliance for 7 months with maximal single step advancement, followed by retention with an Andresen activator. Lateral cephalograms were taken pre-treatment, after Herbst appliance treatment, after 6 months retention with the Andresen activator, and at the 2 year follow up after Andresen activator retention (Phan *et al*., 2006).
RESULTS: Comparing the treatment effects of the two protocols demonstrated: (1) initially greater forward positioning of the mandible in the adult group; (2) less relapse after appliance removal in the adult group; (3) long term, greater stability in the adult group; (4) greater skeletal contribution to overjet and molar correction in the adolescent group.
CONCLUSION: Long-term stability of Herbst appliance treatment is affected by the treatment protocol employed. Based on the increased stability of the adult group, it is recommended to treat for 12 months in a stepwise manner for mandibular advancement for both adolescent and adult patients without retention between phase I and II treatment.

80 MAXILLARY PROTRACTION WITH A FACEMASK: EFFECTS ON SAGITTAL AIRWAY DIMENSIONS

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AIM: A skeletal Class III malocclusion is one of the most severe maxillofacial deformities, causing many functional, phonetic, aesthetic and social problems. Maxillary protraction with a facemask is one of the most frequently used therapies in growing patients. The aim of this study was to analyze the effects of maxillary facemask protraction (FM), or rapid maxillary expansion followed by maxillary facemask protraction (RME+FM), on the sagittal airway dimensions in subjects with a skeletal Class III malocclusion, compared with an untreated control group.
SUBJECTS AND METHOD: Forty-seven subjects divided into three groups: group 1 (RME+FM), 15 subjects (T1-T2 period 1.5 years); group 2 (FM), 18 subjects (T1-T2 period 1.5 years); group 3 (control), 14 subjects (T1-T2 period 1.6 years). Cephalometric radiographs were taken immediately before (T1) and after (T2) treatment and, in 33 subjects, after a follow-up period of 1.9 years (T3). Linear and angular measurements were evaluated: PNS-AD1, PNS-AD2, SPS, MPS, IPS, SN/CVT. Differences between the three groups were analyzed with analysis of variance.
RESULTS: Favourable changes induced by maxillary protraction, with or without palatal expansion, were associated with only slight changes in the antero-posterior oro- and rhino-pharyngeal dimensions. A general increase in airway dimensions was observed in the treated subjects, though none of the changes was statistically significant (PNS-AD1 group 1, +0.73 mm, group 2, +1.46 mm, group 3, –0.5 mm; IPS group, 1 +1.2 mm, group 2, +1.6 mm, group 3 –1.87 mm; SN/CVT group 1 +6.16 degrees, group 2 +4.9 degrees, group 3 +1.41 degrees.
CONCLUSION: Orthopaedic treatment of a Class III malocclusion did not result in a statistically relevant increase in airway dimensions in the short or long term.

81 ROOT RESORPTION AFTER 2.5 AND 15 DEGREE BUCCAL ROOT TORQUE FOR 4 WEEKS: A MICRO-COMPUTED TOMOGRAPHIC STUDY

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AIM: Root resorption is an undesirable but inevitable consequence of orthodontic tooth movement. The severity is unpredictable and despite extensive research, the aetiology remains unknown. Torque has been acknowledged as a risk factor for root resorption. The aim of this study was to evaluate and quantify the extent of root resorption following the application of 2.5 and 15 degrees buccal root torque for 4 weeks.
SUBJECTS AND METHOD: Fifteen patients requiring extraction of bilateral upper first premolars for orthodontic treatment. Using a standardized experimental protocol, the right and left premolars were randomly subjected to either 2.5 or 15 degree buccal root torque. At the end of the four-week experimental period the premolars were extracted. A volumetric analysis of the extent of root resorption was performed using micro-computed tomography and measured using specially designed software.
RESULTS: Overall, the amount of root resorption was comparable after the application of 2.5 or 15 degree buccal root torque ($P = 0.59$). A significant difference between the two force levels existed only at the apical region ($P = 0.034$). More root resorption occurred in areas of compression than in areas of tension. The variables of age and gender were not statistically significant.
CONCLUSION: (1) Root resorption was evident after four weeks of buccal root torque application. (2) More root resorption was seen at the apical than at the middle and cervical regions. (3) Higher magnitudes of torque have the potential to cause more root resorption, particularly in the apical region.

82 TWO SCORING SYSTEMS FOR TREATMENT EVALUATION OF BILATERAL CLEFT LIP AND PALATE PATIENTS

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AIM: A complete bilateral cleft lip and palate (CBCLP) is an 'orphan' condition due to its low incidence. Therefore nearly all scoring systems that measure treatment outcome have been developed for unilateral clefts. However, it is essential to have reliable methods for assessment of treatment outcome in CBCLP, which involves treatment until facial growth has ceased. The aim of this study was to compare two scoring systems, i.e. the Huddart/Bodenham (HB) system and the newly developed BCLP yardstick, which classifies treatment outcome in terms of dental arch relationships in patients with CBCLP. In addition, a further aim was to evaluate the predictive value of these scoring systems for treatment outcome.
SUBJECTS AND METHOD: Dental arch relationships of 44 CBCLP patients were evaluated at 6, 9, and 12 years using the HB-scoring system and the BCLP yardstick. In total 121 dental casts were rated. For each age group the HB-scores were correlated with the BCLP yardstick scores using Pearson's correlation coefficient. The predictive value of the two scoring systems was evaluated by backward regression analysis.
RESULTS: Intra-observer kappa values for the BCLP-yardstick scores for the two observers were 0.506 and 0.627, respectively, and interobserver reliability ranged between 0.427 and 0.581. Intra-observer reliability for the HB-system ranged from 0.92 to 0.97 and interobserver reliability from 0.88 to 0.96. The BCLP-yardstick scores at 6 and 9 years together were predictors for the outcome at 12 years (explained variance 41.4%). Adding the incisor and lateral HB-scores in the regression model increased the explained variance to 67 per cent.
CONCLUSION: The BCLP-yardstick and the HB-system are reliable scoring systems for evaluation of dental arch relationships of CBCLP patients. The HB-system categorizes treatment outcome into similar categories as the BCLP-yardstick. In case a more sensitive measure of treatment outcome is needed, selectively both scoring systems should be used.

83 FINITE ELEMENT ANALYSIS OF MINI-IMPLANT AND PERIPHERAL BONE DURING UPPER CANINE RETRACTION

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AIM: To investigate the stress distribution in mini-implants inserted in the maxilla and supporting bone using finite element analysis (FEA) during maxillary canine retraction.
MATERIALS AND METHOD: The computerized tomography image of a patient was utilized to obtain a three-dimensional model of the maxilla for FEA. In the model, three different mini-implants: Neo-anchor plus (1.6 × 8 mm), Dewimed (1.6 × 8 mm) and Spider (2 × 8 mm) screws and Ormco brackets were employed. Mini-implants were positioned between the roots of the second premolar and first molar and 6 mm gingival to the apical bone crest. The force applied for maxillary canine retraction was taken as 200 g. Von Misses stress distributions in the mini-implants, the surrounding bone, and the canine were evaluated to determine the effect of the screws.
RESULTS: FEA showed that maximum von Misses stress values obtained in the cortical bone were 2.9, 3.4 and 4.7 MPa for Neo-anchor plus, Dewimed and Spider screws, respectively. The corresponding stress values within the mini-implants were 7.7, 12.0 and 5.3 MPa, respectively.
CONCLUSION: Lower stress values occur in the cortical bone when smaller diameter screws are used. However, the stress values decrease further if a screw that has smaller pitch length in the region which is in contact with the cortical bone is inserted.

84 NOCTURNAL ENURESIS AND RAPID MAXILLARY EXPANSION

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AIM: Nocturnal enuresis (NE) is not uncommon in children. Rapid maxillary expansion (RME) has the effect of widening the maxillary suture as well as the nasal width. There have been a few reports of RME having anti-enuretic effects. The aim of this study was to prospectively evaluate RME treatment in a group of severely therapy-resistant enuretic children with long-standing resistance to medical therapy, considering prognostic factors and effects on sleep and respiration.
SUBJECTS AND METHOD: Eleven children with NE, aged 9-15 years old (mean age = 12), who wet their bed almost every night and had never been dry. Sleep registrations, rhinomanometric measurements and bladder diaries were completed before and after RME, with an extra bladder diary completed with the orthodontic appliance *in situ* but before expansion of the maxilla to evaluate the possible placebo effect of RME for a period of four weeks. After this period the maxilla was expanded for 10-14 days. Mean RME was 6.0 mm (range = 5-7 mm).
RESULTS: All but three of patients became dry or almost dry. The number of wet nights per week pre-study, with the appliance *in situ* and after maxillary expansion was 4.6 ± 1.43, 3.9 ± 1.64, and 1.4 ± 1.69, respectively. The anti-enuretic effect was highly statistically significant [Within-subjects ANOVA $F(2, 20) = 39.7$; $P < 0.001$]. No prognostically significant factors were found among anamnestic data or bladder parameters, but the non-responders noted that the amounts of urine lost in bed during wet nights decreased during treatment.
CONCLUSION: Orthodontic RME is a new option for treating children with NE and may be a potentially curative treatment of therapy-resistant nocturnal enuresis.

85 WHITE SPOT LESIONS AFTER ORTHODONTIC TREATMENT – THREE MONTHS USE OF CASEIN-PHOSPHOPEPTIDE AMORPHOUS-CALCIUM-PHOSPHATE FLUORIDE PASTE

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AIM: Casein-phosphopeptide amorphous-calcium-phosphate fluoride paste (CPP-ACP-F) may promote remineralization of white-spot lesions (WSL) by supplying bioavailable calcium and promoting a healthier plaque. The aim of this study was to evaluate the effect of CPP-ACP-F paste versus a placebo paste, when WSL were present after fixed appliance treatment. Changes in the size and depth were monitored using quantitative light fluorescence during a three month period.
SUBJECTS AND METHOD: Initial buccal carious lesions were determined in 51 adolescent orthodontic patients at debond. Subjects with WSL were given CPP-ACP-F paste (n = 26) or a placebo paste (n = 25) to use once a day at bedtime. At debond and after three months, carious lesions were examined by QLF. Integrated fluorescence loss (IFL) was determined for every lesion.
RESULTS: A total of 30 female and 21 male adolescent orthodontic patients, with an average age at debond of 15 years 3 months, participated. A total of 945 elements were monitored, of which 59.8 per cent were affected. Two hundred lesions in the CPP-ACP-F-group and 365 in the placebo-group were found. Reduction of total IFL was seen in 65.4 per cent of subjects

in the CPP-ACP-F group and 56 per cent in the placebo group. Overall there was no significant difference in improvement between the groups ($P = 0.391$).
CONCLUSION: It is assumed that lesions developed during treatment tend to improve after appliance removal. The use of CPP-ACP-F paste; however, may improve the lesions by decreasing the lesion size and depth after appliance removal and this is supported by the data, however lesion reduction in size and depth were not statistically significantly different between the groups after three months. A randomized clinical trial with a longer follow-up should be performed.

86 MANDIBULAR FEATURES OF CLASS III PATIENTS WITH IMPLICATIONS ON TEMPOROMANDIBULAR DISORDERS

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AIM: Differences in the heights of the right and left mandible rami have been suggested as important skeletal problems associated with temporomandibular joint pathology. The aim of this research was to quantify the degree of mandibular asymmetry in Class III patients and its implications on the appearance of temporomandibular disorders (TMD).
SUBJECTS AND METHOD: Fifty patients (aged 11–17 years). Each patient underwent a full clinical examination and standard orthodontic records (plaster models, extra- and intraoral photographs, panoramic and lateral cephalometric radiographs) prior to orthodontic treatment. The subjects were divided into a control group of 25 Class I patients (13 females, 12 males) and a study group of 25 Class III patients (15 females, 10 males). The presence of TMD signs and symptoms was evaluated by an anamnestic questionnaire (joint pain in the previous month, joint sound and limitation of mouth opening) and a clinical examination. Mandibular asymmetry measurements (as described by Kjellberg) were performed on the panoramic radiographs.
RESULTS: Fifty six per cent of the control group and 48 per cent of the study group had no TMD symptoms. The asymmetry indices showed different values for the two groups, but no gender-related differences were observed. In some cases, the asymmetry value correlated with the degree of TMD.
CONCLUSION: Alteration of spatial intraarticular relationships due to mandibular asymmetry may contribute to the appearance of TMD, particularly in Class III patients.

87 INFLUENCE OF PACIFIER NECK DIMENSIONS ON FLEXIBILITY AND INTRAORAL FORCE DISTRIBUTION

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AIM: A pacifier may be seen as a child's first oral appliance, yet little research is available on the ideal properties that will facilitate natural dentoalveolar development. The aim of the study was to test the influence of pacifier neck dimensions on its flexibility and ability to allow for desirable intraoral force distribution.
MATERIALS AND METHOD: Thirteen different silicone pacifiers. The precise neck dimensions were obtained using an optical measuring method. Five samples of each pacifier were subsequently placed in a measuring machine which consisted of three sensors, that could be independently adjusted and measure force and distance in two dimensions. Two of the sensors represented the upper and lower dentition and enclosed the pacifier's neck with a defined force of 200 cN. The third sensor was used to apply force to and thereby elevate the head of the pacifier in place of the tongue.
RESULTS: Vertical neck dimensions ranged from 2.28 to 10.15 mm. A mean of 46.55 ± 17.08 cN was required to lift the pacifier's head 2.6 mm. At this position, Pearson coefficient showed a strong and highly significant correlation ($r = 0.882$; $P < 0.01$) between the applied force and the vertical diameter of the pacifier neck. For linear regression, the coefficient of determination, r2, was calculated at 0.778. Similar results were obtained after further elevation to 5 mm $r = 0.845$ ($P < 0.01$); $r2 = 0.714$.
CONCLUSION: There is a strong influence of the neck dimensions of a pacifier on overall flexibility. A more flexible pacifier should provide less resistance to the natural position of the tongue and also less undesirable force on the alveolar processes and dentition during their development. While a thin neck should therefore be recommended, other parameters such as acceptance and durability also have to be considered in an ideal pacifier design.

88 MAXILLARY PROTRACTION WITH OR WITHOUT PALATAL EXPANSION: CEPHALOMETRIC SAGITTAL EFFECTS

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AIMS: Growing patients with a Class III skeletal pattern often exhibit a hypoplastic maxilla with a maxillary transverse deficiency. Maxillary protraction has become an established paradigm in the early management of skeletal Class III malocclusions, and rapid palatal expansion (RPE) is often used to increase the transverse width of the upper arch. The aims of this study were to analyze the sagittal effects of treatment with a facemask, with or without palatal expansion, and to compare the results with an untreated control group.
MATERIALS AND METHOD: Lateral cephalograms of 47 patients with a Class III malocclusion were examined before and after treatment and, in 33 cases, approximately two years post-treatment. The sample was divided into three groups 1) 15 subjects RPE and facemask; 2) 18 subjects facemask only; 3) 14 subjects, control with untreated Class III malocclusions. Differences between the groups were determined with analysis of variance (ANOVA).
RESULTS: Sagittal skeletal parameters were significantly affected by facemask therapy. No significant differences were found between the expansion and non-expansion groups for any measured variable. Sagittal treatment effects were characterized by skeletal maxillary advancement and a restraining effect on mandibular growth rate. Cephalometric variables showed improvements in ANB (group 1, +3.06° ***, group 2, +3.36° ***) and Wits appraisal (group 1, +2.9 mm ***, group 2, +3.9 mm ***). Comparisons of treated and control subjects showed significant treatment effects beyond normal Class III growth. Long-term, the treated patients tended to resume a Class III growth pattern (Harvold Δ group 1, +2.42 mm *, group 2, +3.81 ns, group 3, +3.71 **), though the correction of the malocclusion was often maintained.
CONCLUSION: Facemask protraction produces similar changes, characterized by a maxillary forward displacement, whether associated or not with RPE.

89 VERTICAL SKELETAL CHANGES WITH FACE MASK THERAPY, WITH OR WITHOUT PALATAL EXPANSION

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AIMS: A Class III malocclusion is important in orthodontic practice, representing a difficult challenge due to its functional, aesthetic and psychological repercussions. Recent investigations have focussed on three-dimensional changes due to facemask therapy, with accurate analysis of sagittal, transverse and vertical dentofacial parameters. The purposes of this research were to evaluate the vertical skeletal effects of treatment with the facemask, with or without rapid palatal expansion (RPE), and to compare these results with an untreated control group.
SUBJECTS AND METHOD: Forty-seven patients with a Class III malocclusion, divided into three groups 1) 15 subjects RPE and facemask; 2) 18 subjects facemask only; 3) 14 subjects, control, with untreated Class III malocclusion. Cephalometric radiographs were taken before and after treatment and, in 33 cases, about two years post-treatment. Differences between the groups were determined with the analysis of variance test.
RESULTS: There was a significant increase in face height but only in group 1 (Harvold Hf + 4.26 mm *). All other vertical parameters increased, but their differences were not significant. At the long-term observation, gonial and Schwarz angles decreased in group 1 (ArGoMe –1.53° *, Schwarz –3.7° **) while face height increased in group 3 (Harvold Hf +4.46mm ***).
CONCLUSION: Cephalometric analysis showed an increase in intermaxillary vertical relationship in both treated groups, but statistically significant only in group 1. Further analysis of 33 patients, 21 months after the end of treatment, showed a normalization of the cephalometric vertical variables during the post-treatment period. This could be explained by the reduction in clockwise rotation, due to the tendency of both maxillary and mandibular planes to return to their previous inclination.

90 HUMAN PRIMARY TEETH REVEAL THE INFLUENCE OF EPITHELIAL CELLS AND INNERVATION IN RESORPTION

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AIM: Dentitions with ectodermal characteristics are predisposed to root resorption (Kjær, 1995). Studies indicate that the ectodermal derived epithelial cells of Malassez protect against root resorption (Brice *et al*., 1991; Lambrichts *et al*., 1993; Kat *et al*., 2003; Kjær and Nolting, 2009). A connection between resorption in primary teeth and permanent teeth indicates an inborn aetiology (Bille *et al*., 2008). The aim of this study was to describe the epithelial cells of Malassez and innervation in three different root surface areas without resorption, areas with resorption, and areas with repair after resorption.
MATERIALS AND METHOD: Paraffin sections of 13 primary molars and six primary canines from four boys and six girls aged 8–15 years. Sections were stained using REAL TMEnvision™ Detection System (K5007, Dako). Wide spectrum

screening (Z0622, Dako) diluted 1:5000 in antibody diluent (S2022, Dako) was use for immunohistochemical detection of epithelial cells. Neuronal nuclei (MAB377, Chemicon/Millipore) diluted 1:50 (S2022, Dako) was used for detection of nerves.
RESULTS: The epithelial cells of Malassez were scattered in small islands along root surfaces without resorption and along root surfaces with repair after resorption, but epithelial cells were not present in areas with resorption. Innervation was seen along all three root surface areas and also within the epithelial cells of Malassez.
CONCLUSION: Human primary teeth reveal that the epithelial cells of Malassez and innervation may play a role in root resorption.

91 THE CRANIAL BASE AND CRANIOFACIAL COMPLEX IN CLASS III MALOCCLUSION: A CEPHALOMETRIC STUDY***

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AIMS: To evaluate the cephalometric characteristics of the cranial base, the middle cranial fossa and the nasomaxillary complex, to identify the proportions of the soft tissue profile, and to establish differences in the parameters of the craniofacial complex in patients with Class III malocclusions.
MATERIALS AND METHOD: Lateral pre-treatment cephalograms of 100 patients (40 females, 60 males) aged between 6 and 30 years diagnosed with a Class III malocclusion. The patients presented mandibular prognathism or maxillary retrusion, or a retrusive maxilla with a protrusive mandible and an open bite facial type. Jarabak, Ricketts, Tweed and Downs methods were used. The data were statistically analysed.
RESULTS: Significant differences between males and females were found for anterior cranial base angle. Statistically, a growth deficiency at the mid cranial fossa was evident.
CONCLUSION: A posterior position of the maxilla in Class III patients is not only caused by a short maxilla, but can significantly be influenced by a growth deficiency in the mid cranial fossa. The mandibular prognathism was related to a small saddle angle. Different cranial growth base patterns influence the characteristics of the craniofacial complex.

92 ADULT CLASS II DIVISION 1 HERBST TREATMENT – IS IT STABLE?

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AIM: To assess the skeletal and dental changes occurring during the retention period after adult Class II division 1 Herbst treatment.
SUBJECTS AND METHOD: Fifteen Class II division 1 subjects (overjet >6 mm) with a minimum age of 18 years who completed growth according to pre-treatment hand wrist radiographs. All subjects were treated with a Herbst appliance (mean 9 months), followed by multibracket (MB) treatment (mean 14 months). The retention period was at least 24 months (mean 36 months). Lateral cephalograms (T1 before treatment, T2 after Herbst-MB treatment, T3 after retention) were analysed using the SO-analysis described by Pancherz, and standard cephalometrics.
RESULTS: The amount of relapse during T3-T2 was small, amounting to 1.0 mm ($P < 0.001$) for overjet and 0.3 mm ($P > 0.05$) for molar relationship. The final relative contribution of skeletal changes to overjet and molar relation was lower by 6 and 12 per cent, respectively, compared with the active treatment period (T2-T1). During the entire observation period (T3-T1) the overjet was, on average, reduced by 5.2 mm ($P < 0.001$, minimum –2.5 mm, maximum: –8.0 mm; 12 per cent skeletal changes, 88 per cent dental changes) and the molar relation improved by an average of 3.2 mm ($P < 0.001$, minimum: ±0 mm, maximum: –7.0 mm; 19 per cent skeletal changes, 81 per cent dental changes). During T3-T2 the jaw base relationship deteriorated (ANB +0.3°, $P > 0.05$) and the hard as well as soft tissue profile convexities increased (NAPg –0.3°, $P > 0.05$; N'SnPg' +0.6°, $P > 0.05$) slightly. Nevertheless, during the entire observation period (T3-T1) the jaw base relationship improved (ANB –0.6°, $P < 0.05$, minimum: +0.5°, maximum: –2.8°), and the hard and soft tissue profile convexities decreased (NAPg +1.2°, $P < 0.01$, minimum: –1.3°, Max: +5.3°; N'SnPg' +2.1°, $P < 0.01$, minimum: –0.5°, maximum: +5.0°).
CONCLUSION: Although Class II correction in adult Herbst-MB treatment is achieved by mainly dental changes, the treatment results showed good overall stability.

93 *EN MASSE* RETRACTION OF ANTERIOR TEETH WITH THE BIDIMENSIONAL TECHNIQUE

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AIM: The bidimensional technique emphasizes the three-dimensional (3D) control of maxillary incisors and space closure in extraction treatment by sliding mechanics, but needs double steps of the retraction phases (first the canines then the incisors). This presentation demonstrates the 3D control during *en masse* retraction (one single step) with sliding mechanics using the bidimensional technique in extraction treatment.
SUBJECTS AND METHOD: Sixteen adolescent patients (mean age 13.9 ± 1.42 years) with a Class II division 1 malocclusion, normal skeletal pattern, increased overjet (7 mm) and no crowding in the lower arch treated with two upper first premolar extraction. Orthodontic treatment was carried out using traditional fixed orthodontic appliance with bidimensional prescription. The brackets consisted of two different slot sizes (0.018 × 0.025 inch on the anterior teeth and 0.022 × 0.028 inch on the lateral-posterior teeth). During *en masse* retraction a 0.018 × 0.022 inch stainless steel wire was used, with crimpable hooks distal to the canines, molar toe-in and accentuated curve of Spee, in order to manage torque control of the incisors. In the lateral segments the same archwire was undersized allowing easy sliding mechanics during space closure with a NiTi coil spring (300 g) extended from the first molar hooks to the archwire hooks. Posterior anchorage was controlled by means of a transpalatal bar. Panoramic and lateral radiographs were obtained for all patients at the beginning and end of treatment.
RESULTS: A Class I canine and Class II molar relationship was achieved in all patients. All patients showed bodily movement of the upper incisor with a good torque control evidenced on the cephalometric superimposition following Björk's method, and a mean variation of 1-ANS/PNS of 12 degrees.
CONCLUSION: The modified two-dimensional technique with *en masse* retraction on sliding mechanics using a 0.018 × 0.022 inch stainless steel wire and traditional brackets could be considered an effective and less time-consuming option in extraction treatment.

94 ENZYMATIC ACTIVITY IN GINGIVAL CREVICULAR FLUID WITH SELF-LIGATING BRACKETS

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AIMS: Bone remodelling is a biological process involving an acute inflammatory response. Different gingival crevicular fluid (GCF) constituents have been shown to be diagnostic markers of active tissue destruction in periodontal disease. Lactate dehydrogenase (LDH) is an enzyme usually limited to the cytoplasm of cells and it is released extracellularly only after cell death. Its activity in GCF is significantly correlated with gingival inflammation and tissue destruction and these phenomena also take place in the periodontal ligament during orthodontics. The aim of this study was to investigate the activity of LDH in GFC during orthodontic tooth movement using self-ligating brackets. The usefulness of this enzyme as a potential biomarker of tissue response to orthodontic treatment was also examined.
SUBJECTS AND METHOD: Forty patients selected according to the following criteria: similar age, equal relationship between genders, FMA ~27 degrees, SN^GoGn ~37 degrees and mandibular anterior crowding 4-8 mm with no need for extractions. They were divided into two groups, according to the type of self-ligating bracket used. Each patient received professional oral hygiene and instructions for correct home care. GCF was collected at one site for each tooth, at baseline, one hour after bonding and on days 7, 21 and 42. The test teeth were 4 1, 4.3 and 4.5 and the control teeth 1.1, 1.3 and 1.5. LDH activity was estimated using a LDH cytotoxicity assay kit. Data were analyzed using dedicated software.
RESULTS: Statistical analysis showed no significant differences in LDH activity among the test and control teeth, but differences were present when orthodontic forces were applied.
CONCLUSION: LDH activity can be successfully estimated in the GFC using dedicated assay kits. LDH can be used as a potential marker for tissue metabolism for orthodontic mechanics, even if further investigations on its activity may be necessary.

95 ELECTRON PROBE MICROANALYSIS OF TEN REPRESENTATIVE NICKEL TITANIUM ARCHWIRES

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AIM: To determine the composition of 10 representative nickel titanium (NiTi) archwires by electron probe microanalysis.
MATERIALS AND METHOD: Ten upper 0.017 × 0.025 inch NiTi archwires: Nitinol®, Nitinol SE®, Nitinol HA® (3M-Unitek), Neosentalloy® 100 and 200 g (GAC), Copper NiTi® 27°C, 35°C and 40°C (Ormco), Rematitan Lite®, Rematitan Lite White® (coated version) (Dentaurum). The archwires were cut into segments and embedded in cross-section in an epoxy resin. The samples were polished initially with 120 to 4000 grid SiC paper under water, and finally with a 1 µm diamond suspension and lubricant. Wavelength dispersive spectrometry measurements were then taken at 10 different

locations of the same cross-section with a SX100 Cameca® microprobe and average values were calculated.
RESULTS: Nitinol®, Nitinol SE®, Nitinol HA®, Neosentalloy 100 and 200g® and Rematitan Lite were exclusively made of Ni (~54 to 55 ± 1.0% weight composition) and Ti (~45 to 46 ± 0.6% weight composition). These alloys showed only minute differences in composition. Copper Niti® showed a different content, in as much that Ni weight composition dropped to 48.4 per cent whereas Cu represented 5.7 per cent and Cr 0.2 per cent of their weight. NiTi alloys were nearly equiatomic whereas Cu and Cr represented respectively 4.8 per cent and 0.2 per cent of the atomic composition of Copper NiTi® at the expense of the Ni fraction.
CONCLUSION: Two categories of wires can be distinguished by their composition, the standard NiTi alloys and the Copper NiTi®. Since no difference in composition can be detected within these two categories, the distinct mechanical properties of these wires within their own group may be due to their specific thermo-mechanical treatment during the manufacturing process.

96 ASSOCIATION BETWEEN ORTHODONTIC TREATMENT NEED AND MAXILLARY INCISOR TRAUMA

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AIM: To investigate the association between gender, malocclusion complexity, orthodontic treatment need and the prevalence of maxillary incisor trauma (MIT).
SUBJECTS AND METHOD: Five hundred and two subjects (253 females, 249 males, aged 11-14 years), including one female and five males who were wearing an orthodontic appliance. The Index of Complexity, Outcome and Need (ICON) scores were calculated and the subjects were categorized into five groups according to ICON complexity (easy, mild, moderate, difficult and very difficult). Subsequently they divided into two groups according to orthodontic treatment need (subjects with an ICON >43 and those with an ICON <44). Fisher's exact test was performed to determine any gender differences in trauma experience. Logistic regression was undertaken to test for any differences in risk of trauma among subjects in different ICON complexity groups, and also to estimate the predictive value of gender, orthodontic treatment need and ICON scores for MIT
RESULTS: Overall 9 percent experienced incisor trauma. Of those, 93 and 7 per cent had maxillary and mandibular incisor injuries, respectively. Males had greater odds of MIT compared with females (OR = 2.16). Subjects with an orthodontic treatment need (ICON > 43) had greater odds of MIT compared with those with no orthodontic treatment need (ICON < 44) (OR = 2.37). Only subjects presenting with a difficult complexity grade (64 < ICON <77) showed significantly higher odds of experiencing MIT (OR = 3.16) when compared with the easy complexity group (ICON <29)
CONCLUSION: Female gender decreased the risk of MIT by 46.2 per cent. Every unit increase in ICON score increased the risk of MIT by 1.2 per cent. The prevalence of incisor trauma in this study was rather low in comparison with other research. The current finding may be important in terms of targeting and screening certain vulnerable groups during the course of orthodontic treatment.

97 COMPARISON BETWEEN THE INDEX OF COMPLEXITY OUTCOME AND NEED AND THE INDEX OF ORTHODONTIC TREATMENT NEED

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AIM: A cross-sectional study to investigate the agreement between assessments of orthodontic treatment need using the Index of Complexity, Outcome and Need (ICON) and the Index of Orthodontic Treatment Need (IOTN).
SUBJECTS AND METHOD: Five hundred and two subjects (253 female, 249 males, aged 11-14 years), including those who were wearing an orthodontic appliance (1 female and 5 males). ICON and IOTN [Dental Health Component (DHC) and Aesthetic Component (AC)] scores were recorded in those not undergoing treatment. The percentage of subjects needing treatment (ICON >43) and different complexity compartments of the ICON were compared in different genders. Observed percentage agreement and kappa statistics were used to analyse the agreement between different components of the IOTN (AC and DHC) and also the ICON and DC and AC of the IOTN dichotomized into yes or no categories of orthodontic treatment need.
RESULTS: No gender differences were found for treatment need (ICON >43, $P > 0.05$) or treatment complexity ($P > 0.05$). Kappa statistics for diagnostic agreement between the DHC and AC of the IOTN was 0.55 (95% CI 0.48-0.63) and for diagnostic agreement between the ICON and AC and DHC of the IOTN 0.40 (95% CI 0.33-0.46) and 0.78 (95% CI 0.73-0.83), respectively. The observed agreement between the DHC and AC of the IOTN was 81.8 per cent. The observed agreement

between the ICON and AC and DHC of the IOTN were 71.3 and 89.5 per cent, respectively.
CONCLUSION: In terms of orthodontic treatment need, there was moderate agreement between ICON and AC (IOTN) and between DHC and AC, respectively. There was good agreement between the ICON and the DHC of the IOTN. ICON is a good substitute for the DHC of ION.

98 DENTOSKELETAL AND SOFT TISSUE PROFILE CHANGES IN CLASS II HIGH MANDIBULAR ANGLE PREADOLESCENTS

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AIM: To show the skeletal, dental, and soft tissue changes in pre-adolescent patients with a Class II malocclusion and high–angle growth pattern treated with a headgear-activator.
SUBJECTS AND METHOD: Two groups of 25 subjects aged between 8 and 12 years, sufficient with respect to age, gender, observation time, and dentofacial characteristics. The first group were treated with an activator-headgear for an average period of 22 months until a Class I molar and canine relationship and reduction of overjet was established. The second group (control) did not receive any form of orthodontic treatment. Pre- and post-treatment cephalograms were analyzed and paired *t*-tests were used for comparison of the differences between the control and treatment group.
RESULTS: Compared with the control group, the treatment group showed a decrease of 3.41 mm in forward growth of the maxilla, an increase of 4.06 mm in mandibular protrusion, a decrease of 1.63 degrees in ANB angle, and a decrease in overjet and overbite. There were no significant differences in craniofacial growth between the two groups. Posterior face height showed a similar increase in both groups. The activator appliance caused lingual inclination of the upper incisors, whereas inclination of the lower incisors remained unchanged. The soft tissue profile in the treatment group was significantly improved: a decrease of 3.33 degrees in soft tissue convexity, a decrease of 4.8 mm in protrusion of the upper lip, an increase of 5.4 mm in lower lip protrusion and an increase of 6,29 mm in chin prominence.
CONCLUSION: The activator headgear appliance had a positive influence on the anteroposterior aspect of the facial profile. With regard to vertical facial dimensions, whilst the appliance did not significantly change the existing growth pattern, it did not cause additional mandibular inclination or undesirable posterior mandibular rotation.

99 A NOVEL METHOD OF ANALYSIS OF CLASS III PATIENTS USING THREE-DIMENSIONAL SOFT TISSUE ANALYSIS

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AIM: To determine differences between Class III patients and a normative dataset using three-dimensional analysis.
SUBJECTS AND METHOD: Fourteen Class III males (MCIII) and 15 Class III females (FCIII). Forty- three males and 44 females with a Class I occlusion allowed construction of an average male (AvM) and female (AvF) face. Coordinates of three points on the facial templates of groups MCIII, FCIII and the templates AvM and AvF were compared. MCIII-AvM and FCIII-AvF superimpositions were evaluated for differences.
RESULTS: Vertical distances [sellion (S)-soft tissue pogonion ([P)] were statistically significantly higher for the AvM (9.1%) and MCIII (10.1%) than for AvF and FCIII ($P < 0.05$). The distance of point P in the horizontal (x) axis was positive in 80 per cent for the FCIII group and in 85.7 per cent for the MCIII group. The Class III subjects differed from the average face in the lower two-thirds but in 50 (MCIII) and 60 (FCIII) per cent they also differed in the upper facial third.
CONCLUSION: (1) The average and Class III Slovenian male morphological face height is statistically significantly higher than the females; (2) The Slovenian Class III males and females tend towards having a left-sided chin deviation; (3) Differences between Class III patients and a normative dataset were determined.

100 INCOMPETENT LIP SEAL AND TONGUE POSTURE – IS THERE A CORRELATION?

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AIM: An incorrect tongue posture on the floor of the mouth is an important aetiological factor for malocclusion development. It is difficult to clinically diagnose tongue posture in incompetent lip seal patients in the early dental developmental period.

The aim of this study was to assess tongue posture in children with an incompetent lip seal (ILS) and in those with a competent lip seal (CLS) in the normal mixed dentition using three-dimensional (3D) ultrasonography.
SUBJECTS AND METHOD: Fourteen children with an ILS (mean age 7.91 years; SD = ±1.53) and 15 children with a CLS (control group; mean age 7.48 years; SD = ±0.38). An ultrasound system, Voluson 730 Expert, and a 3D convex transducer, RAB 2-5 MHz, were used in the study. The reference 3D ultrasound reconstructions were used for assessment of the tongue posture twice in each child. Fisher's exact test was used for statistical analysis.
RESULTS: Tongue posture was found to be statistically significantly different between ILS and CLS. Sixty-four per cent of children with ILS and 33 per cent of children with CLS demonstrated posture on the mouth floor. The difference was statistically significant ($P < 0.005$).
CONCLUSION: In the majority of ILS patients the tongue is on the mouth floor. Therefore, assessment of tongue posture in ILS patients is an important aetiological factor in functional diagnosis of orthodontic patients.

101 CEPHALOMETRICS IN THE MAGNETIC FIELD***

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AIM: New cephalometry without X-rays by means of a 92 g head cap is an accurate alternative to classic cephalostats. The new cephalometry is based on three-dimensional (3D) registration in a magnetic field. The carbon head cap, in combination with a 3D magnetic scanner, represents a digital presentation and cephalometric analysis technology for orthodontic diagnostics. One problem of conventional cephalometry is the exact and reproducible positioning in the cephalostat and its verifiability. The aim of this study was to determine the measurement accuracy of the noXrayCeph® device for repeated measurements
SUBJECTS AND METHOD: Ten patients were measured with the noXrayCeph® device and the reproducibility of the projection to the midsagittal plane was examined by 10 repeated measurements of the same patient on different days. The differences in accuracy of the lateral cephalogram and the noXrayCeph® were analysed with a Mann-Whitney *U* test.
RESULTS: The accuracy of the production of a cephalometric drawing with the new magnetic device does not depend on standard positioning of the patient. The device produces reproducible drawings with different positioning of the patient's head. The error of the mean quartal deviation was < 0.05.
CONCLUSION: Due to the construction of a new midsagittal plane with each measurement, repeated evaluations are possible.

102 FINITE ELEMENT ANALYSIS OF STRESS AND STRAIN DURING USE OF RAPID PALATAL EXPANDERS

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AIM: To analyze stress-strain of the human skull using the finite element (FE) method, simulating the loads at insertion of rapid palatal expanders with 2 or 4 arms.
MATERIALS AND METHOD: A digital skull model, produced with Computer Aided Design, Solid Works 2005 programs and force application with FE analysis. The forces applied to the cylindrical forms were equivalent to the teeth over which the palatal expander acts. The software package used was Cosmos Works 2005. The study was conducted first for half a skull and then for a complete (symmetric) skull. Thus two possibilities were studied; a 4 and a 2 point expander. The forces used with the 4 and 2 point expanders were F = 22.5 N and F = 45 N, respectively.
RESULTS: Maximum tension was registered at the base of the medio-palatal suture, maximum of 9.364 MPa a smaller value compared with the 133 MPa, which represents the maximum admitted tension. The maximum movement was realized at the level of the free extremity of the mesially orientated cylindrical form that corresponds to the first premolar. The force registered was 9690 for 0.019 mm displacement of the 4 arm and 0.020 mm for the 2 arm expander.
CONCLUSION: Regarding the four distinct FEAs, two conclusions can be drawn. The first recommends the use of a 4 arm rapid palatal expander due to the fact that it produces lower levels of stress and deformation than one with 2 arms, and thus a higher degree of comfort for the patient. The second is strictly tied to the FEA approach, the 3D geometrical model for the semi human skull being more appropriate to reality regarding the boundary conditions.

103 IMPACTED MAXILLARY CANINES: IMPLICATIONS FOR ORTHODONTIC TREATMENT ON ROOT LENGTH

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AIM: The incidence of impacted maxillary canines varies from 1 to 3 per cent. Root resorption of maxillary incisors is a common sequela of maxillary canine impaction. Treatment of impacted canines is often challenging and causes an additional burden on neighbouring teeth. The aim of this study was to evaluate the effect of maxillary canine impaction on root resorption caused by orthodontic treatment. The effect of several characteristics of the impacted canine on root shortening of the adjacent incisors was also studied.
MATERIALS AND METHOD: Orthodontic records of 64 treated patient. Thirty-two patients had a unilateral impacted maxillary canine, while the rest did not have any impaction. All were treated with fixed appliances. Crown and root lengths of the maxillary incisors were measured on pre- and post-treatment periapical radiographs corrected for image distortion. The percentage of root shortening and root length loss in millimetres was then calculated. The inclination of the eruption path of the impacted canine, relative to the midline, the long axis of the lateral incisor, the occlusal plane and the nasal line, was recorded on dental pantomograms (DPTs) and lateral cephalometric films taken before any treatment. Horizontal and vertical impacted canine position was also evaluated on the DPTs. Impacted canine root development and width of the dental follicle were also recorded.
RESULTS: No significant difference was found in root resorption of the maxillary incisors during orthodontic treatment between patients with impacted canines and those without impaction.
CONCLUSION: It seems that the treatment of impacted canines does not cause any additional burden to the roots of the neighbouring incisors, than normal orthodontic treatment of dentitions without impacted canines.

104 CEPHALOMETRIC EVALUATION OF WITS ANALYSIS

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AIM: The weakness of the tracing of the Wits appraisal on lateral cephalometric headfilms is that the slightest deviation caused by erroneous positioning of the head can result in significant changes in the identification of both points A and B. The alternative to classic tracing represents the direct registration of the points in a magnetic field with the noXrayCeph® device. The present study aimed to assess the diagnostic significance of the Wits analysis by means of a mobile measuring device in order to prove the suitability of this method, especially for appraisal of anteroposterior jaw disharmony. In addition, whether the measurements taken with the mobile measuring device by two different observers correlated with each other was investigated.
SUBJECTS AND METHOD: Thirty-six patients were selected and the double series of tracings were recorded by two observers. Dahlberg's coefficient was used to evaluate the reproducibility of the measurements.
RESULTS: There was no statistically significant difference in reproducibility of the Wits assessment based on a double series of tracings by either observer. Interobserver repeatability was also very good, the values varied by approximately 90 per cent.
CONCLUSION: The major source of error on the lateral cephalometric headfilm such as blurring, fuzziness and shifting as a result of movement during exposure was eliminated with the new mobile head cap of the noXrayCeph® device. The tracing was presented in a real size 1 to 1 scale in accordance with actual anatomy. Therefore, the main advantage of the method is the possibility to directly measure anatomical three-dimensional structures. The method reflects more accurately the extent of anteroposterior jaw dysplasia than the cephalometric lateral image.

105 THREE-DIMENSIONAL COMPARISON OF AVERAGE FACES OF CHILDREN WITH ORAL CLEFTS

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AIM: The introduction of three-dimensional (3D) non-invasive imaging systems and the implementation of advanced statistical analyses have widened the perspectives of their application to assist in clinical diagnosis and evaluation of treatment outcome through visualization. The aim of this research was to discriminate between 3D average faces of children with oral clefts and matched controls.

MATERIALS AND METHOD: A prospective cross-sectional 3D stereophotogrammetric study of the facial morphology of 103 children with non-syndromic oral clefts; 40 unilateral cleft lip and palate (CLP); 23 unilateral cleft lip and alveolus, 19 bilateral CLP; 21 cleft palate, and 80 gender and age matched controls.
RESULTS: Significant morphological differences between the mean facial shapes of all groups were found ($P < 0.005$). Shape variation between the five group means was visualized by superimposing each average face with the control group average face. The differences were mainly in the nasolabial region but not confined to it, and more pronounced in groups where the lip was affected. This suggests that cleft lip and soft tissue lip repair has a greater effect on facial shape than cleft palate repair alone. These results emphasize the fact that a cleft palate only has a different aetiology than a CLP.
CONCLUSION: 3D shape analysis allows both subjective and objective morphometric discrimination between subjects with craniofacial anomalies and control groups, and underlines the potential value of statistical shape analysis in assessing the outcomes of CLP surgery and orthodontic treatment.

106 META-ANALYSIS OF SKELETAL MANDIBULAR CHANGES DURING FRÄNKEL APPLIANCE TREATMENT

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AIM: To perform a meta-analysis to verify mandibular changes produced by the Fränkel-2 (FR-2) appliance during treatment of growing patients with Class II malocclusions when compared with untreated growing Class II subjects.
MATERIALS AND METHOD: The literature published from January 1966 to January 2009 was reviewed with search engines, PubMed, the Cochrane Central Register of Controlled Trials (CENTRAL), Scirus, Lilacs, Embase and Scopus. A quality analysis was performed. The effects on primary endpoints were calculated with random-effect models. Heterogeneity was assessed using Q statistic and investigated using study-level meta regression.
RESULTS: A total of nine articles were identified. The quality of the studies ranged from low to medium. Meta-analysis showed that THE FR-2 was associated with enhanced mandibular body length [0.4 mm/year 95% confidence interval (CI) 0.182 to 0.618], total mandibular length (1.069 mm/year, 95% CI 0.683 to 1.455) and mandibular ramus height (0.654 mm/year, 95% CI 0.244 to 1.064). A consistent heterogeneity among studies was found for all the considered linear measurements.
CONCLUSION: The FR-2 appliance had a statistically significant effect on mandibular growth. Nevertheless, the heterogeneity of the FR-2 effects, the quality of studies, the differences in age, skeletal age, treatment duration and the inconsistent initial diagnosis seem to overstate the benefits of THE FR-2 appliance. An evidence-based approach to the orthodontic outcomes of FR-2 appliance is needed to select and compare groups of children with the same cephalometric characteristics with and without treatment.

107 COMPARISON OF ARCHAIC AND CONTEMPORARY ITALIAN SKULLS USING THREE-DIMENSIONAL COMPUTED TOMOGRAPHIC VOLUME RENDERING IMAGES

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AIM: Variations in linear and angular craniometric measurements correlate with the evolution of the nervous system and gnathic development. The purpose of this research was to assess the evolution of the neuro- and splanchnocranium over two millennia in a southern Italy population through a comparative craniometric analysis of archaic Pompeian and contemporary skulls.
MATERIALS AND METHOD: Twenty skulls dating back two millennia, found during excavations of ancient Pompeii were computer tomographically scanned by sequential and contiguous 1 mm slices. On subsequent volume rendering software reconstructions, craniometric landmarks, for linear and angular measurements, were identified. These features were compared with modern skulls on latero-lateral cephalograms.
RESULTS: Significant differences of some linear and angular parameters were found between the ancient and contemporary skulls. Major differences concerned prominence of the frontal bone, skull base angle, length of the anterior and posterior skull base, distances from sella to the frontal bone, from basion to bregma, from sella to lambda, from nasion to lambda and the diameter of the neurocranium from nasion to opisthocranion, transverse dental arch dimension and arch depth. The latter two measurements are important to define the evolution of gnathic development.

CONCLUSION: Comparative assessment of linear and angular craniometric measurements of ancient Pompeian and modern skulls clarified the relationship between the neuro- and splanchnocranium and the gnathic development.

108 CONE BEAM COMPUTED TOMOGRAPHIC BASED TREATMENT OUTCOME ANALYSES OF ACTIVE AND PASSIVE SELF-LIGATING BRACKETS

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AIMS: Self-ligating brackets, combined with the prescribed archwires, are reported to lead to a widening of the alveolar process together with good torque control. The aims of this randomized prospective clinical trial were to assess changes in the torque of central incisors, transverse tooth movements and buccal bone modelling in the maxilla achieved with active or passive self-ligating systems.
SUBJECTS AND METHOD: Patients with Class I, Class II and mild Class III malocclusions, all characterized by crowding, were randomly allocated for treatment with passive (Damon® 3 MX) or active (In-Ovation) self-ligating brackets. Impressions and cone beam computed tomographic (CBCT) scans were taken before (T0) and after (T1) the completion of treatment, and digital study casts were generated. The overall movements of the central incisors, canines, first and second premolars, and first molars were evaluated. Changes in basal alveolar bone and dental arch shape were assessed using three-dimensional colour-coded maps.
RESULTS: Twenty-two patients in the Damon group and 20 in the In-Ovation group completed treatment. For both groups: 1) expansion of the dental arch took place in the canine and even more in the premolars regions; 2) transverse expansion mainly occurred as a result of tipping; 3) neither bodily movement of the teeth nor augmentation of basal bone could be detected. There was no statistically significant difference in torque-control of the two self-ligating systems, though a tendency for more torque-control was observed with the active brackets.
CONCLUSION: In the majority of the cases, the anticipated true-expansion and buccal bone modelling when using self-ligating brackets could not be confirmed using CBCT-based analyses. Active and passive self-ligating brackets showed no difference in torque control. Due to the large inter-individual variation, a patient-specific analysis seems to be mandatory to identify individual factors influencing the final treatment outcome.

109 EFFECTS OF FLUORIDE-CONTAINING CASEIN PHOSPHOPEPTIDE-AMORPHOUS CALCIUM PHOSPHATE ON SHEAR BOND STRENGTH OF ORTHODONTIC BRACKETS

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AIM: To investigate the effect of enamel pre-treatment with a new 900 ppm fluoride-containing casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) complex on the shear bond strength (SBS) of brackets bonded with etch-and-rinse or self-etching adhesive systems.
MATERIALS AND METHOD: Extracted human premolars were randomly divided into six groups (n = 11/group) with respect to the enamel pre-treatments and adhesive systems employed. Group I, No pre-treatment was performed on the enamel and the brackets were bonded with an etch-and-rinse adhesive system (Transbond XT). Group II, the enamel was pre-treated with a fluoride-containing CPP-ACP paste (MI Paste-Plus) and the brackets bonded with Transbond XT. Group III, the enamel was pre-treated with a non-fluoride CPP-ACP paste (MI Paste) and the brackets bonded with Transbond XT. Group IV, no pre-treatment was performed and the brackets were bonded with a self-etching adhesive system (Transbond-Plus). Groups V and VI, the enamel was pre-treated as for groups II and III, respectively, and the brackets bonded with Transbond Plus. Bonded specimens were subjected to thermocycling (×1000) and 6 weeks water degradation before SBS testing. The residual adhesive on the enamel surface was evaluated after debonding with the adhesive remnant index (ARI).
RESULTS: Enamel pre-treatment with either the fluoride or non-fluoride CPP-ACP paste had no significant effect on the SBS of the self-etching adhesive system ($P > 0.05$). Enamel pre-treatment with non-fluoride CPP-ACP significantly reduced the SBS of the etch-and-rinse adhesive ($P < 0.001$), while pre-treatment with the fluoride-containing CPP-ACP paste did not affect debonding values ($P > 0.05$).
CONCLUSION: The fluoride-containing CPP-ACP did not compromise the bond strength of brackets bonded with the tested etch-and-rinse and self-etching systems, but its non-fluoride version significantly decreased the SBS of the etch-and-rinse adhesive system.

110 THERMOCYCLING EFFECTS ON THE BOND STRENGTH OF BRACKETS BONDED WITH DIFFERENT LIGHT SOURCES

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AIM: To compare the effect of thermocycling on the shear bond strength (SBS) of brackets and to evaluate the bond failure sites after debonding.
MATERIALS AND METHOD: Two hundred and forty premolar teeth divided into six equal groups. The brackets (3M/Unitek) were bonded with Transbond XT. Group 1 was cured with a normal halogen curing light for 40 seconds, groups 2, 3 and 4 were cured for 2, 3 and 6 seconds, respectively, with a high-power halogen light (Swiss Master Light) and groups 5 and 6 with a 3rd generation light emitting diode Bluephase (Ivoclar) for 10 and 20 seconds, respectively. After storage for 24 hours in the dark at 37°C in water, half of the samples were thermocycled in water baths at 5°C and 55°C with a dwell time of 30 second and a transfer time between dwells of 4 seconds for 7.500 cycles.
RESULTS: Thermocycling significantly reduced the SBS of group 4 while the decreases in other groups were not significant. Adhesive remnant index scores were significantly different between the groups.
CONCLUSION: A high-power halogen light with 2 seconds curing time is not recommended.

111 DENTAL EFFECTS OF MAXILLARY PROTRACTION WITH A FACEMASK, WITH OR WITHOUT PALATAL EXPANSION

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AIM: To compare the dental effects of maxillary facemask protraction (FM) and rapid palatal expansion (RPE) followed by facemask protraction (RPE+FM), in subjects with a skeletal Class III malocclusion, compared with an untreated control group.
SUBJECTS AND METHOD: Forty-seven subjects divided in to three groups: group 1 (RPE+FM), 15 subjects; group 2 (FM), 18 subjects; group 3 (control), 14 subjects. Cephalometric radiographs were taken before and after treatment and, in 33 cases after a follow-up period (1.9 years). Changes between the three groups were analyzed with analysis of variance.
RESULTS: Cephalometric analysis showed statistically significant changes in the dental variables. The short-term evaluation showed an increase in overjet in both treated groups (group 1 +3.7 mm ***, group 2 +4 mm ***), and a significant increase in PTV-6 distance in group 1 (+4 mm ***). The other dental values examined did not show significant modifications between the three groups, although a tendency towards an increased vestibular inclination of the upper incisors (I/SN, I/Mx) was observed, with a decreased inclination of the lower incisors (i/Md). In the long-term the results obtained were maintained.
CONCLUSION: Maxillary protraction induced a marked improvement in the dental relationships both in the short- and long-term, although treatment with the FM mainly produced orthopaedic effects.

112 THREE-DIMENSIONAL STUDY OF THE DUMBO RAT

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AIM: A variation of the domestic rat, the dumbo rat, has similar traits to human craniofacial disorders such as Treacher Collin syndrome or other pharyngeal arch disorders. The dumbo rat's malpositioned ears and retrognathic aspect strongly suggest a defect in the development of the first and second pharyngeal arch. Possible causes of such abnormal development may be faulty migration of neural crest cells, a genetic mutation (e.g. TCOF1) or external factors such as teratogens (e.g. retinoids). Beside an embryologic and genetic approach focused on possible causes, the anatomical traits of the dumbo rat need to be precisely defined. The aim of this three-dimensional (3D) cephalometric analysis was to validate a new 3D rat analysis and to define more precisely the anatomical malformations of the dumbo rat in comparison with the Wistar rat.
MATERIALS AND METHOD: Amira 4.0 software was first used to analyze the computed tomographic scan data (dicom files) and to create a 3D model of the head of the rat. The second phase, with LHPBuilder software, consisted of anatomical landmarks on the 3D model. Numerous linear and angular measurements were inferred from these landmarks. 3D cephalometric results obtained from a sample of dumbo rats were compared with a control group of Wistar rats.
CONCLUSION: The 3D study of dumbo rat could be a first step in using this rodent as an animal model for better understanding human pharyngeal arch disorders.

113 EFFECT OF MINIMAL OSTEOPERFORATIONS ON BONE REMODELLING AND TOOTH MOVEMENT

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AIM: It has been shown that orthodontic forces induce aseptic inflammation but the relationship between the magnitude of inflammatory response and the rate of bone remodelling and consequently tooth movement is not clear. The objective of this research was to investigate whether an increase in local inflammation affects the rate of bone remodelling and tooth movement.
MATERIALS AND METHOD: Forty-eight rats divided into four groups: a baseline, and three groups fitted with a 50 cN force closing coil nickel titanium spring on the maxillary first molar with implementation of a soft tissue flap, force plus flap plus three perforations of the cortical plate mesial to the first molar, or no force (controls C). After 28 days, the maxillae were analyzed by microcomputed tomography (μCT) and histology. RNA isolated at different time points was used to evaluate the expression of inflammatory markers by real-time reverse transcription polymerase reaction.
RESULTS: Local perforation of cortical bone caused an increased inflammatory reaction as shown by both histology and expression of inflammatory cytokines. This was accompanied by an increase in the rate of tooth movement and bone remodelling as revealed by μCT and fluorescent microscopy. The increase in the rate of bone remodelling was not limited to the first molar region and spread to adjacent alveolar bone.
CONCLUSION: An increase in magnitude of inflammation is accompanied by an increase in the rate of bone remodelling and tooth movement.

114 RADIOGRAPHIC STUDY OF SUPERNUMERARY TEETH CAUSING NON-ERUPTION OF PERMANENT INCISORS

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AIM: To investigate the radiographic characteristics of anterior maxillary supernumerary teeth associated with impacted maxillary permanent central incisors in an Asian population.
SUBJECTS AND METHOD: Sixty-five patients aged between 7 to 16 years (mean = 9.1 years, s.d. = 2.2 years) who presented with impacted permanent central incisors associated with the presence of supernumerary teeth. Radiographs of these patients were evaluated to investigate the features of the supernumerary teeth.
RESULTS: The majority of the cases (n = 63) involved unilaterally impacted permanent central incisors (28 left, 35 right) while only two involved both permanent central incisors. There were more males than females, a ratio of 2:1. The supernumerary teeth in 31 cases (48%) were odontomes, 18 (28%) were conical shaped, while the remaining 16 (24%) were tuberculate shaped. All but two of the supernumerary teeth were unerupted with the majority positioned palatal to the impacted permanent central incisors (60%) while the rest were either occlusal to the impacted incisors (32%) or at the midline (18%).
CONCLUSION: Males in this study were twice as likely to present with unerupted permanent central incisors associated with submerged supernumerary teeth. Odontomes were found to be most commonly associated with unerupted permanent central incisors.

115 EFFECTS OF *SALVIA MILTIORRHIZA* ON OSTEOBLASTIC CELL LINE OF MC3T3-E1

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AIM: Orthodontic tooth movement is mediated by bone remodelling. Sufficient bone is essential for the success and effectiveness of orthodontic treatment. It has previously been found that *salvia miltiorrhiza* extract (SM), a commonly used Chinese herb in cardiac disease to enhance blood perfusion, could increase bone formation *in vivo*. The aim of this study was to investigate the effects of SM on bone cells *in vitro*, to obtain a better understanding on how SM can promote bone remodelling.
MATERIALS AND METHOD: MC3T3-E1, an osteoblastic cell line, was cultured with SM for different time intervals (24, 48 and 72 hours), whereas the control group consisted of cells cultured without any intervention. The mRNA expressions of alkaline phosphatase (ALP), osteocalcin (OCN), osteoprotegerin (OPG) and the receptor activator of nuclear factor kappa β ligand (RANKL) were examined by real-time polymerase chain reaction.
RESULTS: The expression of ALP showed an early increase at 24 and 48 hours by 50 and 13 per cent, respectively ($P < 0.001$). OCN was decreased by 22 per cent at 24 hours ($P < 0.001$) but increased by 50 and 88 per cent at 48 and 72 hours,

respectively ($P < 0.001$). OPG was up-regulated by 10 per cent at 48 hours ($P < 0.01$) and 68 per cent at 72 hours ($P < 0.001$), while RANKL showed an early increase at 24 and 48 hours by 45 ($P < 0.001$) and 36 ($P < 0.01$) per cent, respectively. OPG/RANKL was first down-regulated and then up-regulated.
CONCLUSION: SM enhances bone remodelling by regulating the gene expressions of ALP, OCN, OPG and RANKL. It is a potential medicinal herb that could be utilized in the application that requires stimulation in bone cell activities.

116 ORTHODONTIC-PERIODONTIC INTERRELATIONSHIP: A SYSTEMATIC REVIEW

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Orthodontic treatment aims at providing an acceptable functional and aesthetic occlusion with appropriate tooth movements. These movements are strongly related to interactions of teeth with their supportive periodontal tissues. In recent years, because of the increased number of adult patients seeking orthodontic treatment, orthodontists frequently encounter patients with periodontal problems.
Aesthetic considerations, such as uneven gingival margins or functional problems resulting from inflammatory periodontal diseases should be considered in orthodontic treatment planning. Furthermore, in cases with severe periodontitis, orthodontics may improve the possibilities of saving and restoring a deteriorated dentition. In modern clinical practice, the contribution of the orthodontist, the periodontist and the general dentist is essential for optimized treatment outcomes.
The aim of the present review is to describe the existing evidence in the literature concerning certain types of orthodontic tooth movement in cases of compromised periodontium. The tooth movements considered and reported with relevant cases are: orthodontic extrusion and intrusion, molar uprighting, orthodontic movement in edentulous areas, and labial tilting.

117 THE EFFECT OF DIABETES TYPE 1 ON ORAL HEALTH FACTORS IN CHILDREN IN THE MIXED DENTITION PERIOD

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AIM: Diabetes is a chronic disease that can also affect oral health. The objective of this study was to determine the effect of type 1 diabetes on some oral health factors in children in the mixed dentition period.
SUBJECTS AND METHOD: Seventy-nine children with an average age of 10.8 ± 1.8 years. The study group included 40 randomly referred children (10.7 ± 1.8 years) with diabetes type 1. The control group comprised 39 healthy children (average age 10.8 ± 1.7 years), who were comparable by gender and age with the study group. Children who were already undergoing orthodontic treatment were excluded. The quantity of plaque was assessed by drawing a probe on the surface of the tooth next to the gingivae. Plaque was categorized into levels 0 to 3. Bleeding was provoked by drawing the tip of the probe between the free gingiva and the tooth. The relationship of the dental arches was assessed using Angle's classification.
RESULTS: Children with type 1 diabetes had a higher incidence of plaque ($P = 0.000$). Second and third degree plaque occurred more often in the study group, whereas zero and first degree plaque were more common in the control group ($P = 0.000$). The children with type 1 diabetes had a higher incidence of provoked gingival bleeding ($P = 0.000$). There was no statistically significant difference between the study and control group in the incidence of malocclusion according to Angle classification ($P = 0.510$).
CONCLUSION: Diabetes type 1 affects the incidence of plaque and bleeding. This has to be taken into consideration when planning orthodontic treatment.

118 ROOT DAMAGE AFTER SCREW INSERTION FOR ORTHODONTIC MINIPLATE PLACEMENT IN DOGS

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AIM: The risk of damaging roots during placement of temporary skeletal anchorage devices is not negligible. The aim of this investigation was to describe the healing reactions following root damage using a miniplate anchorage system.
MATERIALS AND METHOD: In four beagle dogs, 32 titanium miniplates (2 self-tapping screws/miniplate) were placed between the roots, after drilling of pilot holes (1.6 mm-Ø). During the drilling process of six screws, the root and/or

periodontal ligament (PDL) of the upper canine was damaged. Two weeks later, half of the miniplates were loaded with a coil spring. The dogs were killed 7 or 29 weeks after placement. Fluorescent markers were injected at placement and at sacrifice. Jaw samples were embedded and cut into sections. The sections were microradiographed and then observed under ultraviolet light.
RESULTS: Four roots were directly damaged by the screws. One screw did not contact the root itself, but the hole was drilled deeper than required, damaging the root. One screw went into the PDL without damaging the root. Three screws injured the roots at the apex level, and three screws hit the mesial side of the canine root or its PDL. Among the six involved screws, two were mobile and four were stable at sacrifice. This distribution was not related to the location of the root damage or the loading status of the miniplates. Observation of the fluorescent markers displayed almost no root repair after 7 weeks. In contrast, a thick layer of mineralized material was observed on the lesions 29 weeks after root damage. The screw placed into the PDL but not in direct contact with the root, did not result in any root resorption. The presence or absence of tissue repair was not related to root damage location, screw stability or loading status.
CONCLUSION: Limited root damage showed signs of healing by apposition of new cementum in the defect after 29 weeks.

119 IMPACTED MAXILLARY CANINES – AN EPIDEMIOLOGICAL STUDY OF TREATED PATIENTS

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AIM: Impacted maxillary canines (IMC) occur in approximately 2 per cent of the population. The condition is thought to be genetic and related to an Angle Class II division 2 malocclusion. Extraction of the primary canine is a possible preventive measure and is most successful in patients under 13 years of age. The aim of this study was to collect epidemiological data regarding IMC in the Slovenian population. Emphasis was placed on the age at the beginning of orthodontic treatment. A further interest was whether the primary canines had been extracted by a general practitioner and if a correlation exists between age and severity of displacement.
MATERIALS AND METHOD: Data from the dental casts and radiographic images of 35 patients (21 girls, 14 boys) with IMC. Two age groups were formed: up to 13 years and older than 13 years. The position of the IMC and the presence of the primary canine were recorded. Dental casts were assessed for crowding with a calliper and classified according to Angle's classification. From panoramic radiographs, among other data, canine angulation to the midline was measured using a digital screen protractor.
RESULTS: The mean age at the start of treatment was 15.4 years. Twenty patients (57%) were older than 13 years. Both canines were impacted in five patients (14%). Palatal impaction was present in 28 patients (80%) and buccal impaction in seven patients (20%). Twenty-two patients (63%) still had the primary canines. The occurrence of RII was 46 per cent. Crowding of 4 mm or more was correlated with buccal impaction. Angulation to the midline exceeded 15 degrees significantly more frequently in patients over 13 years of age.
CONCLUSION: The majority of patients start treatment for IMC too late; the primary canines are still present. Early intervention is vital because IMC tend to shift mesially in time, complicating treatment and inducing root resorption of adjacent teeth.

120 AN ETHNIC BACKGROUND-BASED CEPHALOMETRIC STUDY IN HUNGARIAN AND JAPANESE CLASS III SUBJECTS

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AIM: To characterize the morphological differences of craniofacial structure in two ethnic groups.
MATERIALS AND METHOD: Cephalometric data of Hungarian and Japanese patients with a Class III malocclusion diagnosed as requiring orthognathic surgery were compared. The study sample consisted of standardized pre-treatment cephalometric radiographs of 28 (14 males, 14 females) Hungarians (24 year 1 month) and 28 (14 males, 14 females) Japanese (22 years 11 months). Measurements were performed using the method of Ricketts with FR Win 5.0 for Windows®. Ten linear and angular variables were analysed. Basic statistics, F-, two sample *t*-, Mann-Whitney and Wilcoxon tests were used.
RESULTS: The Japanese sample presented stronger negative values for facial convexity. Lower face height and mandibular plane angle showed increased values in the Japanese sample resulting in an increased lower facial third and a very accentuated open bite tendency. Decreased values of maxillary depth angle showed a retroposition of the upper jaw. On

average, values for conical angle were smaller than normal, due to a forward position of the chin, especially in the Japanese group. Facial depth showed an increased average value, indicating a more forward mandible with reference to the cranial base in both groups. Mandibular angle (Xi) slightly differed from normal. The Hungarian group presented higher values, which can be considered as the upper limit of normal. A higher angle for the position of the mandibular ramus (ramus Xi position) was observed in both groups. As expected, constant values (such as craniofacial deflection, facial axis) remained close to normal.
CONCLUSION: The null hypothesis that there is no difference between the data of the two groups was rejected. The results appear to suggest real differences in skeletal features between Hungarian and Japanese Class III surgical patients due to ethnicity and the nature of the samples.

121 RADIOGRAPHIC ASSESSMENT OF THE PRESENCE OF THIRD MOLAR GERMS IN MACEDONIAN CHILDREN

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AIM: To investigate the stages of calcification and eruption times of various teeth, especially third molars, in Macedonian children, correlating dental and chronological age.
MATERIALS AND METHOD: Dental panoramic radiographs of 1000 subjects (527 males, 473 females) born between 1985 and 2005 who were between 5 and 16 years of age at the time a dental pantomogram (DPT) were obtained. All children were placed in the age group closest to their chronological age. Calcification of the each tooth on the left side of the mandible was rated in eight stages of calcification, A to H, according to the method described by Demirijan.
RESULTS: Significant differences were found between chronological and dental age. The findings showed premature eruption times in girls, but delayed calcification in boys compared with Demirijan's stages of calcification. The earliest appearance of visible signs of lower third molars (start of follicle development) was found at 7.4 years for both genders. The latest appearance was found at 10.6 years in girls, and 13.2 years in boys.
CONCLUSION: Radiographic assessment of calcification times of the permanent dentition, including the third molars, is of importance.

122 HYOID BONE POSITION, MANDIBULAR GROWTH DIRECTION AND HEAD POSTURE IN MOUTH BREATHERS

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AIM: To assess the effects of impaired nasal breathing on head posture, position of the hyoid bone and the tongue, and mandibular growth direction. A further aim was to estimate the relationship between head posture and hyoid bone position.
MATERIALS AND METHOD: Study casts and lateral skull radiographs of 100 children from 8 to 14 years of age. After otorhinolaryngological evaluation, the patients were divided into two groups. Group 1 comprised 50 mouth breathers with nasopharyngeal obstruction and group 2, 50 nose breathers with no history of impaired nasal breathing, who served as the control. To estimate the position of the hyoid bone and the tongue, six diameters (hy-gn, hy-cv4ip, hy-MP, hy-NS, PP-hy and PP-dl), and six craniocervical angles determining the extension of the head (NS/OPT, FH/OPT, PP/OPT, NS/CVT, FH/CVT and PP/CVT) were measured. Standard lateral cephalometric radiographs were obtained to evaluate mandibular growth direction using the following measurements: inclination of the mandibular plane, gonial angle and basal plane angle.
RESULTS: Hyoid position in children in group 1 was found to be more inferior to normal in relation to the mandibular plane and SN reference line, and more distally positioned. The average craniocervical angles were found to be extremely large, exceeding the average values in group 2. The significantly increased gonial and basal plane angle, and the slope of the occlusal plane and higher inclination of the mandibular plane in-group 1 indicated vertical growth in a clockwise rotation. A steeper PP/Mp angle, and palatal-tongue distance showed a positive correlation with an increased craniocervical angulation.
CONCLUSION: Determination of hyoid bone and tongue position in children with impaired nasorespiratory function can be used in therapeutic and prognostic evaluation.

123 THREE-DIMENSIONAL CEPHALOMETRY FOR DIAGNOSIS AND TREATMENT PLANNING OF IMPACTED CANINES

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AIM: An impacted tooth is defined as one that fails to erupt at its appropriate site in the dental arch, within the normal period of growth. Maxillary canines are the most frequently impacted teeth, after third molars. Conventional radiographic techniques can be somewhat limited in the visualization of impacted teeth, due to problems involving superimposition and the complex nature of related dentoalveolar structures. Three-dimensional (3D) volumetric imaging with cone-beam computed tomography (CBCT) has the potential to define correct localization of impacted canines, using spatial relationships. The aim of this investigation is to propose a new 3D cephalometric analyzing system for diagnosis and treatment planning of impacted maxillary canines.
MATERIALS AND METHOD: Diagnostic CBCT records of 25 subjects with uni- or bilateral impacted maxillary canines were retrieved from a CBCT archive of 550 patients. All records were obtained with a NewTom 3G FP CBCT scanner. With an orthodontic image processing software (Simplant Ortho Pro v2.0), a 3D study model was reconstructed and cephalometric analyses were realized for each data set. Specialized landmarks, lines and reference planes were designed for the analysis of impacted maxillary canines to the related dentoalveolar and craniofacial structures. Axial inclination, crown rotation, bucco-palatal localization, stereoscopic position to the reference planes, proximity to the adjacent teeth and overlapping rate, root morphology and development, resorptive potential, peripheral bone density, impaction depth and distance to the ideal position, amount of available space and crown size of impacted maxillary canines were measured and analyzed. Craniofacial pattern and relative morphological and spatial relationships of other dentoalveolar structures were also evaluated.
CONCLUSION: Comprehensive diagnosis is the key for successful treatment planning to obtain maximum therapeutic results.

124 USE OF DELMOPINOL GEL IN PATIENTS UNDERGOING FIXED ORTHODONTIC TREATMENT

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AIM: Multibracket orthodontic treatment makes it difficult to maintain correct oral hygiene, thus facilitating plaque accumulation and gingival inflammation. The aim of this study was to verify the effectiveness of Decapinol Gel to reduce plaque formation and gingival inflammation when applied around brackets.
SUBJECTS AND METHOD: Thirty subjects randomly separated into two equal groups. Before orthodontic treatment (T0) the plaque (PI) and gingival (GI) indices were measured and professional scaling, instruction and motivation were carried out. After 15 days (T1) the measurement were repeated and the brackets bonded. Group B were trained to apply the gel around each bracket at home, after brushing and flossing. Measurements were repeated after 15 (T2), 30 (T3) and 45 (T4) days. At T4 treatment was interrupted for 15 days, and then at T5 group A began to use the gel and indices were obtained after 15 (T6), 30 (T7) and 45 (T8) days.
RESULTS: At T1 all patients showed both overall PI and GI equal to or lower than 1. At T2 group A showed significantly higher indices than group B. At T3 the difference between the two groups was lower, but still statistically significant ($P < 0.05$). At T4 the indices were still higher in group A than in group B, but the difference was not statistically significant. At T5, no significant difference was observed between the groups. At T6 GI and PI were higher in group B group, but the difference was not statistically significant. At T7 group B showed significantly higher overall indices than group A. At T8 the indices were higher in group A, but the difference was not statistically significant.
CONCLUSION: Decapinol Gel can give beneficial effects especially during the early weeks of orthodontic treatment, when patients are not well trained in bracket maintenance.

125 INFLUENCE OF SELF-ESTEEM ON QUALITY OF LIFE IN CHILDREN SEEKING ORTHODONTIC TREATMENT

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AIM: There are children who complain about minor aesthetic orthodontic problems, while others with a severe malocclusion are not even aware of it. Does self-esteem (SE) contribute to differences in perception of orthodontic problems? The aim of

this study was to investigate the possible role of SE as an influencing factor on oral-health-related quality of life (OHRQoL) in children seeking orthodontic treatment.
SUBJECTS AND METHOD: A cross-sectional study of 78 children (43 boys, 35 girls) aged 11 to 16 years. SE was assessed by the domain 'sense of dignity' of the Competence Perception Scale for Adolescents (Dutch translation of Harte's Self-Perception Profile). OHRQoL was scored with the use of the Child Perception Questionnaire [CPQ 11-14 4 domains, oral symptoms (OS), functional limitations (FL), emotional well-being (EW) and social well-being (SW) and total score]. The Index of Orthodontic Treatment Need [IOTN, Dental Health Component (DHC) and Aesthetic Component (AC)] was used to quantify treatment need. Multiple regression analysis was undertaken to evaluate the impact of SE on the relationship between orthodontic treatment need and OHRQoL. The results were obtained after correction for age and gender.
RESULTS: SE had a significant impact on the relationship between FL and the DHC of ION in the group of children with low SE values; OHRQoL was lower for those who needed treatment (DHC 4–5) compared with those who did not (DHC 1–3). However, for high SE values the reverse occurred in that children with a high treatment need experienced a better OHRQoL. For all the other analyzed relationships, except that between SW and the DHC of the ION, a similar pattern was found, although these interactions were not significant.
CONCLUSION: There appears to be no significant impact of SE on the relationship between OHRQoL and orthodontic treatment need, with the exception of the relationship between FL and the DHC of the ION. Longitudinal data in a larger sample will be of value to further elucidate the role of SE as a moderator.

126 EVALUATION OF THE CRANIAL BASE ANGLE IN ACHONDROPLASTIC DWARFS – A CEPHALOMETRIC ANALYSIS

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AIM: Achondroplasia is the most common cause of dwarfism. This condition is genetically based, autosomal, dominant with full penetration. It affects 1 in 15000 to 30000 live births. Almost every case of achondroplasia is associated with a mutation of FGFR-3. Short stature is one of the most characteristic features of achondroplasia. Skull changes include hypoplasia of the jaw bones, enlargement of the cerebral skull and closing of cranial base angle. Cranial base growth affects the relationships between the maxilla and mandible. The aim of this study was to determine measurements of the cranial base angle of achondroplasic dwarfs.
MATERIALS AND METHOD: Cephalograms of 18 achondroplastic dwarfs. Achondroplasia was genetically confirmed for every patient. Two cephalometric parameters were analyzed, N-S-Ba and N-S-Ar angle, which describe skull base flexure. The mean values and standard deviations for these angles were calculated, both for the whole group and separately for the genders.
RESULTS: The mean values for the angles were 128 degrees (±9.1°) for S-N-Ba and 117.8 degrees (±10.5°) for S-N-Ar. Differences in the mean angle values between genders were observed. For females these values were 126.7 degrees (±9.5°) for N-S-Ba and 115.3 degrees (±11.2°) for N-S-Ar and for males 129.6 degrees (±8.8) and 120.8 degrees (±9.2°), respectively.
CONCLUSION: Cranial base angle in achondroplasts is within the normal range or slightly above. Further research is required to determine other factors that might be involved in the characteristic facial profile of achondroplastic dwarfs.

127 THE EFFECT OF LIP ADHESION ON EARLY MAXILLARY GROWTH IN BILATERAL CLEFT PATIENTS

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AIM: To investigate the effect of the lip adhesion procedure on early maxillary growth for bilateral cleft patients.
SUBJECTS AND METHOD: Eighteen bilateral complete cleft patients (AG) treated with the lip adhesion procedure 1 month after birth, followed by lip closure 4 months after birth. Another group of 11 bilateral complete cleft patients (PG) pre-surgically treated with a passive moulding appliance followed by lip closure at 5 months of age. Records of the AG group were made at the ages of 1 and 4 months after birth and of the PG group at the ages of 1 and 5 months after birth. Specific landmarks on casts were three-dimensionally digitised. The positional changes of the maxillary segments in both groups were analysed and statistically compared.
RESULTS: For the AG group there was a significant reduction of the distance between the premaxilla and lateral segments, of the width of the palatal cleft, of the protrusion of the premaxilla and of the distance between L-L'. There was a significant increase in the width of the premaxilla. For the PG group there was a significant increase in the width of the premaxilla and

a significant decrease in the distance between the premaxilla and lateral segments. Between the AG and PG groups, there was a significant difference in transverse dimensions, with higher values for the PG group. There was a significantly higher reduction in the distance between the premaxilla and the lateral segments, only on the right side in the AG group.
CONCLUSION: The lip adhesion procedure at the age of 1 month can be advocated in bilateral complete cleft patients with severe premaxillary protrusion and a wide alveolar cleft.

128 ORTHODONTIC STATUS AND ORTHODONTIC TREATMENT NEED AMONG SEVENTH GRADE STUDENTS

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AIMS: To determine the prevalence of malocclusion and orthodontic treatment need among students of seventh grade classes in Gorazde (Bosnia and Herzegovina) and to compare the results with other populations.
SUBJECTS AND METHOD: Three hundred and fifty eight students from the seventh grade classes in Bosnian-Podrinje Canton (Bosnia and Herzegovina) aged from 12-13 years. The measurement instrument was the Dental Aesthetic Index (DAI).
RESULTS: The incidence of orthodontic anomalies was 60.44 per cent and the average value of the DAI 25.25 (SD 8.771). The percentage of students requiring orthodontic therapy (DAI $\geq$ 31) was 29.61 per cent. There were no statistically significant differences in DAI score between genders [girls 24.70 (SD: 8.784), boys 25.71 (SD: 8.755)].
CONCLUSION: The distribution of DAI scores in this sample of students is not very different to that reported for other European populations.

129 APPLICATION OF A ER:YAG LASER FOR ORTHODONTIC BONDING. A PRELIMINARY *IN VITRO* STUDY

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AIM: The use of lasers in orthodontics was, for many years, limited to surgery of the pathological fraenulum and the uncovering of enclosed teeth. Recently, with the introduction of the Er:YAG laser in dentistry for ablation of hard tissue such as enamel and dentine, this wavelength was studied for enamel treatment before orthodontic bracket bonding.
MATERIALS AND METHOD: Sixty teeth, extracted for orthodontic reasons, with no decay or previous treatment. The samples were stored in a saline solution at 4°C to avoid dehydration or alteration of the enamel tissue, for a period not exceeding 21 days. The roots were then included in a resin block to hold the specimen and to ease bonding procedure. The teeth were divided into five groups treated with different bonding procedure. Group 1 was prepared with orthophosporic acid, group 2 were treated with a Er:YAG laser 80 mJ and group 3 with a laser at 80 mJ and orthophosporic acid. Groups 4 and 5 were treated using same procedures as for groups 2 and 3 but at a lower energy, i.e. 40 mJ.
RESULTS: After debonding significant differences were found difference between the five adhesion groups.
CONCLUSION: The application of a Er:YAG laser (2940 nm) for bonding should be combined with orthophosphoric acid.

130 AUTOMATED TRACKING OF FACIAL LANDMARKS FOR THREE-DIMENSIONAL ANIMATED MODELS, USING STEREOPHOTOGRAMMETRY

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AIM: Correct three-dimensional (3D) diagnostic classification of developmental disharmonies is essential for assessing rehabilitation of facial soft tissue and skull-facial structures, and for monitoring the changes induced by surgical, aesthetic and functional treatment. The aim of this study was to evaluate a simple and economic digital close range photogrammetric system developed for measurement and tracking of facial movements. The system produces a 3D animated model (wire frame, tasselled and textured surfaces), which accurately reproduces the subject's facial movements during opening and closing of the mouth.
MATERIALS AND METHOD: Three Canon EOS 40D, calibrated cameras were used. A 12 bit coded target L frame provided the scale factor and also the fixed reference points during data acquisition. The main software used was PhotoModeler Video. A laser scanner Konica Minolta Vivid was positioned between the left and middle camera; in order to compare only

the photogrammetrically acquired static data to the laser scanned acquired static data. Biometric measurements were first determined on a dummy face, and then on a subject's face to study the transformations of distances, angles and relationships between landmarks during motion.
RESULT: Recognition and tracking of facial landmarks was achieved by automated procedures that required minor human intervention. An animated 3D triangulated surface was produced, which also accurately reproduced the subject's movements. Accuracy values in the order of fractions of a millimetre can be achieved.
CONCLUSION: The use of a laser scanner allows 3D biometric point positions to be determined only statically and a set of values to be calculated, but its accuracy is much lower when compared with the photogrammetric technique, and motion capture is not possible.

131 *IN VITRO* STUDY LABORATORY TEST OF THE SHEAR BOND STRENGTH OF METAL BRACKETS BONDED TO ENAMEL

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AIM: To compare, *in vitro,* the shear bond strength (SBS) of five different types of metal orthodontic brackets with diverse mechanical retention on the enamel surface of bovine teeth.
MATERIALS AND METHOD: The lateral incisor teeth of 50 young cattle with undamaged buccal enamel, no cracks caused by the extraction forceps, and no defects observed by two investigators with a magnifier. The teeth were polished with pumice and water containing no fluoride, and embedded in a self-curing acrylic resin. Five types of orthodontic metal brackets were selected, 10 of each type (G1: miniequilibrium, Dentaurum, Pforzheim, Germany; G2 elite opti-MIM mini-twin regular profile, Ortho Organizers, San Marcos, California, USA.; G3: mini-dynalock, 3M Unitek, Monrovia, California, USA.; G4: minisprint, Forestadent, Pforzheim, Germany; G5 mini-diagonal, Leone, Italy) and bonded to the enamel surfaces of the teeth with Pad Lock (Reliance Orthodontic Products, Inc., Illinois, USA). The specimens were tested for SBS with an Instron universal testing machine. The base surface of the brackets after debonding was observed using a microscope at ×20. Data obtained in Newton and Megapascal were analyzed with descriptive statistics. The adhesive fracture site was classified with the adhesive remnant index (ARI).
RESULTS: All groups showed statistically differences from each other, but had sufficient SBS to resist orthodontic forces. G1 showed the greatest bond strength, both in Newton and Megapascal. The ARI confirmed the greater retention capacity of the surface and the lower percentage of residual composite on the buccal enamel after debonding.
CONCLUSION: The different mechanical retention of the bracket bases influences bond strength. Although the dimensions of the brackets were small, all groups showed adequate bond strength.

132 APPRAISAL OF THE GEOMETRIC EFFECTS ON TWO CEPHALOMETRIC INDICES OF SKELETAL CLASS

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AIM: The importance of accurate anteroposterior measurement of the maxillo-mandibular relationships, i.e. skeletal Class, is critical in orthodontic diagnosis. Among the most popular cephalometric indices are ANB angle and Wits appraisal on the functional occlusal plane. However, these indices are geometrically sensitive and can give false results. The present investigation was thus aimed at providing quantitative knowledge for the most relevant geometric effects on these indices, which can be corrected on the individual skeletal morphological features.
MATERIALS AND METHOD: One-hundred and forty-four lateral cephalograms of 8-to-14-year-old subjects seeking orthodontic treatment were traced. Seventeen different cephalometric variables were recorded and used as independent variables in backward multiple regressions; the outcomes were either ANB angle or Wits appraisal. The most relevant associations were thus retrieved for both these two indices of skeletal Class.
RESULTS: ANB was mostly correlated with the mandibular plane angle to S-N plane and SNA angle. Wits appraisal was mostly correlated with the mandibular plane and bisected occlusal plane angle to the S-N plane. Through the multiple regression models, correction coefficients were retrieved for each of the indices. Subsequently, corrected indices were calculated on an individual basis. In the whole sample, the correlation coefficients for the uncorrected ANB and Wits appraisal was 0.72, and reached 0.96 between the corresponding corrected indices. Through elimination of geometric distorting effects, the increase in agreement between the indices of skeletal Class is expected to be consistent with a more accurate diagnosis that would be based on individual corrections.

CONCLUSION: Cephalometric indices of skeletal Class are subject to geometric effects making individual corrections useful to avoid bias in diagnosis.

133 POSTERIOR CROSSBITE AND SUCKING HABITS IN CHILDREN FOLLOWED BETWEEN 3 AND 7 YEARS OF AGE

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AIMS: Longitudinal studies following the development of occlusion are rare. Therefore a longitudinal study was started in 2003 to observe the development of the occlusion and sucking habits between 3 and 7 years of age. The aims were to analyze the prevalence of a posterior crossbite in a group of children followed longitudinally, and to evaluate if the posterior crossbite is influenced by sucking habits.
SUBJECTS AND METHOD: Four hundred and fifty seven, 3-year-old children (234 girls, 223 boys) examined by one experienced orthodontist. In the follow-up, 386 children at 7 years of age were re-examined by the same examiner. Data from the clinical examination and a questionnaire were used to determine malocclusion traits and sucking habits.
RESULTS: The prevalence of a posterior crossbite was 19 per cent (89/457) at 3 years of age and 18 per cent (68/386) at 7 years of age. If the child had a posterior crossbite at 3 years of age it had a 28 times increased risk of having a posterior crossbite also at 7 years of age. In 6 per cent of the children with a normal transverse relationship at baseline, a new posterior crossbite was developed between 3 and 7 years of age. Spontaneous correction occurred in 27 of the 76 children with a posterior crossbite. The prevalence of sucking habits decreased from 66 to 3 per cent between 3 and 7 years of age.
CONCLUSION: When a posterior crossbite is present at 3 years of age, the possibility was high that it remained at 7 years of age. The influence of sucking habits on the prevalence of posterior crossbite at 3 years of age was high, but not confirmed at 7 years of age.

134 ESTIMATION OF DENTAL ALVEOLUS MORPHOLOGY AS A PROGNOSTIC INDICATOR OF GINGIVAL RECESSION

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AIM: Gingival recessions (GR) are the final effect of the action of multi-various aetiological factors, of which identification is essential in prevention and dental treatment. The aim of this study was to describe and estimate a method of assessment of labial bone width in the mandibular anterior area in a sagittal direction (API-CEJ2-B) and mental muscle (BD) width based on lateral radiographs in occlusion.
SUBJECTS AND METHOD: Ninety-eight randomly selected subjects with an average age 27.8 years, divided into two groups with (I) and without (II) gingival recession and two subgroups with expansion or retraction in the lower incisor region. Using a computer program, cephalometric analysis according to Björk was carried out, in which additionally some modifications were used. API-CEJ2-B [°], API-B [mm], CEJ2-B [mm], height of bone dehiscence (CEJ2-ID [mm]) and muscle (distance between point B and authors D-point, pointing at width of BD) were marked.
RESULTS: Significantly lower values for API-CEJ2-B and higher values for CEJ2-ID were found before treatment in group I. As a result of treatment, differences between the bone parameters in both groups were balanced. The greatest change in bone parameter values were observed in group II, and of BD in group I. Expansion treatment, regardless of grouping, significantly influenced the decrease of API-CEJ2-B and the increase of CEJ2-ID, whereas retraction in group I additionally caused a significant increase of BD width. Prediction values of parameters that considerably influence the occurrence of GR are: API-CEJ2-B <16 degrees, CEJ2-ID >1.4 mm and age >24.4. A constructed multiple regression model of parameters which significantly influence GR explained the potential recession-causing influence in 72 per cent.
CONCLUSION: Assessment of API-CEJ2-B is of diagnostic importance as well as for determining therapy.

135 SURGICAL TREATMENT PLANNING OF PATIENTS WITH CLASS II MALOCCLUSIONS

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AIM: Precise planning of treatment leads to the most predictive results. The purpose of this research was to define value of a divergence of the planed and actual results of surgery with special attention given to soft tissue parameters and facial aesthetics.
SUBJECTS AND METHOD: Forty patients with a Class II malocclusion and transverse skeletal deformities. Evaluation of photographs, postero-anterior and lateral cephalographs, anthropometric measurements and computer cephalometric planning was carried out. For all stages a uniform wax record was used that provided stable position of the temporomandibular joints. Soft tissue measurements were made undertaken the method of Arnett. Dolphin Imaging was used with metal markers positioned on the cheek bone, orbital rim, subpupil, nasal base, neck-throat point and a calculation of parameters concerning the true vertical line.
RESULTS: According to the generated inspection and planning algorithm, a discrepancy of the changes in bone soft tissue parameters was found. The aesthetics of the face became more harmonious while bone parameters in some cases worsened. In all patients bimaxillary surgery and genioplasty were performed. After surgery all patients underwent orthodontic treatment to achieve maximal intercuspation.
CONCLUSION: In most cases it is not sufficient to have only orthodontic calculations and planning as they involve only the average sizes of the bone parameters without division of patients by race. Only careful inspection and planning of treatment allows achievement of an aesthetically harmonious facial profile.

136 SKELETAL MATURATION IN CHILDREN

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AIM: Optimal effectiveness in the use of orthodontic or orthopaedic treatment has been associated with skeletal maturation. The aim of this study was to investigate the correlation between chronological age, cervical vertebral maturation (CVM) and Björk's hand-wrist skeletal maturity indicators.
MATERIALS AND METHOD: A hand-wrist bone and cephalometric cervical vertebral radiographs of 30 patients (15 males, 15 females; 10-17 years of age). The hand-wrist radiographs were evaluated according Björk's index and CVM assessed using the CVM method. To define vertebral stages, the evaluation consisted of three cervical vertebrae (concavity of C2, C3 and C4 and the shape of C3 and C4). These measurements were then compared with the hand-wrist bone analysis and the results statistically analyzed using Spearman rank correlation.
RESULTS: The most frequent cervical vertebrae stages in females were stages CVM V (33.3%) and CVM III (26.7%). For males the most frequent stages were CVM II (46.7%) and CVM III (40.0%). For hand-wrist skeletal maturation, the most frequent stages were MP3u (33.3%) and MP3cap (26.7%) in females and MP3 (33.3%), S (26.7%) and MP3cap (26.7%) in males. Spearman rank-order correlation coefficient between chronological age and cervical vertebrae maturation was 0.53 (P = 0.007) for the genders combined; between chronological age and hand-wrist maturation stages it was also 0.53 (P = 0.003). Spearman rank-order correlation between hand-wrist and cervical vertebrae maturation was 0.96 (P = 0.00001) for both genders.
CONCLUSION: A high correlation was found between hand-wrist skeletal maturation and vertebral maturation in Polish subjects.

137 CHANGES IN SKULL PARAMETERS IN CLASS II DIVISION 2 SUBJECTS

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AIM: To study age-related change intensity in the cerebral and facial parts of skull of Angle Class II division 2 children to detect the skull morphological structures differing from their normal growth intensity during the primary dentition period.
MATERIALS AND METHOD: Sixty-two teleroentgenograms of the head in lateral projection. Thirteen longitudinal and 14 vertical parameters of the facial and cerebral parts of skull of 30 children (7-12 years of age) during the primary dentition period and of 32 children (12-15 years of age) were measured.
RESULTS: The intensity of age-related changes of many longitudinal and vertical parameters of the skull significantly differed from normal. .
CONCLUSION: Children with an Angle Class II division 2 malocclusion should be treated as early as possible.

138 CEPHALOMETRIC DECISION: WHETHER OR NOT TO EXTRACT IN ORTHODONTIC TREATMENT PLANNING

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AIM: The position of the lower incisor, cephalometrically described, is considered important in the decision as to whether or not to extract in orthodontic treatment planning. Several different measurements are known. However, Ricketts' A-Pogonion line (APg to 1) and Downs' mandibular plane to lower incisor (MPL to 1) are the most frequently mentioned, but on an individual basis. The aim of this study was to assess the interchangeability of both measurements and characterization of subjects based on distinct cephalometric differences.
MATERIALS AND METHOD: On pre-treatment lateral cephalographs of 115 Caucasians (64 females, 51 males, mean age of 12.2 ± 1.1 years), 13 landmarks were traced twice. Two dental and nine skeletal cephalometric measurements were calculated and the mean values were used for further analysis. To compare APg and MPL to1, mean values from the subjects were converted into *Z*-scores in relation to the normative means and standard deviations of the two parameters. The subjects were divided into groups based on clear differences in *Z*-score, group 1 (difference < –2), group 2 (–2 ≤ difference ≤ 2), group 3 (difference > 2).
RESULTS: The difference between the mean *Z*-score of Apg to 1 and MPL to 1 was statistically significant ($P < 0.000$, paired *t*-test). Statistically significant differences between groups 1, 2 and 3 were found for Apg-1, MPL-1, sagittal position of the chin (Pogonion to NB), the anteroposterior relationship of the maxilla to the mandible (ANB), and the vertical inclination of the mandible (Spina Plane and Sella-Nasion to MPL respectively) ($P < 0,007$, one way ANOVA).
CONCLUSION: Cephalometric measurements, Apg to 1 and MPL to 1, should not be used in isolation when irreversible decisions such as extractions are considered in orthodontic treatment planning.

139 ORTHODONTIC TREATMENT OF PATIENTS WITH CROWDING USING SELF-LIGATING BRACKETS

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AIM: To compare the results of orthodontic treatment of patients with crowding and to determine the influence of the functional condition of the orbicularis oris muscle on the results of treatment of such patients using passive and active self-ligating brackets.
SUBJECTS AND METHOD: Sixty patients with crowding divided divides into three groups: group 1, 20 patients, treated with passive self-ligating brackets, Damon-3; group 2 patients treated with active self-ligating brackets, Time-2, and group 3, patients treated with ligating brackets MBT. Dental casts were measured using electronic digital calliper before and after active treatment. A unique patented device, the Vestibulotometer (patent application number 12007115849) was used to determine the influence of the muscles surrounding the mouth on craniofacial structures.
RESULTS: Group 1 patients showed maximum expansion between the upper (10 mm) and lower (6 mm) premolars while a significant increase in arch length was observed in group 3. A low correlation was found that the orbicular oris muscle tonus had an impact on treatment in group 3. A significant medium correlation was found with interincisor angle (correlation coefficient 0.5). In patients treated with active self-ligating brackets, lip tonus influence was also significant on interincisor angle alteration. In the patients with passive self-ligating brackets, there was an influence of lip tonus on the length of the dental arch and interincisor angle.
CONCLUSION: Passive self-ligating systems allow expansion of narrow dental arches without additional appliances. Lip tonus influences the results of treatment. Hypertonus assists in the decrease of incisor protrusion and dental arch expansion, but not in retrusion elimination.

140 CEPHALOMETRIC MORPHOLOGY OF ADULTS WITH OBSTRUCTIVE SLEEP APNOEA

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AIM: Obstructive sleep apnoea (OSA) is a common respiratory disorder, with a frequency that increases with age. The mechanisms contributing to the aetiology of OSA include genetic and environmental changes in craniofacial dimensions. The aim of this study was to assess the cephalometric features of Romanian adults with OSA.
MATERIALS AND METHOD: Cephalometric radiograph of 20 randomly selected adult OSA patients (5 females, 15 males, aged 34-76 years) with a mild to moderate apnoea/hypopnoea index (range 5-23) and a mean Body Mass Index of 28.75 ± 4.13. Linear and angular parameters for dental and skeletal features were assessed.
RESULTS: The mean values for SNA and SNB were: 79.65 ± 4.89 and 76.77 ± 3.58, respectively, with the cranial base angle within the normal range (131.2 ± 4.84). The mean values for the parameters of the vertical skeletal pattern were: NL-NSL 7.47 ± 4.07, ML-NSL 29.82 ± 5.10, upper molar-NF 26.82 ± 3.81 and lower molar-MP 38.62 ± 3.44.

CONCLUSION: Romanian adult patients with OSA have a retrognathic anteroposterior skeletal pattern with a severe retroposition of the mandible, but also a retruded maxilla and a tendency to counterclockwise rotation of the mandible.

141 COMPARISON OF PLAQUE REMOVAL OF TWO POWER BRUSH HEADS VERSUS A MANUAL TOOTHBRUSH

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AIM: To evaluate the plaque removal efficacy of a power toothbrush with an orthodontic brush head compared with a regular brush head and a manual toothbrush in orthodontic patients.
SUBJECTS AND METHOD: All 45 patients who completed the study had multibracket-appliances in the upper and lower arch. This study was a randomized, operator-blind, six-period crossover design, which examined plaque removal of three toothbrushes: Oral-B® Triumph™ 5000 with an Ortho brush head or a FlossAction™ brush head and an ADA manual toothbrush. Digital plaque imaging analysis (DPIA) was used to measure the pre- and post-brushing plaque level. The scores were analyzed for group differences using a mixed model ANCOVA.
RESULTS: The mean age of the subjects was 14.6 ± 2.4 (minimum 12 years, maximum 25 years). The average baseline DPIA scores were 46.5 per cent for the Triumph™ with Ortho head, 45.5 per cent for Triumph™ with the FlossAction™ head, and 46.1 per cent for the ADA manual brush, which were not statistically different from each other ($P = 0.856$). The plaque reduction for the power brush with orthodontic brush head was 59.5 per cent and with the regular brush head 55.9 per cent. For the manual toothbrush plaque reduction was 47.0 per cent ($P < 0.001$). The Triumph™ brush with the Ortho or FlossAction™ brush head was statistically superior to the ADA brush ($P < 0.001$). The power brush with an orthodontic brush head showed statistically higher plaque reduction than the power brush with a regular brush head ($P = 0.007$).
CONCLUSION: Both power brush/brush head combinations were found to remove statistically significantly more plaque compared with a manual toothbrush in patients with fixed appliances.

142 HUMAN FOETUS CADAVERS WITH A CLEFT LIP AND PALATE IN THE THIRD TRIMESTER: CASE REPORT

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AIM: A cleft lip and/or palate (CLP) is one of the common forms of congenital anomalies in newborns. It can be associated with syndromes such as anencephaly. The aim of this study was to morphometrically analyze the craniofacial form and intraoral region of three human foetus cadavers in the third trimester with CLP.
SUBJECTS AND METHOD: Three human cadavers retrieved from the archives of Süleyman Demirel University. The first, a male, showed anencephaly and a unilateral CLP at 29 weeks gestation. The second, a female, showed anoculi and an isolated cleft lip and alveolus at 37 weeks gestation, and the last, also female, had a total bilateral CLP at 37 weeks gestation. Crown-rump length, biparietal diameter, head circumference and femur length were measured as general parameters. Vertical and transverse lengths were measured extraorally. Trays made of acrylic were prepared for intraoral evaluation. Upper and lower casts were obtained and alveolar arch width, length, and amount and shape of the cleft were evaluated.
RESULTS: In the anencephalic foetus, the mouth, lips, face and eyes appeared abnormal. The lack of cephalic tissue resulted in a failure in formation of the cranium. Macroglossy was one of the main anomalies of the intraoral region. In the second foetus with anoclui restricted development of the middle and upper face region was the main atypical facial feature. Deformation of the hands and feet was the other external anomaly. The last foetus with bilateral CLP resembled a normal face except for the oral and subnasal regions.
CONCLUSION: Frequent disturbance in closure of the palate with craniofacial malformations is identified. These cases may be important for foetopathological examination and to help diagnose craniomaxillofacial growth pathology.

143 RELATIONSHIP BETWEEN DENTAL MALOCCLUSION AND OTITIS MEDIA IN CHILDREN: A DESCRIPTIVE ANALYSIS

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AIM: To examine the relationship between otitis media and the dentition.
SUBJECTS AND METHOD: Sixty-four children, aged 3 to 10 years, selected from those who at their first visit reported suffering from otitis. Their parents completed a questionnaire concerning pacifier use, thumb/finger-sucking, mouth breathing habits, method of feeding, day care attendance, and upper respiratory infections. All patients underwent an orthodontic clinical examination where overbite, crossbite and overjet and the presence of parafunctional oral habits such as atypical swallowing, mouth breathing and sucking of the inner lip were investigated. The collected data were analysed through descriptive analysis. Associations between otitis media and the presence of malocclusion were investigated. The employed tests were chi square and Fisher, with a significance level of 5 per cent.
RESULTS: In this study, 82.8 per cent of the children presented some type of malocclusion: anterior open bite (42.2%), increased overjet (42.2%), posterior crossbite (28.1%), deep bite (17.2%). In this group the most common factors were bottle feeding (92.2%), pacifier habit (67.2%), mouth breathing habit (35.9 per cent), finger sucking habit (28.1%), allergic rhinitis (21.8%), day care attendance (21.8%), asthma (3%). No statistically significant association between malocclusion and otitis was observed ($P > 0.05$).
CONCLUSION: Although, the results indicate no significant association between malocclusion and otitis media, clinical-descriptive analysis was able to show a high incidence of malocclusion in children with otitis, the presence of risk factors common to both the development of otitis and malocclusion, and an improvement in the symptoms of otitis, as a result of interceptive orthodontic treatment.

144 BONDING AND REBONDING OF DIFFERENT CERAMIC BRACKETS

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AIM: Ceramic brackets have become an established aesthetic option in orthodontic dentistry. In contrast to mesh designed metal bracket bases, ceramic brackets show different base designs. Little evidence exists about the bond strengths and rebonding capacity of these brackets using diverse reconditioning procedures. The aim of this study was to investigate the bond strengths of three different ceramic brackets as well as the rebond strengths using two different conditioning procedures.
MATERIALS AND METHOD: Three different ceramic brackets [Clarity SL (3M), Innovation-C (GAC) and Fascination 2 (Dentaurum)] were bonded on feldspathic ceramic specimens using a standard bonding procedure. Sandblasting or sandblasting in combination with a recently developed ceramic conditioner were included as rebonding procedures. Shear testing was performed with a universal testing machine, followed by stereomicroscope investigation of the debonded brackets.
RESULTS: All ceramic brackets (bonded/rebonded) exceeded the minimum bracket bond strength of 6-8 MPa. A significant difference ($P < 0.001$) was found between the three standard bonded brackets. Sandblasting showed varying, but still high bond strengths compared with standard bonding. Adding the ceramic conditioner to the sandblasted brackets increased and significantly ($P < 0.001$) stabilized the bond strengths.
CONCLUSION: Bonding ceramic brackets with different designed bracket bases leads to different but high bond strengths. Reconditioning ceramic brackets using the above procedures seems to be appropriate for rebonding.

145 ELECTRON BEAM IRRADIATION OF POLYMER BRACKETS

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AIM: Polymer brackets have some disadvantages because of their reduced colour stability and insufficient load resistance. The aim of this study was to improve the mechanical stability of polymer brackets via polymer cross-linking using electron beam irradiation.
MATERIALS AND METHOD: The electron beam irradiation processor was manufactured in Bruchsaal (Germany, Beta Gamma Service). An acceleration voltage 10 MeV was chosen. The energy dose was 100 kGy. Irradiated samples provided from commercially available polymer brackets and polymer bracket raw materials (PC, POM, UDMA, HDPE) were identified. Fracture toughness, Vickers hardness and wear resistance were investigated. Statistical analysis was carried out using the Mann-Whitney U test. The level of significance was set at $\alpha = 0.05$.
RESULTS: Electron beam irradiation caused an improvement of mechanical properties of some samples. HDPE revealed a significant increase of wear resistance and Vickers hardness. However, polyoxymethylene brackets showed almost no change in their mechanical properties compared with the untreated control.
CONCLUSION: Electron beam irradiation seems to be able to change the mechanical properties of polymer brackets. Polymer brackets with lower mechanical properties appear to benefit more from electron beam post-curing.

146 THE INFLUENCE OF ORTHODONTIC ADHESIVE FILLER LEVEL ON BACTERIAL ADHESION AND BOND STRENGTH

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AIM: To evaluate the effect of different filler contents of orthodontic adhesives on colour stability, shear bond strength (SBS), Adhesive Remnant Index (ARI), and bacterial adhesion.
MATERIALS AND METHOD: Four experimental adhesive groups were created: UDMA containing different volumes of SiO_2 filler: 0, 30, 50 and 70 per cent. Cylindrical specimens were incubated with *streptococcus mutans* and colonies were quantified using a luminescence kit and a plate reader. Other samples were exposed to artificial ultraviolet (UV) light for 72 hours. Tomato ketchup, coke and tea were chosen as food colourants, and colour measurements were performed according to the CIE L*a*b* system. SBS and ARI were examined after bonding stainless steel brackets to extracted human third molars using the various adhesives. The means and standard deviations were calculated. Statistical analysis was performed using the Mann-Whitney *U* test. The level of significance was set at $\alpha = 0.05$.
RESULTS: After exposure to food dyes or UV light, higher filled adhesives presented the least and unfilled adhesive the greatest colour changes. Higher adhesive filler levels showed a greater bond strength between the enamel and brackets. Bacterial adhesion was also influenced by varying the filler level of the adhesives.
CONCLUSION: The properties of orthodontic adhesives can be strongly influenced by varying filler level. Bacterial adhesion, SBS and discolouration were altered using different amounts of SiO_2.

147 A NEW CONCEPT FOR ANB ANGLE BASED ON FLOATING NORMS

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AIM: To develop a new formula to determine individual ANB angle based on characteristics of different facial types.
MATERIALS AND METHOD: Eighty lateral teleradiographs of Brazilians of both genders aged between 11 and 17 years with a normal occlusion (skeletal Class I). The sample was divided into three groups according to the facial type: mesofacial, dolichofacial and brachyfacial. The following cephalometric variables were assessed ANB, SNA, ML-NSL, facial axis (FA), total (TFH) and lower (LFH) face height. Multiple regression analysis and *t*-tests (5 per cent) were used. It was found during statistical analysis that the angular cephalometric variables: FA, TFH, SNA and ML-NSL were suitable for statistical calculation.
RESULTS: The calculated values of ANB using the new formula ($3.84 \pm 1.47°$) were identical to the values of ANB measured directly on cephalograms ($3.84 \pm 1.86°$); the paired *t*-test between these two values ($P = 0.98378$) also confirmed that this new formula was appropriate.
CONCLUSION: The established formula having SNA, ML-NSL, FA and TFH [ANB = 13.1865 + (–-0.3855 FA) + (–0.3696 TFH) + (0.4262 SNA) + (0.3327 ML-NSL)] as the independent variables proved to be adequate for determining the individual ANB angle and more appropriate and specific to the different facial types.

148 CORRELATION BETWEEN TOOTH SIZE AND JAW LENGTH IN CLASS III AND CLASS I MALOCCLUSION SUBJECTS

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AIM: To investigate the correlation between jaw length and the sum of the mesiodistal width of six and 12 teeth in the maxillary and mandibular arches of Class III and Class I patients.
SUBJECTS AND METHOD: This cross-sectional study included 120 patients (50 Class I, 70 Class III), 40 with mandibular excess and 29 with maxillary deficiency. The inclusion criteria were permanent dentition with no caries, proximal restorations, attrition or dental abnormalities. The greatest mesiodistal tooth width from the first molar to the first molar was measured on study models using a digital calliper with an accuracy of 0.01. The correlation between the sum of the mesiodistal size of six and 12 teeth to jaw length indices (Co-A and Co-Gn) was analyzed by Pearson test.
RESULTS: There was no significant correlation between arch length indices and the sum of six or 12 teeth. The correlation between Co-Gn and Co-A was significant ($P < 0.001$) in both the Class III (maxillary deficiency and mandibular excess) and Class I patients. Although the correlation between the size of six teeth in the upper and lower arches was significant only in the maxillary deficiency group ($r = 0.4$, $P < 0.01$), the correlation was significant in all groups for 12 teeth.
CONCLUSION: There is almost always a high correlation between maxillary and mandibular arch length, but not between arch length and 6 or 12 teeth, in either jaw.

149 CORRELATION BETWEEN ANTEGONIAL NOTCH DEPTH WITH SAGITTAL AND VERTICAL PARAMETERS

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AIM: Facial growth, especially of the mandible, is an important factor in diagnosis and treatment planning. It has been suggested that the depth of the mandibular antegonial notch can be used as a predictor of facial growth pattern. The purpose of this study was to investigate the correlation between antegonial notch depth with sagittal and vertical indices.
MATERIALS AND METHOD: This cross-sectional study was carried out on 150 cephalometric radiographs of 72 males and 78 females aged 13 to 26 years (mean 19 years) selected using the non-probability sampling method. The vertical (*Y*-axis, SN/MP angle, Björk angle and Jarabak index) and sagittal (ANB and Wits) parameters in three subgroups of antegonial notch (shallow, medium and deep) were measured. Finally the correlation was determined between the antegonial notch with these parameters using ANOVA and Pearson's tests.
RESULTS: There was a high correlation between vertical parameters and antegonial notch depth. The mean of the antegonial notch was 2.4 mm in normal growth patterns and 1.8 and 3.9 mm in horizontal and vertical growth patterns, respectively. Although the Student-Neumans-Keuls test showed significant differences between the groups ($P = 0.001$), the antegonial notch in the sagittal groups was different only between Class III to Class I and Class II malocclusions. Pearson correlation test showed a significant relationship between antegonial notch depth and all parameters, except *Y*-axis in males and ANB in females.
CONCLUSION: There is a close relationship between antegoinal notch depth and vertical determining parameters.

150 ANTERIOR MAXILLARY AND MANDIBULAR INTERRADICULAR DIMENSIONS AND CORTICAL BONE THICKNESS

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AIMS: There are many factors that affect mini-implant success, including implant location related factors such as interradicular distance, buccolingual bone depth, and cortical bone thickness. Although several studies have assessed these factors in the posterior region of the jaws, only limited information is available as regards the anterior region. The aim was to study the interradicular distance, buccolingual bone depth, and cortical bone thickness in the anterior region of the maxilla and mandible using cone beam computed tomography (CBCT), and to detect possible differences associated with age and gender.
MATERIALS AND METHOD: CBCT images of 100 subjects (46 males, 54 females) divided into two age groups (13–18 years) and (19–27 years). The following interradicular measurements were performed: buccolingual (BL) bone thickness, mesiodistal interradicular spaces both buccally (MD-B) and palatally/lingually (MD-P/L), and buccal (BC) and palatal/lingual (P/LC) cortical thickness.
RESULTS: In the maxilla the highest BL (9.6 ± 2.16 mm) was found between the central and lateral incisors. The highest MD-B (4.27 ± 1.23 mm) was between the central incisors. The highest MD-P (3.73 ± 1.28 mm), and BC (1.24 ± 0.53 m) were between the lateral incisor and canine. The greatest PC (1.85 ± 0.64) was between the central and lateral incisor. In the mandible the highest BL, MD-B/L and BC, LC were found between the lateral incisor and canine (7.83 ± 1.36, 3.89 ± 1.33, 3.12 ± 1.51, 1.24 ± 0.19 and 2.36 ± 0.53 mm, respectively. Males and subjects in the older age group had significantly higher BL, BC, and PC in the maxilla. No significant differences were found in the mandible.
CONCLUSION: For mini-implant placement anteriorly, the highest bone dimensions and cortical thickness exists between the central and lateral incisor and lateral incisor and canine in the maxilla, and between the lateral incisor and canine in the mandible. Males and older subjects had significantly higher buccolingual bone depth and cortical bone thickness only in the maxilla.

151 LONG-TERM STABILITY OF SKELETAL CLASS III PATIENTS TREATED WITH SPLINTS AND CLASS III ELASTICS

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AIM: To evaluate stability after facial growth and treatment with splints, Class III elastics, and chincup (SEC III) and to investigate the main determinants of relapse.

MATERIALS AND METHOD: Data from pre-, post-treatment, and long-term (at least 3 years after retention) serial cephalograms of 52 patients who received SEC III treatment were studied only for those whose growth had ceased (females over 18 years, males over 21 years).
RESULTS: At the end of the follow-up period (an average of 9 years), clinical relapse was observed in six subjects (overjet ≤ 0). A low Wits appraisal, ANB angle, and overbite, and high SNB angle were the best predictors of relapse at the end of treatment. Significantly greater decreases of Wits appraisal and increases of ramus length during follow-up were further associated with relapse.
CONCLUSION: SEC III is a reliable treatment for skeletal Class III malocclusions. Long-term stability can be enhanced by a deeper overbite and the best possible skeletal correction. The results suggest that the correction occurs with no mandibular rotation but might be better with forward rotation.

152 SKELETAL CHANGES INDUCED BY RAPID MAXILLARY EXPANSION ASSESSED WITH SUTURAL DENSITY ANALYSIS ON LOW-DOSE COMPUTED TOMOGRAPHY

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AIM: The measurement of sutural density represents a contemporary approach to determine the outcome of orthopaedic intervention on the transverse dimensions of the maxilla and ideal timing for retention of maxillary expansion. The aim of this research was to evaluate the density of the midpalatal suture 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, and uni- or bilateral posterior crossbites. 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 axial CT scanned images four regions of interest (ROIs) were placed along the midpalatal suture (anterior, AS ROI, and posterior, PS ROI) and in two regions of palatal bone (anterior and posterior). Density was measured in Hounsfield units. Mann-Whitney *U* test and Friedman ANOVA with *post-hoc* test were used ($P < 0.05$).
RESULTS: The densities in the AS and PS ROIs were significantly smaller than reference bone densities before RME. Both AS and PS ROIs showed a significant decrease in density from T0 to T1, a significant increase from T1 to T2, and a lack of a significant difference from T0 to T2.
CONCLUSION: Effective opening of the midpalatal suture by RME in prepubertal subjects was associated with a significant decrease in sutural density. Sutural density at T2 indicated reorganization of the midpalatal suture.

153 ORTHODONTIC FORCED ERUPTION IN THE COMPROMISED TOOTH: WEEKLY VERSUS SINGLE FIBROTOMY

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AIM: When considering treatment of a single tooth affected by a subgingival lesion, orthodontic forced eruption could be the best treatment choice, if the dental root is long enough, the periodontal conditions are good and the periodontal margin is in an appropriate aesthetic position. In forced eruption the tooth is moved out of its alveolus. Fibrotomy is useful to keep the periodontal margin in the existing position. Many authors recommend a weekly fibrotomy. The aim of this presentation is to propose a single fibrotomy performed at the end of the orthodontic forced eruption.
MATERIALS AND METHOD: Nine upper second premolars with subgingival lesions. For each tooth forced eruption was performed using brackets and a stiff stainless steel sectional archwire (0.018×0.025 inches), with an inset bend to apply direct axial elastic traction to the tooth. Digital photographs, radiographs and periodontal parameters were taken at three stages. Fibrotomy was performed weekly in four patients, and in five others immediately after active eruption (clinical and radiographic evidence of sufficient crown eruption). Data were clinically compared and statistically analysed with Kendall test.
RESULTS: Clinical crown lengthening was obtained in all subjects. The periodontal parameters (probing, gingival margin and alveolar bone crest location) demonstrated similar amount of eruption obtained in a similar treatment time in both groups (3 mm and 7 weeks, respectively). Statistical analysis demonstrated different behaviour in the two groups for all parameters during treatment, while post-treatment the results were similar.
CONCLUSION: The clinical advantage of the single final fibrotomy is evident, with less discomfort for the patient than the weekly protocol.

154 PREDICTION OF THE OUTCOME OF TREATMENT OF CLASS III MALOCCLUSION – A SYSTEMATIC REVIEW

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AIM: To systematically review the orthodontic literature to assess the possibility of a prediction of outcome of orthodontic treatment in subjects with Class III malocclusions.
MATERIALS AND METHOD: Two authors, using appropriate MeSH and free search terms, independently searched the PubMed, Embase, Cochrane Central, and Lilacs databases as well as hand-searched citations from the relevant articles. Among other data, sample ethnicity, treatment method, age at the start and completion of treatment, age at follow-up, outcome measures, and identified predictors were extracted from the relevant studies. An assessment of methodological quality of the studies was performed.
RESULTS: Two hundred and thirty two potentially relevant citations were identified of which 14 met the inclusion/exclusion criteria. In the included studies 683 subjects were examined on average 6.3 years after treatment with various orthodontic/orthopaedic methods. The age at start of treatment was from 5.6 to 12.4 years and at follow-up from 15.8 to 22 years. The heterogeneity of the samples and treatment methods prevented the carrying out of a meta-analysis. Thirty-eight different predictors of treatment outcome were identified, 35 cephalometric and three derived from analysis of study casts. Prediction models comprising 3-4 predictors were reported in most studies. However, only two studies shared more than one predictor. Gonial angle was most frequently identified (5 publications). Study quality was low (11) or medium (3).
CONCLUSION: The large variety of predictors and disparities among developed prediction models indicate that the possibility of prediction of outcome of orthodontic/orthopaedic treatment of Class III malocclusion is unsubstantiated.

155 INVESTIGATION OF THE MOST PREFERRED MOUTH SHAPE DURING SMILING IN JAPANESE. PART I***

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AIM: To identify the most preferred smiling mouth shape in Japan.
MATERIALS AND METHOD: The different smiling mouth shapes were classified into 12 smile-patterns based on four positions of the corners of the mouth and three types for visibility of the teeth and gums. In classifying the positions of the corners of the mouth, the highest position was A-type, followed by B, C and D types. Regarding the classification of visibility of teeth and gums, in type 1 the upper gum and anterior teeth were visible, in type 2 the upper and lower anterior teeth were visible, and in type 3 the lower gum and lower anterior teeth were visible. The questionnaire was completed by 92 female patients and their mothers, aged from 9 to 51 years. The 12 smile-patterns were classified into four groups based on an evaluation criteria scale of three points for the most desirable mouth shape down to 0 points for the least desirable.
RESULTS: No significant differences were found in the preference of the smiling mouth shape amongst subjects aged under 19 years and those over 20 years. For the position of the corners of the mouth, A-type was ranked highest, followed by B, C and then D types. For visibility of the teeth and gums, type 2 was ranked highest, followed by type 1 and then type 3. Significant differences ($P < 0.01$) were found both in the position of the corners of the mouth and visibility of the teeth and gums. In the ranking of the 12 smile-patterns for the most desirable smiling mouth shape, the most desirable was the combination of A-type and type 2, characterized by the highest positions of the corner of the mouth with visible upper and lower anterior teeth.
CONCLUSION: It seems Japanese people prefer a balanced smile where both upper and lower teeth are visible, showing minimal gingiva and with the corners of the mouth in the highest position.

156 INVESTIGATION OF THE MOST PREFERRED MOUTH SHAPE DURING SMILING IN JAPANESE. PART II: CHANGES AFTER ORTHODONTIC TREATMENT***

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AIM: To examine the changes in the smiling mouth shape before and after orthodontic treatment.
MATERIALS AND METHOD: Two hundred and eighty two frontal photographs and lateral cephalograms taken before and after orthodontic treatment of 141 orthodontic patients (44 males, 97 females, average age 18 years 6 months). The smiling mouth shapes frontal photographs were classified into 12 smile-patterns (Part I of this study). Each photograph received a score (smile score) in accordance with the ranking of desirable smiling mouth shape from 12 smile-patterns (12 points for

the highest ranked smile pattern and 1 point for the lowest ranked smile pattern). The increase or decrease of the smile score following treatment was examined to evaluate improvement or deterioration of the smiling mouth shape. The lateral cephalograms were used to examine the change in the occlusion represented by dental patterns (overjet and overbite) as well as skeletal patterns (AB difference) before and after treatment.
RESULTS: After treatment the average score for the smile types increased significantly from 6.3 to 8.6. Compared with males (increase from 5.5 to 7.5), females (increase from 6.6 to 9.1) showed a higher increase in score. A significant relationship was found between the occlusion and the visibility of the gums and anterior teeth. However, the occlusion did not have a significant effect on the position of the corners of the mouth, nor on the smile pattern.
CONCLUSION: The smiling mouth shape improved significantly after orthodontic treatment both in the male and female groups, with females expressing more interest in their smiles than males. To some extent orthodontic treatment may contribute to improvement in the smile. However, improvement may also come from increased confidence as a result of orthodontic treatment.

157 BOND STRENGTH OF CERAMIC BRACKETS USING DIFFERENT CURING MODALITIES

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AIM: Ceramic brackets are commonly used in combination with adhesive systems and composite photocured materials in orthodontics. Soft light energy release (SLER® Mectron Spa, GE) has recently been introduced in dentistry for photocuring of composite materials. This technology allows thermal control of the curing process by gradually decreasing the light energy in the final step of the irradiation period of the composite material. The aim of this study was to investigate the influence of SLER® technology, compared with standard curing modalities, on the bond strength of ceramic brackets applied with a photocured adhesive system.
MATERIALS AND METHOD: Forty bovine teeth were used as substrates for bonding ceramic brackets (Clarity APC Plus, 3M). The samples were randomly divided into two groups and photocured with two different modalities (standard and SLER®). After bonding, the samples were stored in water for 24 hours prior to testing (Torsiometer IMAD 5 Nm).
RESULTS: Statistical analysis showed a significant difference between the two groups. Samples photocured with SLER® technology demonstrated an increase in mean bond strength values.
CONCLUSION: SLER® technology allows thermal control during the final irradiation time, improving the mechanical properties of the composite materials used for bracket bonding.

158 MUSCULAR EVALUATION IN SKELETAL CLASS II AND III SUBJECTS AT THE END OF GROWTH

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AIM: To evaluate neuromuscular functionality and mandibular kinesiology differences between skeletal Class II and III non-growing patients.
SUBJECTS AND METHOD: Seventy patients periodically analysed during surgical orthodontic therapy to assess muscular functionality and mandibular kinematic during the different phases of treatment using an electromyographer, Freely (De Gotzen) and the electromyographer and electrognatographer (K6-I, Myotronics). In addition differences between the skeletal Class II and III subjects were analysed to identify different neuromuscular functionality as a consequence of the different alterations of maxillary skeletal relationships. Statistical analysis was undertaken with ANOVA, with significance at the $P < 0.05$ level.
RESULTS: At the beginning of treatment differences existed between the Class II and III patients concerning the IMPACT (expression of muscular activity in real time) and muscular activity during maximal contraction with and without cotton cylinders interposed between the two arches. In the post-operative phases this difference was reduced and at the end of treatment all the patients showed similar muscular activity, indicating the corrective role of surgery. The differences were statistically significant.
CONCLUSION: The authenticity of the binomial form-function has been confirmed. Morphology and structure influence the functional capacities of a subject at the end of growth and correction of the dysgnathia.

159 CORRECTION OF ASYMMETRIC TRANSVERSE DISCREPANCIES

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AIM: Premature loss of a primary tooth often causes a loss of space and a deviation of the dental midlines. The aim of this presentation is to propose a new application for the rapid palatal expander (RPE) in patients in the mixed dentition that present an asymmetric transverse discrepancy (monolateral crossbite).
SUBJECTS AND METHOD: Ten patients, characterized by a maxillary transverse hypoplasia and an interincisive midline misalignment, due to early loss of a primary tooth. A modified Hyrax RPE, made of two bands for the first maxillary permanent molars or for the second primary molars, two palatal arms reaching the mesial planes of the canines and a vestibular arm banded to the central incisor, contralateral to the misalignment was used. The RPE was activated one-quarter turn, twice a day, for 15 days. At the end of the activation the appliance was left *in situ* for 6 months.
RESULTS: Maxillary transverse expansion resulting in the creation of a large interincisive diastema was achieved in all patients. The anchorage teeth tipped vestibularly causing a further increase in the transverse arch dimensions. In the sagittal plane rotation of the maxilla in a downward and forward direction occurred due to activation of all circummaxillary sutures with consequent mandibular backward rotation and increase of facial convexity. In the skeletal Class I patients, the change in ANB angle was minimal, while in the skeletal Class II subjects it decreased and in Class III cases it increased, improving in both cases the sagittal relations. Vertically the dimensions increased but this effect relapsed to the original situation during the retention phase.
CONCLUSION: A RPE with a vestibular arm is able to restore the correct transverse diameters of the maxilla and at the same time recover interincisive midline symmetry.

160 BOTULINUM TOXIN INFLUENCES THE HISTOLOGY AND GENE EXPRESSION OF DYSTROPHIC MASSETER MUSCLE

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AIM: Duchenne Muscular Dystrophy (DMD) and its murine model, mdx, are characterized by Ca2+ induced muscle damage and muscle weakness. The disease is caused by mutations in the gene encoding dystrophin. Masticatory muscles of DMD patients show hypertrophic effects followed by distorted dentofacial morphology. Masseteric hypertrophy can be treated with a botulinum toxin A (BTX-A) injection into the masseter muscle. The aim of this study was to evaluate the changes in muscle histology and in the MyHC mRNA expression in muscle tissue specimens from masseter, temporal and tongue muscles of control and mdx mice after injection of BTX-A.
MATERIALS AND METHOD: One hundred day-old mice (12 unilateral, 12 bilateral treated animals, 12 untreated animals of both mice strains, mdx and controls). BTX-A was injected into the right or both masseter(s) to initialise total immobilisation. After 6 weeks, muscle tissue was taken from the left and right side of the masseter, temporal, and tongue muscles using a standardized method. The muscle cross-sections were stained with haemalaun/eosin or with Sirius Red and morphometrically analyzed. The MyHC mRNA levels were studied using quantitative RT-polymerase chain reaction.
RESULTS: The muscles adapted to such stress by changing fibre types and MyHC mRNA content. Paralysed masseters displayed atrophic changes, while other masticatory muscles showed hypertrophic changes as demonstrated by changes in the mean fibre diameter. The diameters of the muscle fibres of the BTX-A groups were more irregular and an increase in the amount of muscle fibres with central nuclei was observed in both mice strains after BTX-A treatment.
CONCLUSION: Treatment with BTX-A may lead to structural changes in affected and unaffected muscles. These changes may cause changes in muscle balance and could compensate the dystrophic effects.

161 ORTHODONTIC-SURGICAL TREATMENT: ELECTROMYOGRAPHIC AND ELECTROGNATHOGRAPHIC EVALUATION

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AIM: Orthodontic surgical treatment has to be planned not only based on clinical and radiographic data, but also by analyzing the neuromuscular function of patients. The aim of this work is the presentation of the evaluation of stomatognathic function through electromyography and electrognathography during orthodontic-surgical therapy.
SUBJECTS AND METHOD: Eighty patients who required orthodontic surgical treatment. Two electromyographic analyses and an electrognathograph were used for functional evaluation of the stomatognathic system, a Freely De Gotzen electromyogram and K6-I electromyogram and kinesiograph. Two duo trode silver/silver chloride electrodes were used. The obtained data were evaluated to analyse changes in function and mandibular kinematics over time. The patients were divided into groups based on gender, vertical dimension and skeletal Class in order to evaluate differences between the

groups. Statistical analysis was conducted with Levene analysis followed by *t*- and ANOVA tests with Bonferroni *post hoc* correction.
RESULTS: At the beginning of the treatment the patients presented compensatory equilibrium to dysgnathia that was altered by pre-surgical orthodontics and by surgical trauma. Functional rehabilitation continued after surgery.
CONCLUSION: The diagnostic and prognostic roles of electromyography and kinesiography in surgical orthodontic treatment have been demonstrated. Functional evaluation should be included in diagnostic and therapeutic surgical-orthodontic treatment planning.

162 FUNCTIONAL EVALUATION IN ADULT PATIENTS WITH OPEN AND DEEP SKELETAL BITES

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AIM: To compare mandibular kinesiology and neuromuscular function between open and deep skeletal bite adult patients before and after surgical orthodontic treatment.
SUBJECTS AND METHOD: Seventy patients (33 skeletal open bite, 37 skeletal deep bite) undergoing orthodontic-surgical treatment who periodically underwent electromyographic evaluation of the masticatory muscles (anterior temporal and masseter) and electrokinesiographic evaluation of mandibular movements. Two electromyographic instruments were used: the Freely electromyograph (De Gotzen, Legnano, Italy) and the electromyograph and electrognatograph K6-I EMG (Myotronics, Tukwila Washington, USA). Statistical evaluation was performed with *t*-tests and ANOVA.
RESULTS: A large number of differences were found between the open and deep skeletal bite patients underlined by analysis of the electromyographic data obtained with both electromyographic systems.
CONCLUSION: Morphological differences between open and deep bite patients can be demonstrated by instrumental examination and their correction after surgery is observable electromyographically and electrognathographically.

163 TREATMENT PLANNING FOR MAXILLARY CANINE DISPLACEMENT BASED ON INDIVIDUAL SKELETAL MATURITY

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AIM: In treatment planning for a palatally displaced canine it is important to determine the timing of potential eruption of the canine (when interceptive procedures can be attempted) versus impaction of the tooth. Thus the aim of this study was to assess the relationship between the eruption of the permanent maxillary canine and individual skeletal maturity in subjects with different skeletal relationships in the sagittal and vertical planes.
SUBJECTS AND METHOD: One hundred and fifty two subjects (63 males, 89 females) with erupting permanent maxillary canines. The individual stage of cervical vertebral maturation (CVM) was assessed on lateral cephalograms. Following this analysis, the subjects were divided into pre-peak (before the pubertal growth spurt, CS1 and CS2), peak (during the pubertal growth spurt, CS3 and CS4), and post-peak (after the pubertal growth spurt, CS5 and CS6) groups. Skeletal relationships in the sagittal and vertical planes were evaluated, and relationships to timing of canine eruption were statistically tested.
RESULTS: The pre-peak group comprised 86 subjects, the peak group 66 subjects. No subjects were classified as post-peak. The differences in prevalence rates between the pre-peak and peak groups were statistically significant ($P < 0.001$). The prevalence rate for hyperdivergent subjects showing eruption of the permanent maxillary canine in the pre-peak group (37.2%) was significantly higher than in the reference orthodontic population (21%).
CONCLUSION: Eruption of the permanent maxillary canine can occur at any stage during skeletal maturation before the end the pubertal growth spurt (CS1 through to CS4), with hyperdivergent subjects showing more frequently pre-pubertal canine eruption.

164 LONG-TERM SKELETAL AND SOFT TISSUE OUTCOMES OF BIONATOR THERAPY IN CLASS III MALOCCLUSION SUBJECTS

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AIM: The literature lacks long-term controlled data concerning the outcomes of functional jaw orthopaedics in Class II patients. The aim of this research was to evaluate the long-term skeletal and soft tissue changes induced by the bionator in Class II subjects at the completion of active growth.

SUBJECTS AND METHOD: Twenty Class II patients (6 males, 14 females) treated consecutively with the bionator. The sample was evaluated at T1, start of treatment; T2, end of Bionator therapy; and T3, long-term observation (including fixed appliances). Their mean age at T1 was approximately 10 years (T1), at T2 approximately 12 years and at T3 approximately 19 years (CS 6). The control group consisted of 20 subjects (8 males, 12 females) with untreated Class II malocclusions. Lateral cephalograms were analyzed at the three time points for all groups. Student's *t*-tests were used for comparisons of starting skeletal facial forms, and of the T1-T2 and T1-T3 changes between the groups.
RESULTS: The bionator group showed significant favourable T1-T2 changes both at the skeletal and dentoalveolar levels. The vertical dimension was increased. Significant modifications were also found for the soft tissues. The treated group showed a final improvement in soft tissue Pogonion of about 2.5 mm. Significant mandibular changes were noted in the treated group, with a net average 3.3 mm long-term increase in mandibular length in comparison with the untreated Class II controls.
CONCLUSION: Bionator treatment of Class II malocclusions maintains favourable results over the long-term with a combination of skeletal, dentoalveolar, and soft tissue changes.

165 LONG-TERM OUTCOME AND STABILITY IN TREATED CLASS I EXTRACTION AND NON-EXTRACTION PATIENTS

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AIM: When evaluating successful treatment result, both the effects of growth and the outcome of orthodontic treatment should be assessed. The purpose of this longitudinal cephalometric study was to evaluate changes in hard and soft tissue variables after treatment, post-retention and 10 years post-retention, and to compare extraction and non-extraction patients.
MATERIALS AND METHOD: Cephalograms of 37 patients, (extraction and non-extraction) with Angle Class I malocclusions were digitized and traced according to hard and soft tissue landmarks.
RESULTS: No significant differences in cephalometric values were identified between the extraction and non-extraction group. Significant changes over time, from were found for SNB, ANB, SNPog, Gonial angle, ML/NSL, ML/NL, interincisial angle, Ili/NB, Holdaway ratio, Ls/EL and Li/EL.
CONCLUSION: Soft tissue variables seemed to change during all of the intervals in the study, while the hard tissue measurements changed mostly during treatment and after the retention phase.

166 ANTERIOR DENTOALVEOLAR MORPHOLOGY IN RELATION TO NATURAL HEAD POSTURE

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AIM: To research the relationship between natural head posture and anterior dentoalveolar morphology.
MATERIALS AND METHOD: Fifty-two natural head positioned lateral cephalogram of subjects with a Class I malocclusion. Six cranio-cervical and 15 dentoalveolar variables were measured. The relationship between anterior dentoalveolar morphology and head posture was analyzed by Pearson correlation analysis.
RESULTS: Statistically significant correlations were found. Positive correlations were observed between the upper/lower dentoalveolar structures and head posture. Negative correlations existed between overbite and head posture.
CONCLUSION: Extension and flexion of the head affects the anterior dentoalveolar as well as craniofacial structures.

167 NOSE CHANGES FOLLOWING BIMAXILLARY SURGERY IN TURKISH SUBJECTS WITH CLASS III MALOCCLUSIONS

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AIM: Skeletal Class III dentofacial deformities may be the result of mandibular prognathism and/or maxillary deficiency. Severe skeletal Class III deformities are treated by orthognathic surgery in adulthood. Besides hard tissue changes, soft tissue changes are also observed after orthognathic surgery. The purpose of this study was to determine changes in the soft tissue nose profile in Turkish Class III patients, after maxillary orthognathic surgery.
SUBJECTS AND METHOD: Nine Class III patients treated by bimaxillary orthognathic surgery (mean age 19.93, 7 females, 2 males) while the control group consisted of 11 Class III subjects with mandibular prognathism (mean age 19.45,

10 females, 1 male). Conventional lateral cephalometric radiographs were used to evaluate changes after surgery. Steiner and McNamara cephalometric analyses and nose measurements were performed (N = –Pr, Pr-N = Sn, Ac-Pr, hump, NLA, NBA, NMA, SFC, Dconv, Cconv, NboneL, NboneA). The obtained data were analyzed statistically by paired *t*- and Student's *t*-tests.
RESULTS: Statistically significant differences were found in the treated group before or after surgery for the following measurements: Pr-N = Sn (nasal depth 1), Ac-Pr (nasal depth 2) ($P < 0.05$), NMA (naso-mental angle) ($P < 0.01$), NBA (nasal base angle) and D-conc (lower dorsum convexity) ($P < 0.05$). With regard to SNA, Na Perp.-A ($P < 0.001$), Co-A ($P < 0.01$) ANB and CoGn-CoA, the measurements were statistically different ($P < 0.01$). The remaining parameters were statistically insignificant. Comparison of the treatment and control group showed that Na Perp-Pog, Hump and SFC (soft tissue facial convexity) measurements were statistically insignificant. D-conv ($P < 0.01$) and all other parameters exhibited statistically significant differences ($P <0.001$).
CONCLUSION: Soft tissue nose profile changes are observed in Turkish Class III subjects after bimaxillary orthognathic surgery.

168 EFFECTS OF CHIN CUP THERAPY ON SYMPHYSIS MORPHOLOGY

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AIM: The chin cup has been used for many years to treat skeletal mandibular prognathism in growing patients. The pull on the orthopaedic-force chin cup is orientated along a line from the mandibular symphysis to the mandibular condyle. The purpose of this study was to evaluate the changes in symphysis morphology after chin cup therapy.
MATERIALS AND METHOD: Pre- and post-treatment lateral cephalometric radiographs of 36 subjects who had Class III malocclusion or anterior crossbite and seven subjects without a Class II malocclusion (control group). SNA, SNB, ANB, Na-Ba/Ptm-Gn, SN-MP, PP-MP, Ar-Go-Na, N-S-Ar, N-Ar-Go, ANS-Me/N-Me, S-Go/N-Me, symphysis height, (SY), symphysis depth (SD), SY/SD and NB/MP measurements were performed. The data obtained were statistically analyzed using a Student's *t*- and paired *t*-tests.
RESULTS: Pre- and post-treatment SNA, ANB, Ar-Go-Na and NB/MP measurements ($P < 0.001$) were statistically significant. Pre- and post-treatment SNB, SY, SY/SD measurements were also statistically significant ($P < 0.01$). Pre- and post-treatment S-Ar-Go measurements were significant ($P < 0.05$). There was no statistical significance for any of the other measurements. The differences between the treatment and control group was statistically significant for all measurements ($P < 0.001$).
CONCLUSION: Chin cup therapy has an effect on symphysis morphology; it increases symphysis height. It also affects SNA, ANB angles and lower anterior face length.

169 ORAL HYGIENE IN ORTHODONTIC PATIENTS – A RANDOMIZED CLINICAL TRIAL

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AIM: To verify, in a single-blind, randomized clinical trial, the oral hygiene efficacy of different tooth brushes in orthodontic patients. The brushes tested had been chosen after prior *in vitro* tests.
SUBJECTS AND METHOD: Thirty-five regular orthodontic patients with a minimum of six brackets bonded to the upper anterior teeth were randomly assigned to three experimental groups of different manual toothbrushes. The best performing *in vitro* tooth brushes with a staged (Parodin plus former Candia Parodin, Migros, 12 patients) or a V-shaped (Oral-B Ortho, Procter & Gamble, 12 patients) brush head design were compared with a planar control brush for cleaning efficacy (Paro M 43, Esro, 11 patients). The participants were advised to brush their teeth twice daily, for 2 minutes, irrespective of the toothbrush used, for 3 weeks. A standard toothpaste (elmex Junior, Gaba) was provided. Prior to the start and at the end of the study the Gingival Index (GI) was undertaken at the mesial, buccal and distal tooth sites (18 sites per patient) to evaluate the level of oral hygiene.
RESULTS: Of the 35 subjects who started the clinical investigation, two (one from the control group and one from the Oral-B cohort) did not attend after 3 weeks and were excluded. At baseline, the control group had a significantly better oral hygiene level (39 sites with GI ≥2) than the two test groups (Parodin 76 sites, Oral-B 70 sites). After 3 weeks of manual tooth brushing with the respective devices, the control group showed no improvement in oral hygiene level (40 sites with GI ≥2), whereas the Parodin-cohort (55 sites with GI ≥2) and the Oral-B group (42 sites with GI ≥2) showed an improvement of 27 to 40 per cent, respectively.

CONCLUSION: Participants using staged and V-shaped brush head designs showed a significant improvement in their level of oral hygiene and gingival health.

170 EVALUATION OF DENTAL AESTHETICS AND ORTHODONTIC TREATMENT NEED

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AIM: To quantitatively determine orthodontic treatment need and dental aesthetics by evaluating the level of malocclusion in a group of young Spanish adults using the Index of Orthodontic Treatment Need (ION).
SUBJECTS AND METHOD: Sixty young adults aged 20-32 years (61.7% females), without a history of previous orthodontic treatment. Their mean age was 24.38 years.
RESULTS: Forty per cent had an IOTN level 3 whereas 46.7 per cent were not in need of treatment or presented a low level of ION. The mean of IOTN was 2.50 with a standard deviation of 0.983. For the aesthetic component, all subjects considered photograph 10 to be the least attractive and 36.7 per cent placed themselves as one code from the ideal. Comparing both components of the IOTN it was found that 93 per cent of the subjects presented very low or no treatment need, while 38.3 per cent were classified as a moderate treatment need.
CONCLUSION: Ninety three per cent of subjects presented very low or no treatment need, a finding that was statistically significant. The largest percentage of subjects answered that their tooth corresponded to numbers 1 or 2 of the stimulus of aesthetic component photographs. Forty per cent presented level 3 of the IOTN, with a moderate or no treatment need, whereas 46.7 per cent had a low level and were not in need of treatment. There was no treatment need in 18.3 per cent.

171 EFFECT OF FLUORIDE ON ENAMEL, WITH EMPHASIS ON FIXED APPLIANCE THERAPY

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AIMS: Decalcification of enamel surrounding brackets and bands is a significant concern during fixed appliance orthodontic treatment. Fluoride has been established as the most important caries preventive agent in dentistry with the following effects: 1) inhibition of mineral loss during demineralization, 2) increased mineral uptake during remineralization. However the protective mechanisms involved remain unclear. In this research analytical investigations with emphasis on X-ray fluorescence spectrometry were performed to determine the concentration of fluoride present in dental enamel after fluoridation and to investigate enamel structural implications in the depth associated with fluoride.
MATERIALS AND METHOD: Twenty impacted third molars were collected and stored in Hanks' balanced salt solution for three weeks. After disinfection with a thymol solution, the samples were treated with 37 per cent phosphoric acid, followed by fluoridation. Their leaching properties and structure were studied with the aid of flame atomic absorption spectrometry, scanning electron microscopy, micro-raman/infrared spectroscopy and synchrotron excited X-ray fluorescence spectrometry.
RESULTS: A significant quantitative and qualitative remineralization effect with fluoride could be observed. The characteristic X-rays of fluoride in the samples could selectively be determined by X-ray fluorescence spectrometry within a range without signal interference from main-component elements. This method showed satisfactory results compared with the other chemical methods.
CONCLUSION: From the perspective of analytical methods, fluoridation can be supported. X-ray fluorescence spectrometry allows high precision in the detailed analysis, excellent depth resolution and is valuable in the analysis of fluoride treatment effects.

172 CORRELATION BETWEEN MANDIBULAR AND CRANIAL BASE FEATURES IN SKELETAL CLASS III ANOMALIES

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AIM: In Class III anomalies, the mandible is located in a forward position in relation to the maxilla, causing a characteristic facial appearance, with major implications for aesthetics. The aetiology and expression of a Class III malocclusion must be

understood before it can be clinically corrected. The aim of this study was to determine whether any correlations exist between mandibular and cranial base alterations.
MATERIALS AND METHOD: Lateral cephalograms of 20 skeletal Class III patients from the southern region of Romania, aged 16-24 years, and a control group of 20 skeletal Class I subjects. The Class III patients were selected according to the following criteria: Class III anomaly, age (after the pubertal growth peak), no evident genetic syndromes or other dental and/or dentomaxillary anomalies. The control group was selected according to similar criteria in terms of age and gender.
RESULTS: For all skeletal Class III subjects, mandibular length was significantly increased, the cranial base was affected not only in terms of dimension, but also morphology (N-S-Ba), leading to a more forward position of the mandible by modification of condylion angle (Se -S-Cd).
CONCLUSION: The increase of mandibular sagittal length is associated with a normal/shortened maxilla. An overall reduction was also observed in the cranial base. S-Ba distance reduction was documented in most cases, while N-S distance reduction was variable.

173 DOES LOCATION OF CONGENITALLY MISSING TEETH AFFECT DENTOFACIAL MORPHOLOGY?

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AIM: To find out whether or not the location of congenitally missing teeth affects dentofacial morphology.
SUBJECTS AND METHOD: One hundred and fifty four patients with two or more congenitally missing teeth. In the first part of the study, the patients were divided into three groups. Group 1 comprised 37 patients with missing teeth only in the maxilla, group 2, 32 patients with missing teeth only in the mandible and group 3, 85 patients with missing teeth both in the maxilla and mandible. In the second part of the study, patients were again divided into three groups. Group 1 consisted of 45 patients with missing teeth only in anterior region, group 2, 57 patients with missing teeth only in posterior region and group 3, 52 patients with missing teeth both in anterior and posterior regions. Fifty Class I patients without any missing teeth served as the controls in both parts of the study. Eighteen angular and 17 linear measurements were performed on lateral cephalograms. All recorded data were statistically analyzed and compared among the groups.
RESULTS: Significant differences were found in anterior and posterior face heights, ramus height and soft tissue measurements, and upper and lower incisor measurements according to localization ($P < 0.05$). Patients with missing teeth only in maxilla had an increased upper lip-E plane length ($P < 0.05$) while those with missing teeth only in mandible or only in anterior region had decreased posterior face heights ($P < 0.05$). Patients with missing teeth only in posterior region had a shorter ramus and anterior face height ($P < 0.05$).
CONCLUSION: Localization of missing teeth significantly affects dentofacial morphology. Missing teeth in the maxilla result in more retrusive lower incisors and upper lip. Anterior and posterior localization of missing teeth has an important impact on face height measurements.

174 EFFECTS OF SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION ON CRANIOFACIAL MORPHOLOGY

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AIM: To evaluate the effects of surgically assisted rapid maxillary expansion (SARME) on craniofacial morphology in non-growing patients.
SUBJECTS AND METHOD: Twenty-eight patients divided into two groups. SARME, with a banded Hyrax-type expander, was carried out in group I (4 boys, 10 girls, mean age 19.6 ± 2.73 years). Rapid maxillary expansion (RME) with an occlusal-coverage Hyrax-type expander was applied to group II (4 boys 10 girls, mean age 14.2 ± 0.74 years). All expanders were activated twice a day (0.5 mm/day). Lateral and posteroanterior cephalograms and dental casts were obtained before and after expansion, and measurements were performed. Intra- and intergroup differences were statistically evaluated with Wilcoxon and Mann-Whitney *U* tests.
RESULTS: In both groups, significant increases were found in intercanine, interpremolar, intermolar, maxillary and nasal widths, and anterior face height ($P < 0.05$). Statistically significant intergroup differences were found for all maxillary dental cast measurements ($P < 0.05$) and in nasal cavity width ($P < 0.05$). No significant difference was found between cephalometric measurements of the groups ($P > 0.05$).

CONCLUSION: With both SARME and RME, successful expansion of maxillary dentoalveolar structures, nasal cavity and palatal widening were achieved. Compared with RME, SARME was found to be more effective in nasal cavity, palatal and dental arch widening.

175 EFFECT OF AUTOTRANSPLANTATION ON BONE REGENERATION IN ORTHODONTIC PATIENTS

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AIM: Horizontally impacted second molars pose a problem to orthodontists. The proximity of the crown of the second molar to the distal root of the first molar can denude the first molar distal root of periodontal ligament and bone. The option of uprighting the second molar extends the treatment time considerably and does not address the periodontal defect on the distal root of the first molar. The aim of this study is to present a protocol for the management of molar stacking complicated by bony defects in adjacent teeth, and to present the effect of autotransplantation on bone regeneration around adjacent teeth.
MATERIALS AND METHOD: Fourteen autotransplanted teeth followed-up radiographically and clinically at 1 and 4 weeks, 3 and 6 months and 1 and 2 year intervals. Examination involved the amount of bone regeneration, mobility, gingival pocket depth, and vitality test. The criteria of success were stability of the transplanted teeth, bone regeneration around periodontally affected adjacent teeth and normal lamina dura formation, and normal mobility and gingival pocket depth of the transplanted teeth as compared with control teeth. Different statistical analysis was performed, including Wilcoxon signed ranks test and repeated measures ANOVA.
RESULTS: The survival rate over at least 2 years (range from 2 to 7%) after autotransplantation was 92.86 per cent. Bone regeneration at the socket site and adjacent teeth was significantly improved. Mobility and gingival pocket depths of the autotransplanted teeth were normal when compared with the normal control teeth.
CONCLUSION: Due to the high success rate and the advantages gained, autotransplantation should be considered as a treatment option for management of molar stacking complicated by bony defects in adjacent teeth.

176 DO DIFFERENT TENSILE BOND STRENGTH STUDIES END IN THE SAME RESULTS?

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AIM: To compare the results of three common methods used for measuring orthodontic tensile bond strength.
MATERIALS AND METHOD: Thirty-three brackets were bonded to human premolars using Transbond XT. The teeth were mounted and randomly assigned to one of the three groups. In group 1, tensile force was delivered using a custom made blade, in group 2, loops of wire were engaged under the bracket tie wings, and in group 3 debonding pliers were used. The adhesive remnant index was also scored for each specimen.
RESULTS: A significant difference existed between the three groups ($P < 0.001$). The diametral compression method showed the highest (16.07 ± 3.90 MPa) and the custom made blade the least (6.28 ± 2.58 MPa) amount of tensile bond strength. The least dispersion was observed in group 2 (Coefficient of variation = 19.50%).
CONCLUSION: The results of orthodontic tensile bond strength tests may vary according to the method of force application. The results of the diametral compression test were significantly different from the other two groups. There is a need for standardizing orthodontic bond strength testing.

177 USING ULTRAVIOLET LIGHT TO ARTIFICIALLY AGE ELASTOMERIC CHAIN

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AIMS: To investigate the effect of ultraviolet type A light (UVA) exposure on the tensile properties of elastomeric chain and to compare its effect to the 'as received' product. UVA light exposure was used as a model for artificial ageing simulating prolonged storage of elastomeric chain.
MATERIALS AND METHOD: The three products tested were from Ormco, Forestadent and 3M. Tensile strength (n = 60) was measured after exposing the chains to UVA light for 0, 2, 3 and 4 weeks. Force decay was measured (n = 60) using chains that were artificially aged for 5, 10 and 14 days. The chains were subsequently stretched at a constant distance and the resulting forces were measured at 0, 1, 24 hours, 7, 14, 21 and 28 days. This test was used to simulate a clinical scenario of pre-stretching and subsequent shortening of elastomeric chain during orthodontic space closure.

RESULTS: In the tensile strength test, statistically significant differences were found that were related to the duration of UVA light exposure. The Forestadent chain, which had the second highest value for the as received product, showed the most consistent values over time with the lowest degradation. The Ormco product showed the lowest as received values as well as after UVA exposure; the 3M product had the highest loss of tensile strength. Significant differences were also found among chains in the force decay test. UVA light exposure of 10 days or more appears to mark a 'watershed' between the products – the 3M product had the most intact chains, while the Forestadent chain had some survivors, depending on the time the chain was stretched for. None of the Ormco product survived UVA light exposure for more than 5 days in the force decay test.
CONCLUSION: UVA light exposure may be used as a model for artificial ageing as it reduces force delivery and tensile strength of exposed chains.

178 BIOCOMPATIBILITY OF ORTHODONTIC BANDS AFTER EXPOSURE TO DENTAL PLAQUE

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AIM: Corrosion parameters of orthodontic alloys and appliances have frequently been assessed *in vitro*. Biocompatibility of orthodontic bands after *in vivo* use mimicking different oral hygiene conditions has so far been poorly investigated. The aim of this study was to assess the biocompatibility of orthodontic bands after exposure to human oral conditions, especially plaque accumulation, over the normal period of orthodontic treatment.
MATERIALS AND METHOD: Cell adherence and cell morphology of gingival fibroblasts grown on 32 orthodontic bands were tested. The bands had been seated intraorally from 6-37 months.
RESULTS: In areas without prior plaque attachment, cell adherence was found for 75.8 per cent of the bands. Cell morphology was evenly spread between spherical and elongated types. Areas with prior plaque attachment showed cell adherence for 83.9 per cent of bands. Cells were of a spherical morphology in 42.2 per cent and of an elongated morphology in 57.7 per cent of cases.
CONCLUSION: As no significant difference was observed in either cell adherence or cell morphology in areas with or without prior plaque attachment, it may be assumed that oral conditions during orthodontic treatment do not impair biocompatibility of orthodontic bands.

179 CHARACTERIZATION OF AS-RECEIVED AND *IN VIVO* ORTHODONTIC STAINLESS STEEL BRACKETS

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AIM: Contemporary orthodontic treatment mostly involves the use of bonded brackets, which can be manufactured from different materials. Most commonly used are stainless steel brackets. These brackets are predominantly made of austenitic stainless steel due to its superior corrosion resistance, excellent formability, and low cost. Because of the manufacturing process, variable amounts and different types of surface defects can be included. These surface defects provide predilection spots for the onset of corrosion. Additionally, galvanic corrosion can occur not only between the wire and the bracket, but also within the bracket if the wing and base material are not identical. The aim of this research was a topographical analysis of the bracket slot of as-received and used brackets and characterization of the alloys of two types of brackets.
MATERIALS AND METHOD: Standard edgewise (GAC Dentsply, New York, USA) and mini twin (Ormco Corporation, Glendora, California, USA) brackets. The brackets were collected, cleaned and coated with a thin gold layer for scanning electron microscopic analysis. Magnification went up to ×20000. Elemental analysis of the bracket base, wing and brazing material was performed to determine the alloys of each bracket.
RESULTS: As-received standard edgewise brackets showed more plastic deformation than the mini twin brackets. Pits, crevices and grain boundaries were observed on all brackets. There was an increase of plastic deformation and scratches on both types of brackets. Elemental analysis revealed that the base and wing material were not the same either in the GAC or Ormco brackets. A different brazing material was used by both manufacturers.
CONCLUSION: As-received brackets show different degrees of surface defects. These defects tend to increase after intra-oral use. As a consequence of the different alloys in each bracket, galvanic corrosion may occur.

180 COMPARISON IN THE ADHERENCE LEVEL OF *STREPTOCOCCUS MUTANS* AND *STREPTOCOCCUS SOBRINUS* ON SELF-LIGATING BRACKETS***

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AIM: To examine the adherence capacity of self-ligating brackets of cariogenic *S. mutans* and *S. sobrinus* that can result in enamel decalcification.
MATERIALS AND METHOD: Five types of self-ligating bracket (Clippy-C, Tomy; Mini Clippy; Clarity SL; Speed; Damon 3) for the experimental group and the composite resin bracket (Spirit MB), metal brackets (Victory) and polycrystalline alumina brackets (Clarity) for the control group. To assess the adhesion status, the brackets of the experimental and control groups were placed on a 24-well plate containing basal medium with 20 per cent sucrose added and cultured for 3, 6, and 24 hours.
RESULTS: For *S. mutans*, there was no difference in the total adhesion amount by bracket type or incubation time ($P > 0.05$). There was a significant difference in the total adhesion amount with the different types of bracket in *S. sobrinus*. Victory showed greater adhesion than Clarity SL and Spirit MB ($P < 0.05$). The adhesion amount for *S. Sobrinus* after 3 hours of incubation was higher than for Clippy-C and Spirit MB. There was no significant difference of adhesion amount following 6 and 24 hours incubation ($P < 0.05$). Scanning electron microscopy examination showed that adhesion amount assumed a high rate for Clippy-C and Victory, and a low rate for Clarity SL.

181 COMPARISON OF CEPHALOMETRIC MEASUREMENTS: COMPUTERIZED VERSUS CONVENTIONAL ANALYSIS

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AIM: To evaluate intra-examiner repeatability and reliability of cephalometric measurements, using software and the manual tracing technique.
MATERIALS AND METHOD: Sixty lateral cephalograms were randomly selected and 11 angular and seven linear parameters were traced and measured using the manual method and Orthalis 4.0. A Student's *t*-test for independent and paired samples was used to compare the mean values of the differences.
RESULTS: The general degree of reproducibility was high. Significant statistical differences were identified for FMIA, interincisal angle, SNOcl, SNGoGN, ANB and for I/NA, AoBo. The repeatability of the computerized measurements was greater when compared with the manual tracings. Only FMIA angle showed a difference greater than 2 degrees, which was considered to be clinically unacceptable. The overall reliability of the computerized measurements was clinically acceptable. Statistically significant differences were identified for SNA, SNB, ANB, SND, SNOCl, FMIA, IMPA, angle Z and AoBo, UL, TC, Hp and Ha. Clinically unacceptable differences were observed for SNOcl, FMIA, Z angle, Hp and Ha.
CONCLUSION: Measurements with the aid of Orthalis 4.0 cephalometric software presented an acceptable degree of repeatability and reliability when compared with conventional measurements. The time saving with Orthalis 4.0 can an advantage.

182 THE BIDIMENSIONAL TECHNIQUE *EN MASSE* RETRACTION USING SELF-LIGATING APPLIANCES

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AIM: The bidimensional (BiDi) technique emphasizes the three-dimensional (3D) control of maxillary incisors and space closure in extraction treatment by sliding mechanics, but needs double steps of retraction phases (first the canines then the incisors). The aim of this presentation is to illustrate 3D control during *en masse* retraction (one single step) with sliding mechanics using the self-ligating BiDi technique in extraction treatment.
SUBJECTS AND METHOD: Sixteen adolescent patients (mean age 13.9 ± 1.42 years) with a Class II division 1 malocclusion, normal skeletal pattern, increased overjet (7 mm) and no crowding in the lower arch, treated with two upper first premolar extractions. Orthodontic treatment was carried out using fixed orthodontic self-ligating brackets (In-Ovation-R) with a BiDi prescription. The brackets consisted of two different slot size (0.018×0.025 inch on the anterior teeth and 0.022×0.028 inch on the lateral-posterior teeth). During *en masse* retraction, a 0.018×0.022 inch stainless steel wire with crimpable hooks distal to the canines, molar toe-in and an accentuated curve of Spee, was inserted in order to manage torque control of the incisors. In the lateral segments the same arch was undersized allowing easy sliding mechanics during space closure with a NiTi coil spring (300 g) extended from the first molar hooks to the archwire hooks. A transpalatal bar was used for posterior anchorage. Panoramic and lateral radiographs were obtained for all patients at the beginning and end of treatment.
RESULTS: A Class I canine and Class II molar relationship was achieved for all patients at the end of treatment. All showed bodily movement of the upper incisors with good torque control, confirmed by cephalometric superimposition following the method of Björk, which showed a mean variation of 1-ANS/PNS of 9 degrees.

CONCLUSION: The modified BiDi technique with *en masse* retraction on sliding mechanics using a 0.018 × 0.022 inch stainless steel wire and self-ligating brackets could be considered an effective and less time-consuming option in extraction treatment.

183 DIAGNOSTIC SET-UP AND OCCLUSAL SPLINT GUIDE

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AIM: Model surgery, typically performed in the week before the surgical procedure, is an integral part of orthognathic surgery treatment protocol. The purpose of this work is to describe an experimental protocol to optimise pre-surgical orthodontic planning by the study of skeletal discrepancies.
MATERIALS AND METHOD: The protocol comprises the following sequence of treatment: 1) face-bow record; 2) three-dimensional cephalometric surgical prediction on lateral, postero-anterior and axial radiographs; 3) model surgery based on cephalometric and aesthetic planning simulated on a semi-adjustable articulator. After model surgery, a pre-surgical diagnostic set-up is created; 4) reproduction of the original skeletal situation discrepancies on the articulator – this position represents the final orthodontic preparation to achieve before surgery; 5) an occlusal thermoplastic material splint tightly formed over the teeth is then fabricated representing a guide for the pre-surgical preparation.
CONCLUSION: Using measurements provided by the orthodontist and surgeon, the orthodontic laboratory can create the pre-surgical set-up, from which a soft splint can be fabricated for clinical reference. The orthodontic diagnostic set-up is completed to the ideal occlusion, representing the final tooth position after surgery. This type of protocol has the overall purpose of improving the quality of care to the patient and allows the orthodontist to improve dental and skeletal treatment planning leading to better biomechanics and treatment results.

184 PHOTOGRAPHIC PROFILE ANALYSIS OF PATIENTS WITH PIERRE-ROBIN SEQUENCE

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AIM: Pierre-Robin sequence is characterized as a congenital combination of malformations of micrognathia, glossoptosis and a median cleft palate (60 to 80%). Every 8,000 to 20,000 births is a baby with Pierre-Robin sequence. The patients often suffer from obstructions in the respiratory tract. Newborns with Pierre-Robin sequence show a typical triad. The intention of this study was to compare growth of the mandible of patients with Pierre-Robin sequence during their first year of life.
SUBJECTS AND METHOD: Using the orthodontic planning software, Onyx Ceph3® for photographic profile analysis, six newborns with Pierre-Robin sequence were examined. All were treated with a modified upper plate with an individual pharyngeal spur. The babies were monitored to check their oxygen saturation during treatment. Photographs were taken before treatment with upper plate (T1), 4 months after insertion of the plate (T2) and after palatal surgical closure (T3). For the profile analysis, the angle between glabella (Gl), labiale superius (Ls) and soft pogonion (Pog) was measured.
RESULTS: The changes of the profile were statistically significant between the three examinations. Between the T1 and T2 the angle of Gl-Ls-Pog increased on average by 13.25 degrees. Between T1 and T3, Gl-Ls-Pog angle changed, on average, by 36.45 degrees.
CONCLUSION: Conservative orthodontic treatment of Pierre-Robin sequence patients with a modified upper plate resulted in a major change in the profile. There was a positional change of the retrognathic mandible. Facial growth of these patients, especially of the lower jaw, should be controlled routinely over a longer time period.

185 FIXED FUNCTIONAL TREATMENT VERSUS PREMOLAR EXTRACTIONS IN YOUNG ADULTS

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AIM: To compare dentoskeletal and profile changes following three treatment protocols: Jasper Jumper application (J), two upper premolar extractions (2P), and four premolar extractions (4P).
MATERIALS AND METHOD: The initial and finishing cephalograms of 91 young adults (54 males, 37 females, 12-17 years of age) with a moderate Class II division 1 malocclusion (overjet ≤ 5 mm, ANB ≤ 4°, GoMe-SN 25-39°). The distribution of the subjects was 36 per cent for the J group, 31 per cent for the 2P group and 33 per cent for the 4P group. The mean ages in three groups were 14.25, 15.08, and 14.42 years, respectively. Thirteen skeletal, 16 dental, and five soft tissue parameters were analyzed, by means of hand-traced cephalograms. The method error was calculated 1 month later.

RESULTS: ANB decreased most in THE J group and least in the 2P group. In the J group, correction was due to maxillary restriction rather than mandibular skeletal growth. The extraction groups showed bimaxillary retrusion, mainly in the maxilla. The mandibular retrusive effect was more evident in the 2P group. Vertical pattern and lower anterior face height increased in all groups, and dental movements were in accordance with the treatment mechanics used. Profile convexity decreased in the J and 4P groups, while the 2P group showed an insignificant increase. Intergroup comparisons revealed no significant differences in maxillary position, vertical dimension, or occlusal plane changes. Significant differences were observed mainly in mandibular sagittal position, dental movements, and soft tissue profile.
CONCLUSION: The decision regarding extractions in young adults should be based mainly on initial mandibular position and profile type.

186 EVALUATION OF SKELETAL CHANGES INDUCED BY SURGICALLY ASSISTED RAPID PALATAL EXPANSION

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AIM: A Class II anterior open bite and/or a steep mandibular plane angle are frequently considered a contraindication to surgically assisted rapid palatal expansion (SARPE). Nevertheless, few studies have investigated the maxillary and mandibular effects after SARPE on the sagittal and vertical planes. The aim of the present research was to evaluate the sagittal and vertical effects after SARPE.
SUBJECTS AND METHOD: Twenty-one consecutive adult patients (7 males, 14 females; mean age 25.6 ± 6.3 years). A subtotal Le Fort I osteotomy with pterygomaxillary disjunction was carried out in all patients. Lateral cephalometric radiographs were taken during pre-operative assessment (T0) and 6 months after the end of expansion (T1). The cephalometric measurements on the radiographs were: SNA, SN-Sna; Frankfort horizontal plane^NA, SN^palatal plane, CF-A, Frankfort horizontal plane^palatal plane, SNB, SnPg, SN^GoGn, mandibular plane angle (FMA), upper anterior face height/total anterior face height, lower anterior face height/total anterior face height, upper posterior face height/total posterior face height, total anterior face height/total posterior face height, upper incisor^NA, upper incisor^SN, upper incisor^, Frankfort horizontal plane. Independent sample *t*-tests and ANOVA analyses were used.
RESULTS: Statistically significant changes were observed only for upper incisor^NA ($P = 0.04$). No skeletal sagittal or vertical variation was found after SARPE.
CONCLUSION: No sagittal and/or vertical skeletal displacement could be linked to SARPE treatment. Consequently, Class II, anterior open bite and/or a steep mandibular plane angle cannot be considered an outright contraindication to its use. Upper incisors retroclination could result after SARPE.

187 VEGETABLE ALTERNATIVES TO FIGHT AGAINST DENTAL MICROBIALS

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AIM: Plant extracts used as anti-infectious ecological alternatives to conventional treatments have many advantages, the most important being the very low risk of side-effects. Many antiseptic substances similar to antibiotics (usnic acid), which curb or destroy the development of microorganisms, have been found. The aim of this research was to investigate *in vitro* the influence of usnic acid on microbial development in orthodontic devices.
MATERIALS AND METHOD: Twenty dental plates, obtained from 20 different subjects obtained under sterile conditions were placed in physiological sterile water for 1–15 minutes with a suspension of usnic acid at a concentration level of 200 μg/ml. A sample for each schema was taken and put placed a brain heart infusion environment in order to set the increase curb by determining the total number of germs developed at different time intervals since incubation (3-24 hours). Determination of the total number of microorganisms was achieved using the method of decimal microdilution and spot sampling on blood gelose.
RESULTS: Usnic acid selectively curbed the development of biofilms formed by gram-positive bacteria and haemolytic expression of the microorganisms isolated on the dental plates. The rate of multiplication of the isolated microorganisms on the dental plate was influenced by the preceding contact with usnic acid; their increase curb being modified. These effects demonstrate the interference of usnic acid with the mechanisms of intra and inter-signalling based ‘quorum sensing and response’.
CONCLUSION: Use of usnic acid prevents dental plate microorganism formation and is a new ecological anti-infective alternative to conventional antibiotheraphy.

188 CONSIDERATIONS ON THE THERAPEUTIC INTERVENTION IN MIXED DENTITION CLASS III CASES

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AIM: The timing of orthodontic intervention in Class III anomalies is controversial. The aim of this study was to investigate orthodontic intervention in Class III subjects (especially pseudo Class III) by taking into consideration several advantages related to the response to orthodontic treatment, orthodontic means, duration and stability over time.
SUBJECTS AND METHOD: Thirty patients in the early mixed dentition (approximately 7-8 years of age), divided into two equal groups. The first group included patients with true mandibular prognathism and the second patients with pseudo-prognathism, orthodontically treated during 2002-2005. The current clinical assessment conducted in 2009, a minimum of 5 years after the end of treatment, focused on the stability of the treatment result while maintaining the overbite.
RESULTS: For the 15 patients with pseudo prognathism, the results were maintained. Five of the skeletal Class III patients required further treatment, due to the association with other dentofacial anomalies, and four-needed comprehensive orthodontic treatment for Class III anomalies.
CONCLUSION: Early treatment of Class III anomalies is beneficial to ensure harmonious growth of both jaws, to create conditions for maxillary development along with bite jumping, set the correct occlusal relationships and improve dentofacial functions, including aesthetics. Early orthodontic treatment, although limited, is indicated in skeletal Class III subjects as an element of interception for severe occlusal disturbances, or as palliative factor leading to a less severe clinical outcome in complex orthodontic interventions.

189 EFFECT OF A CHLORHEXIDINE-FLUORIDE GEL ON PERIODONTAL HEALTH IN ORTHODONTIC PATIENTS WITH FIXED APPLIANCES

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AIM: Cervitec Gel (Ivoclar Vivadent AG, Liechtenstein) is an oral health care gel that includes chlorhexidine and fluoride, and is used for the protection of gums and teeth. The aim of this study was to evaluate the effect of Cervitec Gel on periodontal health and levels of *P. gingivalis* and *T. denticola* in patients undergoing fixed orthodontic treatment for at least 4 months.
SUBJECTS AND METHOD: Twenty-five patients with fixed orthodontic appliances randomly divided into two groups. Thirteen patients were assigned to the test group (mean age 15.31 years) and given Cervitec Gel, and the remaining 12 patients comprised the control group (mean age 15.17 years) and were given a placebo. All patients used the same toothbrush (Banat, Turkey). After periodontal prophylaxis and oral hygiene motivation, plaque index (PI), gingival index (GI), probing depth (PD) and bleeding on probing (BOP) were recorded and subgingival plaque samples were collected. All measurements were repeated after toothpaste application on day 0, 2 weeks and 1 month. Bacterial identification was performed using RT polymerase chain reaction. Intragroup and between group comparisons were undertaken using the Student's *t*- and Mann Whitney *U*-tests.
RESULTS: Intragroup comparisons revealed that PI and GI significantly decreased, while PD, BOP and bacterial indices did not show significant changes in either group. No significant differences were determined in intergroup comparisons.
CONCLUSION: Application of Cervitec Gel did not demonstrate any effect on the clinical indices and bacterial composition of orthodontic patients with fixed appliances.

190 EFFECTS OF A FACEMASK COMBINED WITH A CHINCAP ON MAXILLARY GROWTH IN SKELETAL CLASS III SUBJECTS

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AIM: To investigate whether posterior rotation of the mandible can be corrected with the use of a chincap combined with a facemask, and if the sagittal maxillary growth will be affected.
SUBJECTS AND METHOD: Twenty-nine skeletal Class III patients with maxillary retrusion and normal vertical skeletal growth patterns, treated with rapid palatal expansion (RPE; acrylic cap splint type of Hyrax) and maxillary protraction with a Petit type facemask applying a force of 400 g on each side. In group 1 (16 patients) a posterior high-pull chincap force of 120 g on each side was applied to the chincap part of the facemask by means of hooks for a mean treatment period of 0.82 years, whereas in group 2 (FM) the period was 0.89 years. Pre- and post-treatment lateral cephalograms were used to study the changes of six landmarks, and maxillary rotation using Björk's maxillary superimposition, three linear and five angular

measurements were made. Three-way ANOVA with repeated measurement in time was used to evaluate the data. Intragroup comparison was controlled by Duncan multiple comparison test when necessary.
RESULTS: No statistically significant difference was found between the groups except for the mandibular plane angle, which was increased by 1.88 degrees in group 2.
CONCLUSION: Maxillary growth was not affected by adding a high-pull chincap force to a maxillary protraction facemask to prevent mandibular posterior rotation.

192 SOFT TISSUE PROFILE CHANGES IN THE EARLY TREATMENT OF A DEEP BITE WITH MYOFUNCTIONAL APPLIANCES

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AIM: To investigate, in a longitudinal randomized study, the soft tissue profile changes in deep bite malocclusion subjects when treatment is started during the early mixed dentition with a myofunctional appliance.
SUBJECTS AND METHOD: Twenty-eight children (16 females, 12 males, mean age 6.3 years) randomly divided into two groups. In the myofunctional appliance group (MA) treatment was initiated immediately while the control group received no orthodontic treatment. Digital profile photographs were taken of all subjects at the beginning of the study and after one year. The photographs were traced and the landmarks identified manually.
RESULTS: The mean change in soft tissue ANB angle in the MA group was –1.7 degrees (SD 0.97) and in the controls 0.1 (SD 1.44). The difference between the groups was significant ($P < 0.001$). The mean change in the labiomental angle in the MA group was 5.6 degrees (SD 7.14) and in the controls 0.1 degrees (SD 5.41; $P < 0.003$).
CONCLUSION: Treatment with myofunctional appliances changed the soft tissue profile by straightening the profile in the MA group when compared with the controls.

193 EVALUATION OF CEPHALOMETRIC MEASUREMENTS OF PATIENTS AFTER ORTHOGNATHIC SURGERY

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AIM: Lateral cephalometric radiography is widely used as a descriptive, analytical, and diagnostic tool in clinical orthodontics and prosthodontics. The application of numbers to the radiographic images gives the impression of mathematical accuracy. The purpose of this study was to evaluate lateral cephalometric radiographs taken before and after surgical treatment of orthognathic anomalies and to compare the post-operative radiographs with normative cephalometric data.
SUBJECTS AND METHOD: Twenty-nine Caucasian orthognathic patients aged from 18 to 40 years. The group consisted of 15 Class III patients, six Class II patients and eight open bite patients. Images were taken with the head in a natural position, the teeth in centric occlusion, and the lips in repose. The analysis of McLaughlin and Arnett was used. Fourteen measurements (computer analysis Dolphin Imaging 11.0) were used to determine the skeletal sagittal jaw relationship. Measurement of the soft tissues was also carried out. The cephalograms were analyzed twice by two dentists. Five randomly selected radiographs were remeasured after a period of two weeks. There were no significant differences in the measurements.
RESULTS: The measurements after surgical and orthodontic treatment were close to normative international standards. After orthognathic therapy there was a return to a skeletal and dental Class I relationship. The results showed that SNA, SNB, **ANB** angle was successfully treated in comparison with the standards. Wits appraisal remained deviated in the direction of the original defect.
CONCLUSION: Dental and skeletal cephalometric values after orthognathic therapy are very close to standard values. More discrepancies were found for soft tissue values.

194 STABILITY OF IMMEDIATELY LOADED MINISCREW IMPLANTS ACCORDING TO FORCE LEVELS***

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AIM: To evaluate the initial stability in immediate loaded miniscrew implants loaded with different force levels.

MATERIALS AND METHOD: Two adult mongrel dogs (12 months of age) with an initial weight of 29 kg. Fifty-four newly designed titanium self-tapping miniscrew implants were implanted in the edentulous areas. The miniscrews were loaded with high and low forces in both the maxilla and mandible.
RESULTS: Initial stability was decreased in the first 3 weeks due to the weakening effects of bone remodelling. The high and low force groups did not show a significant difference with regard to failure rate, force magnitude, or mechanical and histological evaluation.
CONCLUSION: It is assumed that force is not the primary factor for miniscrew failure and future studies should evaluate other factors or combinations of factors as reason for miniscrew failure.

195 DOES ORTHODONTIC TREATMENT HAVE ANY EFFECT ON MORPHOPSYCOLOGY?

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AIM: The relationship between physical and morphological appearance and psychological characteristics is discussed in morphopsychology. In dentistry, the size and width of the mouth is considered in morphopsychology. A protrusive mouth indicates strong ambition, while a retracted mouth is usually suggestive of being affected by rules. The aim of this study was to evaluate the morphologic aspects of orthodontic treatment.
MATERIALS AND METHOD: Pre- and post-treatment frontal photograph of 30 patients treated with standard edgewise and 30 with straight edgewise (MBT) appliances. All had a Class I malocclusion (ANB = 2–4, Wits appraisal = –1-1 and moderate crowding). The proposed treatment plan was extraction of four first premolars. On each photograph the distance between the most superior point of the upper lip and the most inferior point of the lower lip and the inter commissural width were measured using Photoshop software. The ratio between lip thickness and intercommissural width was calculated in order to avoid magnification errors. This ratio was calculated between the pre- and post-treatment photographs for both methods, and the data were statistically analyzed using SPSS software.
RESULTS: The mean pre- and post-treatment lip thickness/intercommissural width ratio in patients with standard edgewise appliance was 0.3830 ± 0.1191 and 0.3125 ± 0.06668 respectively, which was statistically significant ($P \leq 0.001$), and the same pre- and post-ratio for the second group was 0.3313 ± 0.08753 and 0.3009 ± 0.0559 which was statistically significant ($P = 0.019 < 0.05$). The mean reduction in the ratio was not statistically significant between either method ($P = 0.127$).
CONCLUSION: Extraction of teeth can cause retrusion of the lips. It is suggested that in borderline cases non-extraction treatment should be considered.

196 BUCCAL CORRIDOR RATIO – DOES IT FOLLOW A RULE?

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AIM: One of the most important aspects of a ‘beautiful’ smile is amount of tooth shown during smiling and the negative space created between the teeth and cheeks. The aim of this study was to determine the relationship between the amount of tooth shown during smiling and intercommissural width (buccal corridor ratio) in Class 1 malocclusion patients.
SUBJECTS AND METHOD: One hundred and thirteen patients with a Class I malocclusion with crowding (ANB 2–4, Wits = –1 to 1, Class I canine relationship). For each patient three photographs were taken during posed smiling and the photograph that was considered as being more close to a posed smile was selected. The ratio between the amount of tooth displayed and intercommisural width was determined and measured as the buccal corridor ratio using the Photoshop cs2 software. The data were analysed using the Statistical Package for Social Sciences.
RESULTS: It seems that in Class I malocclusion subjects the ratio is approximately 1.3.
CONCLUSION: Since the amount of tooth shown during smiling is an important compartment of smile aesthetics it should be considered during reconstructive treatment. In Class I malocclusion patients it follows a rule. Buccal corridor ratio can be used as the transverse limitation of tooth positions.

197 EFFECTS OF PALATAL PLANE ROTATION ON SOFT TISSUE CHANGES IN DOUBLE JAW SURGERY

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AIM: For the correction of skeletal Class III malocclusions, a combination of maxillary clockwise rotation (posterior maxillary impaction) and mandibular setback is one of the most common double jaw orthognathic surgical procedures. The

purpose of this study was to assess soft tissue changes in the upper lip and nose area following double jaw surgery according to the degree of rotation.
SUBJECTS AND METHOD: Fifty-four patients who underwent maxillary posterior impaction and mandibular setback surgery for the correction of skeletal Class III malocclusions were grouped by the degree of palatal plane rotation: group 1 (0–3°), group 2 (3–6°), and group 3 (6–9°). Lateral cephalograms taken 1 month before (T1) and 6 month after (T2) surgery were traced and measurements were performed.
RESULTS: With horizontal backward movement at ANS and U1E and accompanying movement of the upper lip, a progressive increase was observed from group 1 to 3, and statistically significant differences were found between groups (U1E; $P < 0.01$, Stms; $P < 0.05$). A moderate correlation was identified between soft tissue movement of the upper lip and underlying skeletal movement (point A, U1E) in the horizontal plane ($P < 0.01$) but not in the vertical plane. The ratios of soft to hard tissues changes at Stms to U1E increased from group 1 (40.3%) to group 2 (181.9%) but decreased in group 3 (106.8%).
CONCLUSION: The ratio of soft to hard tissue changes specific to the degree of rotation may improve the accuracy of predicting treatment results.

198 THE POSITION OF THE HYOID BONE INVESTIGATED BY DIFFERENT METHODS OF ANALYSIS OF A RADIOGRAPH

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AIM: To investigate the position of the hyoid bone.
SUBJECTS AND METHOD: Sixty subjects, evenly divided into two groups: those with a normal posterior position of the mandible and a control group with a normal mandibular position. The position of the hyoid bone was determined using different methods suggested in the literature and compared with the spine, mandible and cranium.
RESULTS: In general, the hyoid bone followed the posterior position of the mandible, though less in proportion. Comparison of the results with published studies was not possible due to the different methodologies used.

199 POSTURAL INVESTIGATIONS IN CHILDREN AND JUVENILES WITH AND WITHOUT A CROSSBITE

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AIM: The success of crossbite therapy is not always guaranteed. The reasons are varied. Therefore, it is important to determine if the sensorimotor system may have an influence on therapy. The aim of this research was to determine the interdependency between a lateral crossbite and the sensorimotor system in children and juveniles.
SUBJECTS AND METHOD: Sixty-five children and juveniles (28 males, 37 females). Thirty-two had a crossbite. All subjects were posturographic examined and compared with each other. The Interactive Balance System (Germany) was used. It differentiated on four force plates vertical forces in the forefoot and backfoot areas. For eight standardized test items analytical frequency treatment of the force-time-signal was possible. The parameters were evaluated with the Statistical Package for Social Sciences, version 16.00 (SPSS Inc., Chicago, Illinois, USA) and BIAS, version 9. After Kolmogorov-Smirnov testing, as the results showed that the samples followed a normal distribution, the *t*-test was used.
RESULTS: No significant differences were found between the two groups in the parameters of the sensorimotor system. No difference in the function of sensorimotor subsystems was found between patients with or without a crossbite by posturometric measurements.
CONCLUSION: A crossbite does not seem to influence either postural stability or the fall index in children and juveniles. It is feasible that a crossbite can cause body asymmetry after many years of manifestation and thus early preventive treatment should be carried out.

200 DYNAMICS OF THE ERUPTION OF PERMANENT TEETH IN DIABETES TYPE I CHILDREN

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AIM: Diabetes is one of the most widespread chronic diseases that can also affect oral health. The objective of this study was to determine the effect of diabetes type 1 on the dynamics of the eruption of permanent teeth in children in the mixed dentition period and its effect on the incidence of crowding.
SUBJECTS AND METHOD: Seventy-nine children (average age of 10.8 ± 1.8 years): 40 randomly referred children (21 boys, 19 girls, average age 10.7 ± 1.8 years) with diabetes type 1 and a control group of 39 healthy children (19 boys, 20 girls, average age 10.8 ± 1.7 years). Children undergoing orthodontic treatment were excluded. The level of eruption of the teeth was assessed using study models. Each tooth was categorized into one of six levels of eruption, defined according to the data on the standard development of the jaw. Crowding was assessed based on study models measurements using the analysis of Droschl in the mixed dentition period, and the analysis of Lundström in children in the permanent dentition.
RESULTS: Children with type I diabetes were found to have accelerated tooth eruption in the period between phases 5 and 6, i.e. during the later eruption phase of teeth into the oral cavity ($P = 0.049$). The dynamics of eruption did not influence crowding.
CONCLUSION: Eruption is accelerated in the later phases of eruption of a permanent tooth in the oral cavity in diabetes type I children. There is no effect on the crowding.

201 PSYCHOLOGICAL CHARACTERISTICS OF PATIENTS WITH SKELETAL CLASS III MALOCCLUSIONS

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AIM: To evaluate the psychological status of patients with skeletal Class III malocclusions with different degrees of facial deformities.
SUBJECTS AND METHOD: Forty-two patients aged 16–45 years with a skeletal Class III malocclusion were examined before and after orthognathic treatment. Thirty untreated subjects aged 20–30 years with harmonious faces comprised the control group. Diagnostics included photographic analysis of the face and psychological testing (EPI, Spilberger questionnaire and Q-sorting method). Based on photographic analysis, a Facial Changes Index (FCI) was developed to determine the degree of influence of the malocclusion on the facial aesthetics. A series of soft tissue parameters affecting facial changes as a result of a skeletal malocclusion was established. The normal range of these parameters was calculated analyzing photographs of a control group. The patients with a Class III malocclusion were divided into three groups according to the FCI scores minor (0–10), moderate (10–19) and severe (19 and more) changes.
RESULTS: Psychological testing before treatment showed statistically significant differences between the Class III malocclusion groups and the controls. The most apparent changes were found in the patients with severe facial changes. Psychological testing 6 months after orthognathic surgery showed statistically significant changes, with most of the parameters approaching normal values.
CONCLUSION: 1. The FCI is a simple and fast way to determine the severity of facial changes due to a skeletal malocclusion. 2. The severity of facial changes in Class III skeletal malocclusions influences the psychological characteristics of patients. 3. Patients with severe facial changes experience some difficulties in social contacts tending to avoid leadership and group conflicts. 4. Orthognathic treatment can improve the quality of the social life of such patients.

202 ROOT RESORPTION AFTER ORTHODONTIC TREATMENT

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AIM: Resorption is defined as a loss of alveolar bone and hard tissues of the teeth, due to certain physiological or pathological factors. The most frequent and severe resorption is observed in the upper and lower anterior teeth. Roots which are prone to resorption are: dilacerated, bottle shaped and pointed. Treatment for a period of 3 years and a Class III malocclusion increase the risk of resorption. The aim of this study was to analyse the scale of resorption in patients, treated with fixed appliances. An attempt was also made to evaluate the causes of this phenomenon.
MATERIALS AND METHOD: Dental pantomograms (DPTs) of 60 patients aged 8 to 32 years, treated with fixed appliances. The extent of resorption was measured by comparing the root length on DPTs taken before and after treatment. Root length was measured from the radiological apex to the cemento-enamel junction parallel to the long axis of the tooth.
RESULTS: Resorption was observed on the roots of the upper and lower anterior teeth in 28 patients, most frequently on the roots of the upper lateral incisors. The greatest resorption occurred on the lower right medial incisor and the least on an upper right lateral incisor. The phenomenon of resorption was independent of gender. The risk of resorption increased with age. The average treatment time of patients in whom resorption occurred, was 2.9 years. Teeth with an atypical root shape (pointed, curved and narrow) predisposed to resorption. Extraction and Class II elastics increased the risk of resorption.

CONCLUSION: Root shape, type of malocclusion and patient's age should be taken into consideration when planning orthodontic treatment, using continuous forces.

203 FACIAL MORPHOLOGY OF CLASS III PATIENTS IN THE MIXED DENTITION USING THREE-DIMENSIONAL IMAGING

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AIM: To compare facial shape in children with Class I and Class III malocclusions in the early mixed dentition period.
SUBJECTS AND METHOD: Nineteen Class III subjects [9 males, 6–7 years old (mean age 6.96 ± 0.51) and 10 females, 5–7 years old (mean age 7.12 ± 0.66)]. Thirty-six Class I subjects [20 males, 6–7 years old (mean age 6.98 ± 0.61) and 16 females, 5–7 years old (mean age 6.94 ± 0.60)]. Three-dimensional (3D) data were acquired using a laser scanning system and associated software. Average faces were constructed for Class I and III male and female groups and superimposed to quantify differences in the facial shells. Differences in facial landmarks between the groups of children were statistically analysed using *t*-tests.
RESULTS: Absolute facial shell differences between the subgroups ranged from 2.1 to 3.00 mm. The average difference in facial shells for male Class I/III was 0.90 and for females 0.53 mm. Similarities in the facial shells between subgroups ranged from 37.40 per cent (males Cl I/III) to 57.41 per cent (females Cl I/III). The vertical distances N-SN and SN-P showed no statistically significant differences between the average and the Class III group.
CONCLUSION: Patients with a Class III facial morphology expressed more prominent mandibles when compared with the Class I facial template. Using 3D imaging technology, differences in facial morphology can be accurately quantified and visualized.

204 STABILITY OF OPEN BITE CORRECTION IN CLASS II DIVISION 1 ADULTS WITH AND WITHOUT OSTEOTOMY

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AIM: To compare the stability of overbite correction after surgical and non-surgical correction of Class II division 1 malocclusion subjects with an open bite, hypothesizing more stability after surgical correction.
SUBJECTS AND METHOD: Thirty-six adults with a Class II division 1 malocclusion with open bites ranging 3.5 to 11.5 mm. Nineteen underwent orthodontic treatment only, and 17 had surgical-orthodontic treatment (a Le Fort I osteotomy in 10 cases, or Le Fort I and bilateral sagittal split osteotomy in 7 cases). Pre- and post-treatment and long-term cephalograms eight years after treatment were analyzed by measuring dental and skeletal variables.
RESULTS: Significant differences were found only for the increase during treatment in lower face height and the palatomandibular angle in the surgery group. Post-treatment and long-term no significant differences in overbite or in other variables were found. Post-treatment overbite changes in both groups varied from –2.0 to +1.0 mm. The non-surgery group showed stability in 37 per cent, relapse in 55 per cent and overbite increase in 8 per cent, while in the surgery group these were 21, 64 and 15 per cent, respectively. The non-surgery group showed significantly more extrusion of the upper incisors during treatment. Extrusion of the upper and lower incisors during treatment was largely maintained after treatment. The non-surgery group showed significantly more retroclination of the upper and lower incisors, and these changes remained relatively stable. Correlation analyses in the non-surgery group did not show any relationship between post-treatment overbite changes and changes in other variables during or after treatment. Post-treatment overbite changes in the surgery group were correlated with pre- and post-treatment vertical maxillary anterior dimensions and post-treatment lower face height.
CONCLUSION: Both orthodontic treatment only and combined surgical-orthodontic treatment seem to provide equal overbite stability after correction of Class II division 1 open bite malocclusions.

205 EXPRESSION OF GENES INVOLVED IN CALCIUM HOMEOSTASIS IN DYSTROPHIC MASTICATORY MUSCLES

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AIM: Duchenne muscular dystrophy (DMD) and its murine model, mdx, are characterized by calcium ions (Ca^{2+}) induced muscle damage and muscle weakness. The disease is caused by mutations in the gene encoding dystrophin. DMD patients

have distorted dentofacial morphology that could be a result of changed masticatory muscles force balance due to unequal dystrophic changes in various masticatory muscles. Recently it was shown, that the masticatory muscles of mdx mice are differentially affected by the disease. Since an altered Ca^{2+} homeostasis seems to underlie mdx muscle pathology, the expression of genes involved in the Ca^{2+} homeostasis, in particular, ion channels, ion exchangers and Ca2+ handling proteins were studied.
MATERIALS AND METHOD: The mRNA levels of the sarcoplasmic reticulum Ca^{2+} ATPases SERCA1 and SERCA2, the plasma membrane Ca^{2+} ATPases Atp2b1 and Atp2b4, the sodium/calcium exchanger NCX1, the ryanodine receptor 1, parvalbumin, sarcolipin, phospholamban and the L-type Ca^{2+} channel Cav1. 1 were studied using quantitative RT polymerase chain reaction in the masseter and temporalis muscles and the tongue of control and mdx mice.
RESULTS: In mdx masseter muscle no differences were found in the expression of any tested genes compared with the control mice. In contrast, the mRNA amounts of SERCA2 and RYR1 were significantly reduced in mdx temporalis muscle. In mdx, the tongue a down-regulation of the sarcolipin and parvalbumin mRNA expression was found, whereas the phospholamban mRNA level was significantly increased compared with the controls.
CONCLUSION: mdx masticatory muscles showed an unequal modified expression of genes involved in Ca^{2+} homeostasis. This could cause the functional imbalance of masticatory muscles in DMD patients followed by morphological changes, which are observed in this disorder.

206 RELATIONSHIP BETWEEN DELETERIOUS ORAL HABITS AND THE DEVELOPMENT OF MALOCCLUSION

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AIM: Several epidemiological studies have shown a high incidence of occlusal disharmonies in the Brazilian child population. Among the aetiological malocclusion factors, are deleterious oral habits such as mouth breathing, abnormal function of the tongue, and finger, pacifier and bottle sucking. Thus, the purpose of this cross-sectional study was to evaluate malocclusion development and its relationship with the presence of oral habits.
SUBJECTS AND METHOD: One thousand school children aged between 6 and 10 years. A questionnaire related to the child's health and the presence of habits was completed by the parents. On examination, data were obtained regarding occlusion and stomatognathic system functional alterations.
RESULTS: There was a significant statistical association between deleterious oral habits and malocclusion. It was found that habits can cause morphological changes resulting in the development of a malocclusion.
CONCLUSION: Oral habits are potential aetiological factors in the alteration of occlusion and the change in normal growth pattern.

207 EFFICACY OF AN INDIRECT BONDING TECHNIQUE IN REDUCING PLAQUE RETENTION

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AIM: Excessive etching and residual orthodontic adhesive after bonding can facilitate plaque accumulation that causes gingival inflammation. The aim of this research was to establish if an indirect bonding technique with targeted enamel etching and adhesive placement can reduce plaque retention around brackets.
SUBJECTS AND METHOD: Thirty patients in whom brackets were bonded using a split mouth design either direct in one quadrant of the upper arch or opposite in the lower quadrant, and indirect in the other two quadrants. With indirect bonding an acrylic custom made tray with holes on the labial tooth surface, exactly corresponding to the bracket base, was prepared for each patient for enamel etching and orthodontic adhesive application. For the first six months of treatment plaque accumulation indices were recorded by one operator who also registered the presence of white spots before and at the end of orthodontic treatment.
RESULTS: Plaque accumulation was higher in the first months of treatment for all patients, and then decreased. The mesial and distal brackets edges showed more plaque accumulation than the occlusal edges. A significantly higher presence of plaque deposits during all experimental periods, and of white spots after debonding, was found for those teeth bonded using the direct technique.
CONCLUSION: Indirect bonding that involves the use of a custom made tray that allows the clinician to etch dental enamel and apply orthodontic adhesive only where the bracket base is to be bonded, results in a reduction in plaque retention around brackets and a reduction in white spot formation.

208 SELF-LIGATING VERSUS CLEAR ALIGNERS ANALYSIS OF DENTOALVEOLAR EFFECTS

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AIM: Changes in the transverse measurements of the maxillary arch have an impact on arch perimeter with the consequent space created to accommodate teeth in non-extraction treatment protocols. The aim of this study was to evaluate the changes in transverse dimensions and maxillary arch perimeter produced by low friction self-ligating brackets (Time 3) compared with the Invisalign technique.
SUBJECTS AND METHOD: Both the self-ligating and Invisalign groups comprised 20 subjects, evaluated at the beginning (T0) and completion (T1) of therapy. All had a Class I malocclusion with mild crowding in the permanent dentition, without craniofacial anomalies, missing teeth or a history of orthodontic treatment. The following measurements were made on the maxillary dental casts at T0 and T1: intercanine width between the tips of the cusp (CWC) and the most lingual point on the lingual surface (CWL), first interpremolar width between the central fossae (FPWF) and the most lingual point on the lingual surface (FPWL), second interpremolar width between the central fossae (SPWF) and the most lingual point on the lingual surface (SPWL), intermolar width between the mesial fossae on the occlusal surface of the maxillary first molars (MWF) and the lingual fissure location on the lingual surface (MWL), arch perimeter (AP) and arch depth (AD). Significant differences between the treated groups were assessed with an independent samples *t*-test ($P < 0.05$).
RESULTS: Statistically significant differences between the self-ligating and Invisalign group were recorded for CWC, FPWF, FPWL, SPWF, SPWL, and AP measurements. No significant changes were found for CWL, MWF, MWL, and AD values.
CONCLUSION: The low fiction self-ligating system produced statistically significant different outcomes in transverse dentoalveolar width and maxillary arch perimeter when compared with the Invisalign technique.

209 DENTOSKELETAL CHARACTERISTICS IN SUBJECTS WITH ORTHODONTIC TREATMENT NEED IN TOOTH AGENESIS CASES

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AIM: Tooth agenesis, the congenital absence of at least one tooth, is the most frequent dental anomaly with a prevalence in the permanent dentition of 1.0-9.6 per cent in Caucasians, 6.6 per cent in Japanese, and 7.7 per cent in the Black population. The female-to-male ratio is 3:2 for Caucasians and 2:1 for blacks. In the primary dentition, hypodontia occurs less often (under 1%) and has no significant gender distribution difference. The aim of this study was to analyse skeletal and dental and arch morphology in subjects with dental agenesis compared with a control group.
MATERIALS AND METHOD: The records of 84 patients with agenesis and an orthodontic treatment need and a control group of 84 subjects with a complete dentition. Skeletal, dental, morphological and aesthetic parameters were studied on latero-lateral and postero-anterior teleradiographs and dental casts.
RESULTS: The teeth most often missing were the maxillary lateral incisors (72.61%) and lower second premolars. The female-to-male ratio was 5:3. Transverse and sagittal measurements showed a significant decrease in the size of the maxilla in the agenesis group. No changes were observed in the mandible.
CONCLUSION: Consideration should be given to the altered craniofacial dimensions when planning treatment for subjects with agenesis.

210 EPIDEMIOLOGIC STUDY OF MANDIBULAR PROGNATHISM IN KOREAN FAMILIES

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AIM: Inspite of many studies the aetiology of mandibular prognathism has not been clarified. Recently due to the rapid increase in the number of Korean patients requiring surgical correction of mandibular prognathism a sufficient number of subjects is available to the genetics of this malocclusion. The aim of this study was to verify the genetic contribution to mandibular prognathism in Korean families.
SUBJECTS AND METHOD: The probands were 92 patients (47 males, 45 females) with mandibular prognathism who had orthognathic surgery or orthodontic treatment. Each subject completed the questionnaire of the pedigree chart comprising three generations of family members on the facial profile. Heritability (h2) in first degree relatives was evaluated with Falconer's formula.

RESULTS: The average SNA, SNB and ANB angles were: 81.2 ± 3.2, 84.0 ± 4.0 and –2.9 ± 3.1 degrees, respectively. All values, except for SNA, indicated a skeletal Class III malocclusion. A total of 3393 familial members were examined, of which 2.5 per cent had mandibular prognathism. At least one mandibular prognathic member, other than the proband, was found in 42.4 per cent of families. The affected ratio of first-degree relative was 11.1 per cent, which was much higher than that of the second- or third-degree relatives (1.6 and 1.7%, respectively). Falconer's heritability of mandibular prognathism in the first-degree relatives was 32.6 per cent.
CONCLUSION: There is a significant genetic influence in the aetiology of mandibular prognathism in Korean families.

211 EVALUATION OF MAXILLOMANDIBULAR WIDTH USING THREE-DIMENSIONAL CONE BEAM COMPUTED TOMOGRAPHIC IMAGES

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AIM: Rapid palatal expansion (RPE) devices are used correct maxillary transverse deficiency. The question that arises is how can maxillary transverse problems be evaluated to enable the use RPE? Traditionally, for analysis of maxillomandibular transverse differences, the two-dimensional (2D) posteroanterior (PA) cephalogram was used because direct measurement of bone width is impossible. Nowadays, three-dimensional (3D) cone-beam (CBCT) which decreases the radiation dose and 3D image software programs make it possible to have 3D measurements on maxillofacial area. The purpose of the present study was to measure maxillary and mandibular bone width on 3D CBCT image and to compare the maxillomandibular width of 3D image with that on a PA cephalogram.
MATERIALS AND METHOD: Images were taken of 30 adults with normal occlusion. Reference planes of the 3D images were established to be parallel to the functional occlusal plane at the level of the alveolar crest, furcation, root apex and 2 and 5 mm below root apex of the first molar. On each reference plane, the bone widths were measured at the maxillary and mandibular first molar and first and second premolar.
RESULTS: On comparison of the PA cephalograms, the maxillomandibular widths of 3D images of the first and second premolar did not show a statistically significant correlation, while the maxillomandibular widths at the first molar area showed a weak correlation.
CONCLUSION: 3D evaluation is mandatory to accurately measure maxillomandibular width.

212 CLINICAL EFFICACY OF POLYVINYLPYRROLIDONE-SODIUM HYALURONATE FOR THE TREATMENT OF ULCERS CAUSED BY ORTHODONTIC APPLIANCES

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AIM: To evaluate the efficacy of polyvinylpyrrolidone-sodium hyaluronate (Aloclair™) in reducing pain caused by orthodontic appliances.
SUBJECTS AND METHOD: Sixty consecutive patients who were prescribed Aloclair™. The patients were divided into three group and their pain and discomfort levels were investigated using three different questionnaires. The three questionnaires included the included the following: 1. An additional appliance was used; 2. Patients with ulcers caused by orthodontic appliance; 3. Initial placement of brackets. Before and after pain were compared. Visual analogue scales were used to assess the extent of pain.
RESULTS: The mean time for reducing pain and the lasting effect of Aloclair™ was 7 minutes and 3.2 hours, respectively. Most patients reported rapid pain relief and found Aloclair™ easy and more pleasant to use than wax. Aloclair™ provided rapid relief of resting and provoked lower pain.

213 EFFECTS OF RAPID MAXILLARY EXPANSION ON CRANIOFACIAL SUTURES AND SPHENO-OCCIPITAL SYNCHONDROSIS – A COMPUTERIZED TOMOGRAPHIC STUDY

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AIM: Rapid maxillary expansion (RME) is frequently used in orthodontics. Although the major treatment effect is noticed clinically in the area of the dentition, transverse enlargement of the apical bone or the skeletal structures may be considered as additional contributions. Moreover, RME appears to involve a large portion of the craniofacial complex, with enhanced

transverse growth of the circummaxillary anatomical regions. The aims of this investigation were to test the hypothesis that circummaxillary sutures and spheno-occipital synchondrosis show bony displacement in response to RME therapy, and to study the extent of suture opening following RME.
MATERIALS AND METHOD: Sixteen computed tomographic (CT) images were taken of eight growing patients (2 males, 6 females), before (T0) and after (T1) treatment with RME. All patients had been diagnosed with transverse maxillary deficiency. The mean chronological age of the patients was 9.8 ± 1.8 years (range, 8 to 11.4 years). A high-resolution multislice multidetector CT was used to quantitatively study the extent of the opening of the sphenooccipital synchondrosis and craniofacial sutures following RME. A low-dose CT scan protocol was used (80 kV, 10 mA) and the data file of each patient was transferred to a workstation where the anteroposterior width of the spheno-occipital synchondrosis and craniofacial sutures were measured on axial and frontal images.
RESULTS: At T0, the antero-posterior mean width of the sphenooccipital synchondrosis was 1.73 ± 0.46 mm and at T2 2.30 ± 0.47 mm. The craniofacial sutures also showed a significant widening. These differences were statistically significant according to the Wilcoxon signed rank test ($P < 0.05$).
CONCLUSION: RME leads to a small but immediate widening of the sphenooccipital synchondrosis and most craniofacial sutures in children.

214 EDENTULOUS RIDGE ALTERATIONS FOLLOWING ORTHODONTIC TOOTH MOVEMENT†

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AIM: In patients with edentulous areas, prosthodontic rehabilitation may be problematic because of insufficient ridge dimensions. Orthodontic movement of teeth could be a treatment option to prepare for conventional prostheses or for implant installation. The available information regarding the effect of orthodontic tooth movement on ridge dimensions is limited. The aim of this research was to study dimensional changes of the alveolar ridge and root resorption following orthodontic tooth movement into edentulous areas.
SUBJECTS AND METHOD: Six adult patients with a thin, resorbed edentulous ridge in the premolar/molar region. Two types of ridge areas adjacent to 10 premolars were defined for evaluation: A – the edentulous area into which the tooth was orthodontically moved and B – the newly established edentulous area from which the tooth was orthodontically moved. Computerised tomographic (CT) examinations were performed at baseline and after treatment. Intra-oral radiographic examination and three-dimensional (3D) measurements on scanned study casts were also performed 1 year after the end of treatment.
RESULTS: The CT radiographs revealed that the previously edentulous ridges (A) showed an increase in the bucco-lingual width ranging from 0.5 to 2.6 mm whereas the newly formed edentulous areas (B) showed a reduced width varying between 0.4-2.1 mm. 3D measurements, including soft tissue dimensions, showed an increase in the bucco-lingual width of 0-2.6 mm in A and a reduction of 0 5-1.2 mm in B. Only minor changes were noted one year after the end of treatment. Lateral root resorption was seen at the level of the bone crest on the pressure side in all teeth, varying between 0.7-7.4 mm in height and 0.2-1.4 mm in depth. Four of 10 teeth showed minor apical root resorption.
CONCLUSION: Edentulous ridges increased in dimension when teeth were moved into the area. Areas that became edentulous when teeth were moved decreased in dimension. Root resorption was an inevitable side-effect.

†Winner of an EOS Poster Award

215 EFFECTS OF FACEMASK TREATMENT ON SAGITTAL PHARYNGEAL DIMENSIONS IN CLASS III SUBJECTS

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AIM: The literature reports contrasting findings on the possibility of improving the sagittal airway dimension by means of maxillary protraction. The aim of this cephalometric study was to analyze the treatment and post-treatment craniofacial effects of a facemask (FM) combined with a bite block (BB) with specific regard to the sagittal pharyngeal dimensions in Class III malocclusion subjects when compared with an untreated Class III control group.
SUBJECTS AND METHOD: The FM/BB group comprised 22 subjects (12 females, 10 males) with a mean age pre-treatment (T1) of 8.9 ± 1.5 years, at the end of active treatment (T2) of 10.5 ± 1.3 years, and post-treatment (T3) of 12.6 ± 1.9 years. The treated group was compared with an untreated group of 14 subjects (6 females, 8 males) with a Class III

malocclusion. The average age was 7.6 ± 1.4 years at T1, 9.8 ± 1.9 years at T2, and 11.9 ± 1.2 years at T3. All subjects showed a prepubertal stage of skeletal growth (CS 1) at T1 and a post-pubertal stage (CS 4, CS 5, or CS 6) at T3. Comparisons of the T2-T1 and T3-T1 changes between the two groups were analyzed with the Mann–Whitney test.
RESULTS: During T2-T1, the treated group showed significant increments in maxillary skeletal variables; a significant increase in the vertical intermaxillary relationships was also found; no statistically significant differences were observed for any of the analyzed variables for upper and lower sagittal airway dimensions. During T3-T1 no statistically significant differences were found for the vertical skeletal relationships or for upper and lower sagittal airway dimensions.
CONCLUSION: The FM/BB protocol produced significantly favourable and post-treatment stable changes both in the maxilla and mandible in Class III subjects when compared with untreated controls. No significant changes in oro- and nasopharyngeal sagittal airway dimensions were induced by FM/BB therapy when compared with untreated subjects.

216 MAXILLARY SECOND AND THIRD MOLAR INCLINATION AFTER EXTRACTION OF THE FIRST MOLARS IN CLASS II DIVISION 1 SUBJECTS

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AIM: To assess the change in the inclination of the maxillary second (M2) and third (M3) molars after orthodontic treatment of a Class II division 1 malocclusion with extraction of the maxillary first molars.
SUBJECTS AND METHOD: Two groups of individuals were studied. The experimental group consisted of 37 subjects (18 boys, 19 girls, mean age 13.2 ± 1.62). The inclusion criteria were Caucasian origin, Class II division 1 malocclusion, sagittal overjet of ≥ 4 mm, no missing teeth or agenesis, and maxillary third molars present. All patients were treated with extraction of the maxillary first molars and treated using the Begg technique. Standardized lateral cephalometric radiographs were taken at the start of active treatment (T1) and at least 3.7 years post-treatment (T2). The control group was drawn from the archives of the Nittedal Growth Material (Oslo University) and included 54 untreated Class I and Class II individuals (18 boys, 36 girls, mean age 13.4 ± 1.99) followed up for a minimum period of 3.6 years. Second and third maxillary molar inclination relative to the palatal (PP) and functional occlusal plane (FOP) was measured and compared between groups and time periods.
RESULTS: In the control group there was no significant change in the initial distal inclination of M2, whereas in the extraction group, although more distally inclined at T1, it was mesially inclined at T2 (M2-FOP T1 14.2 ± 4.62˚, T2 -6.2 ± 6.10˚, $P < 0.0001$). M3 inclination was similar between groups at T1 (M3-FOP control 17.3 ± 9.35˚, M3-FOP experimental 19.6 ± 7.37˚), and improved significantly in both groups however M3 uprighting was almost 4 times greater in the extraction group (M3-FOP T2-T1: 5.6 versus 19.9˚). The largest distal inclination of M3 at T2 in the extraction group was 9.4 degrees, a value attained by only 43 per cent of the control group.
CONCLUSION: Extraction of the maxillary first molars in Class II division 1 subjects results in significant uprighting of second and third molars and ensures the normal eruption of M3.

217 THE WORLD-WIDE-WEB, ORTHODONTICS AND TEMPOROMANDIBULAR DISORDERS: A BALANCED INFLUENCE ON PATIENT DECISION-MAKING?

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AIM: Controversy over relationships between malocclusion, temporomandibular disorders (TMD) and whether orthodontic treatment cures TMDs remains despite increasing evidence suggesting the aetiology of TMDs has closer links to other chronic pain conditions than to malocclusion. Nevertheless, some clinicians still use orthodontics to treat TMD patients despite instances of litigation. However, 60-80 per cent of world-wide-web (WWW) users have used it to obtain health information (Powell *et al*., 2003). So what information might TMD patients access in deciding whether to undergo orthodontic treatment? The aim of this research was to assess information on the WWW that could affect patients' decision-making.
MATERIALS AND METHOD: Individuals spend approximately 5 minutes searching the WWW when looking for medical information (Eysenbach and Köhler, 2002). Therefore, using a well known search engine and the terms 'TMD' and 'TMJ', the first 10 relevant websites listed (equating to what might be searched in 5 minutes), were examined for advice suggesting malocclusion causes TMD and/or that orthodontics could be used as a TMD treatment.
RESULTS: The term 'TMD' found six (of 10) websites which suggested malocclusion causes TMD and/or that orthodontics could be used as a TMD treatment. The term 'TMJ' found five (of 10) websites which suggested the same. The stance of

three (of 20) was unclear. The information provided was mostly based on the lowest level of evidence. Some sites provided contact details for patients to access the specific clinic the website was associated with.
CONCLUSION: Over half of websites patients are likely to see, suggest malocclusion causes TMD and/or that TMD can be treated with orthodontics but the information may be unbalanced. This suggests that in order to inform patient decision-making appropriately, further education is required amongst clinicians to ensure their understanding of TMD is based on current evidence.

Eysenbach G, Köhler C 2002 Does the internet harm health? Database of adverse events related to the internet has been set up. British Medical Journal 324: 573–577
Powell J A, Darvell M, Gray J A M 2003 The doctor, the patient and the world-wide web: how the internet is changing healthcare. Journal of the Royal Society of Medicine 96: 74–76

218 USE OF TEMPORARY ANCHORAGE DEVICES IN INTRUSIVE MECHANICS

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AIM: To compare intrusive mechanics that use miniscrews with a traditional mechanics.
SUBJECTS AND METHOD: Fifty patients aged between 12 and 54 years who required intrusion of the upper or lower incisors from 3 to 7 mm. The patients were randomly assigned to two groups: 25 treated with utility arches and 25 treated with continuous arches connected with a temporary anchorage device (TAD) for intrusion. The intrusive force was delivered by an elastic chain. The miniscrew was positioned 4-5 mm below the gingival margin between the upper central or lower incisors. The direction of insertion had a variable inclination to avoid contact with the incisor roots. The head of the miniscrews served as a reference point to evaluate the speed of intrusion both for patients that used miniscrews as anchorage and for the control group that used utility arches in the first 4 months of treatment.
RESULTS: Intrusion speed with miniscrews was on average higher than with utility arches. In eight of 25 subjects it was impossible to reach the intrusion target with utility arches in the 4 month period. For all 25 patients with a utility arch, molar dislocation was noted in the posterior segments. Two miniscrews were lost in the TAD group at the end of the experimental period, but without effects on intrusion.
CONCLUSION: Intrusive mechanic were faster with the use of TADs without distal tipping of the anchorage molars. The miniscrews were well tolerated by the patients during therapy.

219 LINEAR VARIABLES AND THE PRESENCE OF THIRD MOLARS IN CLASS III AND CLASS II DIVISION 2 PATIENTS

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AIM: To determine the presence of third molar germs in patients with Class II division 2 and Class III malocclusions regarding linear craniofacial characteristics.
SUBJECTS AND METHOD: One hundred and forty six children [Class II division 2 (n = 77), Class III (n = 69)]. Assessments were made on panoramic radiographs and lateral cephalograms. Two types of measurement of the linear cephalometric variables were undertaken on the lateral cephalograms: the length of the maxilla (CoA) and the length of the mandible (CoGn). The Pearson chi squared , Fisher's exact test and non-linear regression equation was used to determine differences that were statistically significant.
RESULTS: Third molar germs were present significantly more often in the upper jaw in Class II division 2 subjects (58 versus 44%) and in the lower jaw in Class III subjects (83 versus 69%). A correlation between the presence of upper third molar germs was found for CoA, and a correlation between the presence of lower third molar germs for CoGn.
CONCLUSION: There is a correlation between the presence of third molar germs and sagittal maxillomandibular relationship and jaw length of the jaw. Investigations of the differences in calcifications of all permanent teeth in such malocclusion subjects are necessary.

220 FORCE DEGRADATION OF ELASTOMERIC LIGATURES AND ELASTIC SEPARATORS USED AS AN ACTIVE TIEBACK

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AIM: To evaluate the initial force and force decay patterns of two commercially available elastomeric products including elastomeric ligatures and separator elastic used as an active tieback.
MATERIALS AND METHOD: Twelve elastomeric ligatures and also elastic separators from each of three manufacturers (Dentaurum, Rocky Mountain, 3M Unitek) were stretched 100 per cent and 12 samples of each brand were stretched 150 per cent of their inner diameter. Force levels were measured initially and at 3 minutes, 24 hours, and 1, 2, 3 and 4 weeks. All samples were placed in a synthetic saliva bath at 37°C. Data was analyzed statistically by univariate analysis of variance and Tukey *post hoc* test.
RESULTS: The mean initial forces of the elastomeric ligatures and separators stretched 100 per cent of their inner diameters were 199 to 305 g and 330 to 416 g; respectively, whereas stretched to 150 per cent the loads were 286 to 422 g and 433 to 540 g, respectively. Ten to eighteen per cent of the initial force was lost within the first 3 minutes, with 29-63 per cent of force decay occurring in the first 24 hours. The force decay rate then decreased; however 60-81 per cent of initial force was lost in 4 weeks. Although the force decay pattern was identical for all products, the initial force and force decay of Dentaurum elastomeric ligature and separators was less than similar products from RMO and 3M Unitek ($P < 0.05$). The force decay of separator elastic at different time points was almost similar to the elastomeric ligatures of the same company.
CONCLUSION: Regarding the initial force and force decay of elastomeric ligature and separator elastics, they can be used to apply orthodontic force in the form of active tieback.

221 THREE-DIMENSIONAL CHARACTERISTICS OF FACIAL AND JAW MORPHOLOGY IN THE EARLY MIXED DENTITION

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AIM: Facial diagnosis in small children performed from photography and has several drawbacks. A three-dimensional (3D) imaging system has been shown to be accurate for scanning young children and is a non-invasive and completely safe method to obtain 3D facial images. The purpose of this research was to evaluate facial and jaw morphological characteristics in children in the early mixed dentition period.
SUBJECTS AND METHOD: Thirty children [17 girls (mean age 6.94 ± 0.60 years) and 20 boys (mean age 6.98 ± 0.61 years)]. Facial images were taken using the 3D imaging system. The 3D data was imported to a reverse modelling software package, Rapidform™ 2006. Each scan of the face was processed in order to remove unwanted data, registered and merged to produce a complete facial image. A Student's *t*-test was used to assess differences between the facial templates of the girls and boys.
RESULTS: The average facial and study cast template of a Slovenian girl and boy in the early mixed dentition period was established. The difference between the male and female facial template was determined in the cheek area, and in the lower jaw and eyebrow regions. No difference between genders was found in the length of the middle and lower facial third. Study cast analysis of intermolar and intercanine width revealed statistically significant differences between the female (mandibular intercanine 24.08 ± 1.49, intermolar 43.56 ± 1.58; maxillary intercanine 30.73 ± 1.75, intermolar 47.79 ± 1.78) and male (mandibular intercanine 26 ± 2.31, intermolar 43.99 ± 3.00; maxillary intercanine 32.01 ± 2.55, intermolar 49.29 ± 2.20) templates.
CONCLUSION: The 3D laser scanning system is a non-invasive, safe, objective and reliable method to obtain 3D facial images of children during growth and development.

222 ASSESSMENT OF STAINING OF ORTHODONTIC AESTHETIC BRACKETS DUE TO FOOD COLOURANTS

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AIM: To assess if food dyes significantly affect the colour of different brands of orthodontic brackets, both composite and ceramic.
MATERIALS AND METHOD: Eight brands of orthodontic brackets, four composite: Rave, Crystal Clear Plastic Bracket, Silkon Plus, Orthoflex, and four ceramic: Reflections, Pure, Contour and Miso were investigated. Ten samples of each bracket were assessed. Five brackets of each series were stored in coffee and five in red wine for 24 hours. The colour change after storage was analyzed for each sample with the use of a dental spectrophotometer according to the CIE L*a*b* colour scale. The lightness, redness, yellowness and complete colour change (ΔE) of the brackets were statistically analyzed at the level of $P = 0.05$.

RESULTS: The greatest colour change (ΔE) was observed in composite brackets (mean level 13.84 points) compared with porcelain brackets (mean level 3.02 points). Various colour changes were observed both among composite brands (mean ΔE ranged from 6.94 to 18.19) and among the porcelain group (mean ΔE ranged from 2.11 to 3.78).
CONCLUSION: Food colourants cause significant colour changes of both composite and ceramic orthodontic brackets. Composite orthodontic brackets are significantly more susceptible to food discolouration than ceramic brackets.

223 THE SUSCEPTIBILITY TO STAINING OF ORTHODONTIC ELASTICS LIGATURES

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AIM: To assess if food dyes significantly affect the colour of four different brands of orthodontic elastic ligatures.
MATERIALS AND METHOD: Eight brands of elastic ligatures: Ortho Organizers, Dentaurum, Ortho Technology and Dentech Corp., divided according to four colours: transparent, white, yellow and silver, were investigated. Twenty samples from each manufacturer were stored in coffee and 20 in red wine for 24 hours. The colour change after storage was analyzed for each sample with the use of a dental spectrophotometer according to the CIE L*a*b* colour scale. The complete colour change (ΔE) of examined ligatures was statistically analyzed at the level of $P = 0.05$.
RESULTS: The greatest colour change (ΔE) was observed for Ortho Organizers elastics (mean level of 12.81 points) and the lowest for Ortho Technology elastics (mean level 10.93 points). No significant differences among the manufacturers were observed. Significant differences in colour change caused by food dyes were observed in relation to the original colour of the elastics. The greatest colour change was observed for white ligatures (mean level 20.70 points) and the lowest for silver products (mean level 4.91 points).
CONCLUSION: Susceptibility to discolouration of elastic ligatures did not depend on the brand under the conditions of this study. The level of discolouration of orthodontic elastic by food dyes is strongly related to the original colour of the material.

224 VALIDATION OF CONVENTIONAL RADIOGRAPHS EXAMINATIONS TO ASSESS THE MAGNITUDE OF EXTERNAL RESORPTION

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AIM: Assessment of radiographic validity in the evaluation of the extent of external apical root resorption (EARR) and comparison of the accuracy of the measurements.
SUBJECTS AND METHOD: Seventeen patients who required fixed appliance treatment together with the extraction of the maxillary first premolars. A unilateral force of 50 g was applied for six months to the premolars and a force of 150 g to the contralateral teeth. The teeth were then extracted and measured. For all patients an intraoral conventional radiographs (RVG) and dental pantomograph (DPT) was taken as well as computed tomographic (CT) scans before and after treatment. CT scans were further used to produce digital models. The lengths of the tooth and root crown were measured before and after treatment on the RTGs. Radiographic measurement accuracy was evaluated.
RESULTS: The most precise tooth measurements were obtained with the CT scans. The difference between 'real' tooth dimensions and the values obtained from the CT scans were statistically insignificant. Less accurate, but still reasonable, results were obtained with intraoral RVGs, and either inaccurate ones in 3D digital models. The least accurate results were found for DPT measurements – the difference between the DPT and the real dimensions was statistically significant.
CONCLUSION: The most accurate measurements of resorption were found with CT scans and intraoral RVGs. Digital models are beneficial for imaging of bone changes at the maxillary sinus during intrusion, and the panorex for diagnosis of severe EARR.

225 INFLUENCE OF THE MAGNITUDE OF INTRUSIVE FORCE ON EXTERNAL APICAL ROOT RESORPTION AND CHANGES IN ALVEOLAR CREST HEIGHT

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AIM: Determination of the interdependence of the extent of external apical root resorption (EARR) and bone remodelling of the alveolar ridge on the amount of applied orthodontic intrusive force and the correlation between resorption and the extent of intrusion.

SUBJECTS AND METHOD: Seventeen patients who required fixed appliance treatment together with the extraction of the maxillary first premolars. A unilateral force of 50 g was applied for six months to the premolars and a force of 150 g to the contralateral teeth. The teeth were then extracted and measured. Computed tomographic (CT) scans were obtained before and after treatment. On all CT scans the length of the tooth, root, and crown were measured pre- and post-treatment.
RESULTS: The mean intrusion was 1.69 mm with an intrusive force of 50 g and 4.86 mm with an intrusive force of 150 g. The extent of tooth intrusion depended on the extent of the force. The dependence was statistically significant. With an intrusive force of 50 g, the mean change in vestibular root length was 0.44 mm and with a force of 150 g, 0.73 mm. The values were not statistically significant. The mean value for the sulcus was 0.63 mm (50 g force), and 2.17 mm (150 g force). With a force of 50 g, bone sulcus represented 41 per cent of intrusion and with a force of 150 g, 44 per cent of the intrusion.
CONCLUSION: EARR does not depend on the extent of the intrusive force. However, force is a statistically significant factor in the amount of tooth intrusion. During intrusion, the alveolar ridge dislocated in the direction of the tooth movement, and the tooth was partially shifted into the bone.

226 ANALYSIS OF OCCLUSAL PLANE POSITION IN PATIENTS TREATED WITH DISTAL BITE CORRECTORS

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AIM: Correction of the functional status of dentofacial system and occlusal plane position are necessary to provide a stable outcome of orthodontic treatment. A correctly formed occlusal plane results in normal muscular function of dentofacial system and normal temporomandibular joint status. A new generation of appliances for correction of distal occlusion have recently been introduced – hybrid non-removable bite correctors such as the Forsus, SUS II, and the Twin Force Bite Corrector. However no information is available concerning their effects on morphological and functional changes in the dentofacial system after treatment. The aim of this research was to study the occlusal plane angle (<OP/FH: 8 ± 4°) in patients with a distal occlusion before and after treatment with passive self-ligating brackets and hybrid non-removable bite correctors (SUS II, Twin Force Bite Corrector).
MATERIALS AND METHODS: Thirty pre- and post-treatment lateral cephalograms. The position of the occlusal plane was evaluated via <OcP/FH angle.
RESULTS: In 40 per cent of patients low values for <OcP/FH angle were determined pre-treatment that indicated a tendency for low occlusal plane position, while in 60 per cent high values were found indicating a tendency for a high position of the occlusal plane. According to the values of this angle – more or less than 8 degrees – the tendencies were for a vertical or horizontal growth type, respectively. After treatment, a clockwise rotation and an increase of the occlusal plane was noted in patients with low <OcP/FH values. In patients with high values, anticlockwise rotation of the occlusal plane occurred and <OP/FH values decreased.
CONCLUSION: In orthodontic treatment with hybrid non-removable bite correctors, the direction of mandibular movement vector is similar to that of facial growth and it normalizes the position of the occlusal plane.

227 TREATMENT OF PALATALLY DISPLACED CANINES WITH RAPID MAXILLARY EXPANSION AND/OR A TRANSPALATAL ARCH

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AIM: To investigate the effect of rapid maxillary expansion (RME) and/or transpalatal arch (TPA) therapy in combination with primary canine extraction on the eruption rate of palatally displaced canines by means of a randomized clinical study.
SUBJECTS AND METHOD: One hundred and twenty subjects were enrolled based on palatally displaced canines (PDC) diagnosed on panoramic radiographs. They were randomly assigned to one of four groups: three treatment groups (RME followed by TPA therapy plus extraction of primary canines, RME/TPA/EC group, 40 subjects; TPA therapy plus extraction of primary canines, TPA/EC group, 25 subjects; extraction of primary canines, EC group, 25 subjects). A control group (CG; 30 subjects) received no orthodontic treatment. All subjects were evaluated before treatment at the initial observation (T1) and then re-evaluated in the early permanent dentition (T2) to assess the rate of successful eruption of PDCs. Panoramic radiographs and dental casts at T1 and the prevalence rates of successful cases in the three treatment groups compared with the CG at T2 were statistically evaluated. Predictive features at T1 for successful canine eruption were determined in the three treatment groups.
RESULTS: No significant difference was found for any measurement at T1. Three dropouts were recorded. The prevalence of canine eruption was 80 per cent for the RME/TPA/EC group, 79 per cent for the TPA/EC group, 62.5 per cent for the EC

group, versus 28 per cent in the CG, with statistically significant differences between all groups, with the exception of the comparison between RME/TPA/EC and TPA/EC. Predictive pre-treatment variables for the success of treatment were: less severe sectors of canine displacement, prepubertal stages of skeletal maturity, and an open root apex of the PDC.
CONCLUSION: The use of a TPA without RME can be equally effective as RME/TPA in PDC cases not requiring maxillary expansion, thus reducing the burden of treatment for the patient.

228 DENTAL ANOMALIES IN CHILDREN REGISTERED WITHIN THE CLEFT PALATE CENTRE OF STRASBOURG

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AIM: In the general population, the prevalence of hypodontia (excluding third molars) has been reported to range from 3 to 10 per cent. Dental anomalies have been found to be more prevalent in subjects with a cleft lip, with or without palate (CL/P) than in those without a CL/P. The aim of the study was to determine the frequency of these anomalies.
SUBJECTS AND METHOD: Alsatian children with CL/P registered within the Cleft Palate Centre of Strasbourg, France. Cleft types and dental anomalies (missing, supernumerary or peg-shaped teeth) were assessed clinically and radiographically. Exclusion criteria were: patients under 5 years of age and absence of or unusable panoramic radiograph. The investigation included records of 109 patients with CL/P, 79 boys and 30 girls (mean age: 12 years).
RESULTS: Fifty-nine per cent of the subjects had evidence of hypodontia. Cleft types were divided into four groups based on the extent of clefting: [cleft lip only (CLO) 13.8%, cleft lip and alveolus (CLA) 3.7%, CL/P (49.5%) and cleft palate only (CPO) 33%]. There were significantly more dental anomalies associated with CPO and CLP than with CLO. The maxillary lateral incisors and upper and lower premolars were the most frequently missing teeth. Eleven patients had supernumerary teeth in the region of the cleft, and 15 teeth were considered as being peg-shaped (maxillary lateral incisors were the most affected teeth). All these anomalies were found in proportionately higher frequencies as the severity of the cleft increased. A male dominant tendency was evident for all cleft types ($P < 0.0001$) as well as a left side predominance for hypodontia ($P = 0.0015$) whatever cleft sidedness.
CONCLUSION: A statistically significantly higher prevalence of hypodontia was found for this group of French children with CL/P than in the general population. A significant dominant tendency of hypodontia was observed on the left side irrespective of cleft side. It seems that the same environmental and genetic factors are related to tooth development and cleft genesis.

229 THE IMPORTANCE OF HEALTH EDUCATION OF PATIENTS WITH FIXED ORTHODONTIC APPLIANCES

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AIM: To draw attention to correct and regular oral hygiene in patients undergoing orthodontic treatment with fixed appliances because of the possible occurrence of gingivitis and more frequent occurrence of secondary caries and the onset of carious lesions.
SUBJECTS AND METHOD: Fifty subjects, 14 to 16 years of age, of both genders with fixed orthodontic appliances. The patients were observed from the beginning to the end of treatment. At the start of treatment they were given information concerning oral hygiene and the use of adequate aids (fluorogal sol, special interdental toothbrushes).
RESULTS: After several monthly check-ups, motivation had decreased in more than 30 per cent of the patients with the result that the number of patients with signs of catarrhal gingivitis and secondary initial caries increased.
CONCLUSION: It is necessary to re-motivate patients on a month-to-month basis as well as to provide adequate health education in order to maintain the initial results and to prevent the occurrence of complications.

230 FAMOTIDINE AFFECTS HISTOMORPHOMETRIC AND BIOCHEMICAL PARAMETERS DURING TOOTH MOVEMENT

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AIM: Histamine is involved in bone modelling, which is the key process during orthodontic tooth movement. Osteoclasts, which resorb bone, and osteoblasts, the bone-forming cells, both express H2 receptors. H2 receptor antagonists are widely

used in the treatment of gastrointestinal ulcers. The aim of the present study was to determine the effects of famotidine, an H2 receptor antagonist, on bone modelling during orthodontic tooth movement in rats.
MATERIALS AND METHOD: Three groups of Wistar rats, a control group (n = 16), an appliance only group (n = 16) and a famotidine group (n = 16). Animals in the last two groups were fitted with a superelastic closed coil spring (force = 25 cN) between the upper left first molar and the upper incisors. Animals of the control group and the appliance only group were treated daily with saline, and those of the famotidine group with 10 mg kg-1 of famotidine. Tooth movement was measured weekly from day 0 to day 42. The animals of all groups were sacrificed on day 42 and tissue samples were prepared for further analysis. Gene expression levels for bone turnover markers, cathepsin K and osteocalcin, were determined by means of RT-polymerase chain reaction. Alveolar bone, osteoblast and osteoclast volumes were determined histomorphometrically.
RESULTS: Famotidine decreased the amount of tooth movement from day 35 onwards ($P < 0.01$) and also decreased osteoclast volume. An increase in osteoblast volume ($P < 0.01$), osteoblast activity ($P < 0.01$) and osteoclast activity ($P < 0.01$) was observed in the famotidine group compared with the appliance only group. No statistically significant difference was observed in alveolar bone volume between the famotidine and the appliance only groups.
CONCLUSION: Famotidine affects bone resorption and bone formation processes during orthodontic tooth movement. The observed decrease in tooth movement in the late stage of orthodontic tooth movement is probably due to the reduction of osteoclasts.

231 INFLUENCE OF ADHESIVE SURFACE ROUGHNESS ON STREPTOCOCCAL ADHESION FORCES

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AIM: To investigate the influence of adhesive surface roughness (Ra) on streptococcal adhesion forces.
MATERIALS AND METHOD: The Ra of orthodontic light-cured adhesives, Transbond XT and PADLock, were varied by abrading with aluminium and sandpaper, and divided into three groups: untreated (Ra 20 nm), aluminium (Ra 150 nm) and sandpaper (Ra 350 nm). Adhesion forces between streptococcus and adhesive surfaces, in the absence and presence of a salivary conditioning film, were measured by atomic forces microscopy at 0 and 120 seconds surface delay times. Comparisons of the adhesion forces were performed using non-parametric and Weibull analyses.
RESULTS: Bacterial adhesion forces increased with surface roughness in the absence of a salivary conditioning film at 120 seconds surface delay time ($P < 0.05$). Roughening treatments (aluminium and sandpaper abrading) increased the adhesion forces compared with the untreated surfaces at 120 seconds surface delay time in the presence of a salivary conditioning film ($P < 0.05$), and at 0 seconds surface delay time in both saliva conditions ($P < 0.05$). Data at 120 seconds surface delay time [Weibull modulus (m) 4.0 ± 1.5] were more reliable than at 0 seconds (m: 3.0 ± 0.7) for comparison of influence of Ra on streptococcal adhesion forces, regardless of salivary conditions, according to Weibull analysis ($P < 0.01$).
CONCLUSION: Adhesive surface roughness influences streptococcal adhesion forces.

232 EXTRAORAL JUDGEMENT OF SKELETAL CLASS

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AIM: To determine whether it is possible to distinguish the cephalometric skeletal Class from a digital lateral photograph.
MATERIALS AND METHOD: One hundred lateral pre-treatment photographs of orthodontic patients (which had cephalograms assessed with Nemoceph® software) were shown to two groups of participants (7 males, 21 females): nine orthodontists and 19 Master of Orthodontic students All the right profile photographs were taken by the same photographer under the same light conditions using a digital camera (Reflex Olympus E330). The participants were asked to indicate on a questionnaire if the patient was a skeletal Class I, II or III according to Ricketts, with no limit on the time allowed. Data were analysed using one-way repeated measures ANOVA with Bonferroni *post hoc* adjustment for multiple testing and an unpaired *t*-test for gender using the program, Prism 3.0. $P < 0.05$ results were considered statistically significant.
RESULTS: Only 47.96 per cent of the participants correctly identified the skeletal Class of the patients. A Class III was the most difficult to identify (36.76%) versus Class I (39.46%). A Class II malocclusion was correctly identified most often (60.71%). Differences were significant only between Class II and the other two Classes ($P < 0.001$) but not between Class I and Class III ($P > 0.05$). There were no differences between genders ($P > 0.05$).
CONCLUSION: Class II patients are easier to distinguish from a lateral photograph than Class III or Class I. Lateral photographs do not allow correct identification of the skeletal Class – cephalometry is also required.

233 PREVALENCE OF FUNCTIONAL DISORDERS IN PATIENTS WITH CLASS III MALOCCLUSIONS

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AIM: Causal factors for the development of a Class III malocclusion include heredity and functional disorders of the orofacial system. The aim of this study was to determine the prevalence of the latter in patients with a Class III malocclusion.
SUBJECTS AND METHOD: Seventy-two patients with a Class III malocclusion were evaluated for the presence of an incorrect breathing mode, swallowing and chewing, common deleterious habits and speech impairment with the use of functional testing, history and speech assessment. The prevalence of functional disorders was also determined from analysis of sagittal values on lateral cephalometric radiographs.
RESULTS: Functional abnormalities of the orofacial system were identified in all 72 patients. The prevalence did not decrease with age. Some were more common in patients requiring combined orthodontic and surgical treatment than in the group as a whole. The prevalence of functional irregularities was related to the position of the jaws in the sagittal plane.
CONCLUSION: There is a close association and interdependence of morphological and functional disorders of the orofacial system.

234 THREE-DIMENSIONAL LOCALIZATION OF IMPACTED MAXILLARY CANINES AND EFFECTS ON ADJACENT INCISORS

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AIM: Traditionally, many different types of radiographs have been used to localize an impacted tooth in relation to the adjacent teeth. Although these views allowed identification as to whether the tooth was buccal or palatal (lingual), it was still not possible to measure exactly how far away they were impacted from the roots of the other teeth. Cone beam computed tomography (CBCT) provides elements that cannot be observed during traditional radiographic analysis and is, therefore, indicated in the case of impacted teeth or craniofacial structural anomalies. The aim of this study was to evaluate CBCT for three-dimensional localization of impacted maxillary canines and the effects on adjacent incisors.
MATERIALS AND METHOD: Sixty impacted maxillary canines assessed regarding location, shape (with or without dilacerations), inclination, follicle size, and effects on the roots of neighbouring teeth.
RESULTS: The impaction location was 25 per cent (15 cases) buccally, 63.3 per cent (38 cases) palatally, and 11.66 per cent (7 cases) in the middle of the bone. Twenty-five canines (41.66%) had dilacerated roots. For 25 canines (41.66%) the follicle size was normal, 23 canines (38.33%) had a large follicle, and 12 canines (20%) a diminished follicle. Adjacent root resorption was mild in 25 per cent (15 cases), moderate in 5 per cent (3 cases) and severe in 11.66 per cent (7 cases). No resorption was observed in 58.33 per cent (35 cases).

235 IS CASEIN PHOSPHOPEPTIDE-AMORPHOUS CALCIUM PHOSPHATE BENEFICIAL TO ORTHODONTIC PATIENTS?

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AIM: Demineralization of enamel adjacent to orthodontic brackets can be an aesthetic and functional problem. A number of strategies are available to treat these lesions such as casein phosphopeptide-amorphous calcium phosphate (CPP-ACP). The aim of this study was to evaluate the effect of Tooth Mousse™ topical cream in orthodontic patients.
SUBJECTS AND METHOD: Thirty patients divided into three equal groups. No patient had any white spot lesions (WSL) and all underwent oral hygiene instruction. Group 1 used a toothbrush and superflossed twice daily, group 2 used a toothbrush, superflossed twice daily, and used a fluoride mouth rinse before sleep, group 3 used a toothbrush, superflossed twice daily and used a fluoride mouthrinse and tooth mousse before sleep. The patients were examined at 1, 3 and 6 monthly intervals to evaluate the incidence of WSL on the buccal surfaces of 20 teeth from the central incisor to the second premolar in each quadrant by a specialist, and the number of WSL were recorded.
RESULTS: After statistical analysis, the mean prevalence of WSL after 6 months was group 1,7.3, group 2, 4.7 and group 3, 1.6. There was a statistically significant difference between groups 1 and 2, groups 1 and 3, and also between groups 2 and 3.
CONCLUSION: CPP-ACP agents such as Tooth Mousse™ can help in protecting teeth from WSL. Tooth Mousse™ topical cream has additive effects to fluoride mouth rinses and helps remineralize teeth by delivering calcium substrate to tooth structure.

236 FACIAL SOFT TISSUE PROFILE CHANGES FOLLOWING BILATERAL SPLIT SAGITTAL OSTEOTOMY AND SUBCONDYLAR MANDIBULAR SETBACK

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AIM: Successful surgical planning and accurate prediction of orthognathic surgery outcomes include not only occlusal correction and a well-balanced skeletal relationship, but improvement of aesthetics and function. The aim of this retrospective study was to evaluate soft tissue changes following bilateral sagittal split osteotomy (BSSO) and subcondylar mandibular setback.
MATERIALS AND METHOD: Pre- and post-operative cephalometric variables were measured on lateral cephalometric radiographs of 35 individuals, 12 of whom had undergone BSSO surgery, and 23 subcondylar surgery. Analysis of the measured variables was carried out by means of paired *t*- and independent *t*-tests.
RESULTS: Although only mandibular surgery was carried out, upper lip changes were significant. In BSSO cases, lip fullness was increased. Subcondylar cases showed an increase in lower face height and mentocervical angle that supports the idea of a shift toward a vertical facial pattern after this type of surgery. Overall BSSO resulted in more improvement in aesthetics compared with subcondylar surgery.

237 FORCES IN COMPLEX MALALIGNMENT CORRECTION WITH CONVENTIONAL AND SELF-LIGATING BRACKETS

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AIM: There is general consensus that advocates the use of the lightest force capable for achieving orthodontic tooth movement. As it is difficult to directly measure stresses and strains within the periodontal ligament of loaded teeth, measuring the forces that are applied directly to teeth is a valuable estimation tool. The aim of this research was to measure the forces during complex orthodontic tooth malalignment correction with various archwire-bracket combinations using the Orthodontic Measurement and Simulation System.
MATERIALS AND METHOD: Three types of orthodontic brackets (1) conventional ligating brackets (Victory Series and Mini-Taurus), (2) self-ligating brackets (SmartClip, passive self-ligating bracket and Time3, active self-ligating bracket), and (3) a conventional low friction bracket (Synergy). All brackets had a nominal 0.022 inch slot size. The brackets were combined with four archwire types (1) 0.012 inch stainless steel, (2) 0.012 inch Orthonol [nickel titanium (NiTi)], (3) 0.012 inch Thermalloy (NiTi), and (4) 0.0155 inch coaxial. The archwires were tied to the conventional brackets with stainless steel ligatures and elastomeric rings. The malocclusion simulated displacement of a central upper incisor, 2 mm gingivally (*X* axis) and 2 mm labially (*Z* axis).
RESULTS: All brackets showed the lowest forces when combined with either the coaxial or Thermalloy wires. The forces ranged from 3.4 ± 0.2 N to 0.7 ± 0.1 N in the *X* axis direction and 4.5 ± 0.3 N to 0.5 ± 0.1 N in the *Z* axis direction. The highest force was determined when combined with stainless steel wires, ranging from 6.3 ± 0.3N to 3.0 ± 0.1 N in the *X* and 6.3 ± 0.3 N to 1.7 ± 0.1 N in the *Z* direction.
CONCLUSION: Small cross-sectional coaxial wires of 0.0155 inches and Thermalloy wires of 0.012 inches are recommended for use in the initial levelling and alignment stage of orthodontic treatment. Elastomeric rings, when used with conventional brackets, increase the force applied to the teeth.

238 PHOTOGRAMMETRIC PROFILE TREATMENT CHANGES OF CLASS II DIVISION 1 MALOCCLUSIONS

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AIM: To assess soft tissue profile changes associated with various orthodontic treatment protocols in growing individuals presenting a Class II division 1 malocclusion.
MATERIALS AND METHOD: Initial and final, coloured, profile, standardized photographs taken in the natural head position of 110 Class II division 1 growing patients were analyzed by means of 15 angular and one ratio measurement. Different orthodontic treatment protocols were used: one phase/two extractions (n = 21), one phase/four extractions (n = 14), one phase/no extractions (n = 50) and two phase/no-extractions (n = 25). Statistical analysis included paired samples *t*-tests for each pair of observations in each group as well as assessment of the magnitude of the method error using Dahlberg's formula.

RESULTS: Statistically significant ($P < 0.05$) findings included: reduction of facial convexity as well as increase of nasolabial angle, angle of the lips and mentolabial angle, in all four groups. No significant change was observed in the ratio of upper to lower face height in any group. Nasofrontal and cervicomental measurements showed that they constitute parts of the dentofacial system, which were not significantly influenced by the treatment protocols performed.
CONCLUSION: Soft tissue profile was improved by the orthodontic treatment in all groups regardless of the specific therapeutic approach used. Angular photogrammetric profile analysis can be a useful mean for assessing the various soft tissue profile regions of the face.

239 THE BENDING LOAD CAPACITIES OF RAPID MAXILLARY EXPANSION SCREWS – A PILOT STUDY

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AIM: In order to apply high, short-term, forces during rapid maxillary expansion (RME) to the medial palatal suture without causing unwanted side-effects (dentoalveolar tipping etc.), the appliances used should be as rigid as possible. Since the retention arms of the jack screws are vulnerable, stressed weak points, it was the aim of this study to investigate their bending strength.
MATERIALS AND METHOD: The retention arms of 16 RME screws comprising four arms and one with eight arms, were examined using a three-point bending test. The screws were classified according to their ability to absorb the applied bending loads, indicated by the parameters force (F), bending stress (σ) and ductility (fFmax).
RESULTS: Fifteen retention arms (stainless steel), despite having the same diameter (1.48-1.49 mm), differed up to 69.81 per cent between the highest (288.0 N) and lowest (124.5 N) force parameters (F), and up to 66.40 per cent between the highest (3325.9 N/mm^2) and lowest (1464.0 N/mm^2) bending stress parameters (σ). Due to optimum formability, though reduced rigidity, a titanium screw for nickel sensitive patients, displayed the lowest force and bending tension values. The stainless steel double arms of the 8-arm screw device displayed the highest force data. The mean ductilities (fFmax) of the screws with the most and least rigid single steel arms differed by 22.77 per cent. Statistical analysis, using the Pearson correlation coefficient, revealed a significant indirect correlation between ductility and both maximum force ($r = –0.780$, $P < 0.001$) and maximum bending stress ($r = –0.778$, $P < 0.001$).
CONCLUSION: Despite having the same cross-sectional diameters, the single retention arms of all tested stainless steel expansion screws displayed variable loading capacities. Clinically screws with lower rigidity appear acceptable for RME during the pre-pubertal age, while in adolescence and early adulthood screws with higher loading capacities seem advisable.

240 AESTHETICS BEFORE AND AFTER ORTHODONTIC TREATMENT

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AIM: An attractive smile is important for successful aesthetic and orthodontic treatment. Lip position, oral condition, personality traits, and smiling affect the aesthetics of the smile. The aim of this study was to analyse the changes of some aesthetic parameters before and after orthodontic treatment.
SUBJECTS AND METHOD: Ninety-two healthy subjects from the west region of Romania divided into four categories: 23 girls aged between 7 and 13 years, 23 boys between 7.5 and 12.5 years, 23 females between 19 and 35 years and 23 males between 21.5 and 32.7 years. All patients underwent a complete aesthetic analysis before and after orthodontic treatment. Aesthetic evaluation, including measurement of inferior face height, was based on photographs taken in both the frontal and profile view, and during social smiling.
RESULTS: At the end of orthodontic treatment the values were higher than those pre-treatment, especially for females compared with males. The profile angle showed a large change in girls compared with females. Smile analysis was used to evaluate the incisal smile line, the labial line of the smile, the buccal corridors and the midline. The changes were more obvious for females compared with males and for younger age groups compared with adults.
CONCLUSION: It is important to take into account aesthetic parameters while establishing an orthodontic treatment plan.

241 AESTHETIC CHANGES OF THE PROFILE IN EXTRACTION AND NON-EXTRACTION CASES

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AIM: The decision concerning extraction or non-extraction in orthodontics is of interest in aesthetic dentistry, especially as it can influence the profile, smile and face of the patient. The aim of this study was to examine the effects of orthodontic treatment on the soft tissue profile treated either extraction or non-extraction with fixed appliances.
SUBJECTS AND METHOD: Forty healthy subjects with a Class II division 1 or division 2 malocclusion. Profile photographs were taken before treatment, after fixed appliance removal and one year post-treatment. The subjects were 20 females (10 extraction and 10 non-extraction) and 20 males (10 extraction and 10 non-extraction) aged between 19 and 31 years.
RESULTS: The profile angle increased in most of the non-extraction subjects by approximately 3.5 degrees and decreased in the extraction cases by 2.7 degrees. The differences between males and females were less significant. The distance between the aesthetic line and the upper lip decreased. The nasolabial angle also decreased by 2.5 degrees in the extraction cases.
CONCLUSION: The profiles of the treated subjects became straighter immediately after treatment and were unchanged one year later. The differences between extraction and non-extraction aesthetic profiles were minimal.

242 IS THERE A RELATIONSHIP BETWEEN ORTHODONTIC AND PERIODONTAL TREATMENT NEED?

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AIM: It is believed that an orthodontic malocclusion is one factor in the aetiology of periodontal disease. With orthodontic treatment the periodontal health may improve because of the ideal occlusion. The aim of this study was to determine the relationship between orthodontic and periodontal treatment need.
SUBJECTS AND METHOD: Eighty hundred and sixty children (384 males, 452 females) aged between 11–14 years. To ensure data from different socio-economic standards, the schools in Sivas divided into three demographic categories as: high, middle and low socio-economic standards. Using random sampling technique, seven of the 67 schools were selected representing a cross-section of socio-economic status. Eight hundred and sixty of 20781 students were also selected with a random sampling technique. Subjects who had previous orthodontic treatment were excluded from the examination. Four experienced orthodontists and two periodontist performed the clinical examinations. Treatment Priority Index (TPI) scores were used for determining the severity of malocclusion. For determining periodontal status, the Community Periodontal Index of Treatment Needs (CPITN) scores were used. Associations between variables were analyzed by chi-square test.
RESULTS AND CONCLUSION: Thirty-six per cent of the students had normal occlusion, 41.3 per cent had a slight, 15.9 per cent a definite, 4.1 per cent a severe, and 2.7 per cent a very severe malocclusion. The outcome of this study revealed that there was no relationship between orthodontic treatment need and CPITN scores (chi = 19.22, $P = 0.257$, $P > 0.05$).

243 A SYSTEMATIC REVIEW OF INTERCEPTIVE TREATMENT OF PALATALLY DISPLACED MAXILLARY CANINES

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AIM: To assess whether interceptive treatment in the mixed dentition prevents impaction of palatally displaced maxillary canines (PDC) by systematically reviewing the literature.
MATERIALS AND METHOD: A literature search of PubMed, Cochrane Library electronic databases and Scopus, was performed covering the period from January 1966 to May 2009. The inclusion criteria were mixed dentition with uni- or bilateral PDC, randomized controlled trials (RCT), prospective and retrospective studies with untreated controls, and clinical trials comparing at least two treatment strategies. Three reviewers selected and extracted the data independently and evaluated the quality of the studies. Inter-examiner reliability was measured using Intraclass Correlation Coefficient (ICC).
RESULTS: The search strategy resulted in 686 articles, of which two met the inclusion criteria. Because of the unequivocal results and heterogeneity in the study methods, the scientific evidence was too weak to fully evaluate the effect that interceptive treatment might have on PDC and which treatment modalities were most effective. The quality of the studies was rated as low because of inadequate sample selection and deficient description of sample size, confounding factors, uncertainty of randominization and no blinding in measurements. The ICC value for total scores was >0.80, e g. perfect agreement.
CONCLUSION: To obtain reliable scientific evidence as to whether interceptive treatment prevents impaction of PDC and which treatment modalities are the most effective, better controlled and well-designed RCTs are needed. Future studies

should also include assessment of patient satisfaction and pain experience as well as analysis of cost and side-effects of the treatments.

244 FACIAL PROPORTIONS IN SERBIAN FEMALE ADULTS

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AIM: Facial attractiveness is important in interhuman communication because beauty means social power and success and has a positive influence in all areas of civilized society. The aim of this study was to compare vertical and horizontal proportions of the face – frontal view, with golden proportions in adult Serbian females.
MATERIALS AND METHOD: Facial photographs in the frontal view of 120 female dental students. The *en face* photograph of each subject was assessed using horizontal thirds and vertical fifths. Four transverse and six vertical facial distances, were measured and compared with the corresponding calculated divine distances. The relationship between the measurements on the photographs and golden facial proportions was evaluated.
RESULTS: A significant difference between the measured photographs and golden proportions was found for both lower facial third distances and the lateral fifths of the face.
CONCLUSION: The main inequality from the golden proportions was in the lower facial third, as the most impressive attribute of facial attractiveness.

245 CLEFT LIP AND PALATE PATIENTS AND HYPODONTIA – A SINGLE NUCLEOTIDE POLYMORPHISM STUDY

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AIM: There is increasing evidence that supports the assumption that genetic factors increase the risk for susceptibility of individuals to cleft lip and palate (CLP) and/or hypodontia. The purpose of the study was to map the single nucleotide gene polymorphisms (SNP) purported to play an important role in the development of the clefts and hypodontia
SUBJECTS AND METHOD: One hundred and three selected CLP patients examined radiographically genetically and clinically. Sixty had congenitally tooth-germ agenesis and 43 a complete dentition. For gene polymorphism, DNA was isolated from oral mucosa scrapings. A combined and optimized polymerase chain reaction and restriction fragment length polymorphism analysis was used to identify individual SNPs. Subsequently the SNPs were genotyped by the TaqMan SNP genotyping assay kit.
RESULTS: Five SNP procedures were successfully optimized that are putatively involved in CLP and hypodontia (PAX9 -1031G/A, -912C/T, MSX1 3755 A/G, FGFR1 C/T rs881301, IRF6 A/G rs764093). Among the investigated five SNPs of four genes homozygotes rare alleles in all cases were found. The frequency of appearance of the minor G allele of Msx1 was significantly higher in the cleft with hypodontia group than in the cleft /complete dentition group.
CONCLUSION: Missing teeth as well as aplasia occurs more frequently in children with a CLP than in other configurations of the nasal floor. The results clearly show the feasibility of recognition and understanding of the genetic/genomic factors.

246 CONE BEAM COMPUTED TOMOGRAPHY FOR ROUTINE TREATMENT PLANNING IN ORTHODONTICS

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The aim of this research is to demonstrate the advantages of cone beam computed tomography in daily orthodontic treatment planning to assess individual patient needs.
Based upon the findings from more than 2000 orthodontic cone beam computed tomograms (CBCT) per year, the sequence of evaluation is as follows: buccal panoramic view, lingual panoramic view, images of the skull from five angles both with and without soft tissues, images of isolated soft tissues from five angles, three-dimensional (3D) evaluation of either temporomandibular joint, assessment of buccal bone quantity prior to dental arch expansion, mapping of dental arch shape, 2D and 3D cephalometric analysis, 3D assessment of the entire paranasal sinuses, 3D analysis of upper airways and tonsils, 3D diagnosis of asymmetries, 3D imaging of impacted teeth, 3D planning of orthodontic anchorage pins, 3D planning of orthognathic surgery.
The orthodontic analysis described involves an effective radiation dose of approximately 34 to 60 µSv. The combined effective dose of an analogue panoramic radiograph and lateral cephalogram will total 57 µSv, if calculated according to current International Commission on Radiological Protection guidelines.

CBCTs are a useful alternative to conventional panoramic radiographs and lateral cephalograms for orthodontic treatment planning. Compared with conventional radiographic techniques, reasonable additional diagnostic information can be obtained without increasing radiation exposure. At the same time other dental and medical specialties can take advantage of the existing 3D data.

247 EFFECT OF ORAL APPLIANCES ON INFLAMMATORY MARKERS IN OBSTRUCTIVE SLEEP APNOEA

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AIM: Growing evidence demonstrates enhanced systemic inflammation in obstructive sleep apnoea (OSA) that might contribute to atherosclerotic vascular disease. Inflammatory markers including proinflammatory cytokines could be involved in this process. While continuous positive airway pressure treatment is known to decrease systemic inflammation in OSA, data on the effect of oral appliance (OA) treatment on cytokines are scarce. The aim of this study was to evaluate selected interleukins and hs-CRP in OSA patients prior to and following OA treatment.
SUBJECTS AND METHOD: Mild and moderate OSA patients [apnoea-hypopnoea index (AHI) 5-30/hours] and apparently healthy controls (HC) underwent polysomnography at baseline and then after 3 and 6 months. OSA patients were treated with a custom-made appliance, Klearway™, over 6 months. Interleukin-1 beta (Il-1ß), Il-6, Il-10 and hs-CRP were measured in all subjects at all three time points. Interleukins were determined in plasma using ELISA (RAD systems) and serum hs-CRP using nephelometry (Dade Behring).
RESULTS: A total of 15 male OSA patients (mean age 54 years, AHI = 22/hours) and 6 HC (mean AHI 2/h) were analyzed. Demographic variables did not differ between the groups. OA treatment reduced symptoms of OSA and mean AHI from 22 to 9 hours after 6 months ($P < 0.01$). No serious side-effects of treatment were observed. The baseline levels of Il-1ß and Il-10 were significantly higher in OSA patients and decreased by 29 and 57 per cent, respectively (both $P < 0.05$) after 6 months of OA. There were no changes in Il-6 and hs-CRP levels between OSA patients and HC at baseline and these variables remained unaltered during OA treatment.
CONCLUSION: OA therapy not only diminishes OSA symptoms and AHI but also modulates the inflammatory state via mechanisms independent from Il-6.

248 LONG-TERM OUTCOME AND STABILITY IN TREATED ANGLE CLASS II DIVISION 1 PATIENTS

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AIM: To evaluate long-term hard and soft tissue changes in Class II division 1 patients treated with fixed orthodontic appliances.
MATERIALS AND METHOD: Lateral cephalograms of 68 patients, 40 extraction and 28 non-extraction cases. Lateral cephalograms taken pre-treatment (T1), post-treatment (T2), post-retention (T3), and 10 years post-retention (T4) were digitized and traced.
RESULTS: No statistically significant changes were found between the extraction and non-extraction group for soft and hard tissue variables, except for gonial angle. Significant longitudinal changes occurred from T1 to T2. ANB and SNA showed a marked reduction during T1-T2 and remained stable thereafter. SNB and SNPog increased during the whole observation period (T1-T4). Interbasal angle (ML/NL) decreased continuously from T1-T4. Both upper and lower incisors showed significant uprighting during treatment. Post-treatment there was a tendency towards relapse. Upper and lower lip distance to the E-line increased progressively from T1-T4, most marked from T1-T2 and the Holdaway angle decreased.
CONCLUSION: Prior to treatment, during treatment and post-treatment, the extraction and non-extraction Class II division 1 subjects presented identical hard and soft tissue profile characteristics. There was a tendency towards dental relapse 10 years post-retention, a marked lip retrusion relative to the E line, and a decrease in the Holdaway angle.

249 DEVELOPMENTAL ANALYSIS OF ETHMOIDAL SINUS EMPLOYING SAGITTAL COMPUTED TOMOGRAPHIC SCANS***

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AIM: To investigate the use of computed tomographic (CT) image analysis to assess the relationship between sinus development stage and occlusal development.
MATERIALS AND METHOD: Dried human skulls served as the experimental material; five samples were selected for each stage and a total of 50 samples were examined. CT imaging of the ethmoidal sinus was performed with the Somatom Emotion 6 (Siemens). Imaging conditions were as follows: X-ray tube voltage of 130 kv, tube current of 63 mA in bone mode, scan duration of 2.7 seconds and slice interval of 2 mm. The images of the sagittal view at the midline and the axial view at the Frankfort horizontal plane were acquired at WW3000;WL480. Analyzed images were transferred to a high-speed three-dimensional analysis device, Virtual Place Advance Plus (AZE Ltd.), in order to construct images for measurement. The area and growth rate of the sagittal image and the area of the ethmoidal sinus were then measured on the images and evaluated.
RESULTS: 1. The area of the sagittal image at stage IA, which was about 2 cm^2, increased to approximately 9 cm^2 by stage VA. The growth rate at stage VA was approximately 4.5-fold based on stage IA. The increase in size after stage IC, from about 5.5 to 9 cm^2, was linear. 2. The growth distance in the sagittal image was identical in all sections, including the superior section, the uppermost two-thirds, and the inferior section of the ethmoidal sinus. The length at stage IA, which was about 3.5 cm, increased to approximately 6 cm by stage VA. The growth rate at stage VA was approximately 1.7-fold based on stage IA. The increase after stage IC, from about 5.04 to 5.88 cm, was linear.

250 RESVERATROL INHIBITS PERIODONTAL PATHOGENS *IN VITRO*

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AIM: Oral hygiene maintenance is an essential requirement for successful orthodontic treatment in all patients, particularly 'high-risk' candidates with a history of periodontal disease. The gram-negative anaerobic bacteria, *A. actinomycetemcomitans* (Aa) and *P. gingivalis* (Pg), are key components in the aetiology of periodontal disease, and associated hard tissue destruction. Resveratrol is a phytoalexin, produced naturally by several plants when under attack by bacterial or fungal pathogens. It is found in many foods including mulberries, peanuts, and the skin of labrusca and muscadine grapes. The objective of this study was to evaluate the effect of resveratrol on growth of periodontal pathogens Aa and Pg *in vitro*. For comparison, resveratrol's effect on a variety of other oral microorganisms was also evaluated.
MATERIALS AND METHOD: As resveratrol demonstrates a poor solubility in water, different concentrations of resveratrol in the solvent dimethyl sulphoxide (DMSO) were added to calibrated suspensions of the microorganisms. As a control, a parallel series of dilutions containing the vehicle DMSO alone were used to measure the effect of the solvent. Minimum inhibitory concentrations of the periodontal pathogens were calculated. All suspensions were incubated for 1, 3, 6, and 24 hours in an anaerobic chamber at 37°C. At each time interval, selected dilutions from each culture broth were plated on blood agar plates. Colonies appearing on blood agar plates were visually counted at at day 3 for Aa, and day 5 for Pg.
RESULTS: The periodontal bacteria, Aa and Pg, showed a significant decrease ($P < 0.05$) in viable counts after 1 hour, whilst no colony forming units were observed after 24 hours. There was no effect on the other microorganisms tested.
CONCLUSION: Resveratrol possesses significant antimicrobial properties on periodontal pathogens *in vitro*.

251 INFLUENCE OF THE VISUAL SYSTEM TO HORIZONTAL JAW RELATIONSHIP DETERMINATION – A PILOT STUDY

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AIM: Documentation of changes in the visual system to horizontal jaw relationship determination by means of an intraoral, electronic needle point tracing during standing.
SUBJECTS AND METHOD: Measurements were carried out in 10 healthy adults with open and closed eyes during standing. For recording the horizontal jaw relationship, and particularly lateral and sagittal movements of the mandible, the IPR System (IPR Systems GmbH, Germany) was used. The following movements were registered: initial and final contact position as well as protrusion, retrusion and transverse movement. In order to record the limiting movements of the mandible, casts and a facebow transfer are necessary to produce templates of the lower and upper jaw. During registration it is necessary to use an incisal blocking of 1 mm. Subsequently, the data were statistically analysed with the software program, BIAS, using Wilcoxon's matched pairs test.
RESULTS: The visual system had an influence on the final contact position ($P \leq 0.05$). This influence was evident regarding the sagittal axis, as the final contact position with the eyes closed was, on average, approximately 0.7 mm further retral. Because of deprogramming through the coordination movements carried out so far, the habitual contact position changed.

This is normally used as an encryption position in horizontal jaw relationship determination.
CONCLUSION: There is no influence of the visual system on limiting movements of the mandible. The range of motion is limited by individually predetermined anatomical structures.

252 THE IMPACT OF FORCED LEG LENGTH DISCREPANCIES ON BODY POSTURE AND JAW POSITION

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AIMS: To determine how orthopaedic factors can affect body posture and movement sequences in the temporomandibular joint by documentation and analysis of the interdependencies between temporary provoked leg length discrepancies on upper body posture and the position and movement path of the mandible.
SUBJECTS AND METHOD: A 1 cm and 3 cm thick wooden panel was consecutively placed unilaterally under the left or right foot of 30 subjects (21 females, 9 males) while simultaneously recording upper body posture and movement trajectories of the mandible. The three-dimensional imaging system MiniRotKombi (ABW / GeBioM, Germany) allowed analysis of the upper body surface curvature by applying light-line projections while the electronic registration system, Arcus Digma (KaVo, Germany) recorded the mandibular position and movement paths based on ultrasound. Statistical analysis was carried out (*t*-test for correlated samples).
RESULTS: A unilateral increase of the foot caused a change in posture in relation to the pelvis and shoulder positions ($P \leq 0.00$), which may be due to a compensating movement to the increase. The range of motion correlated with the height and relevant side of the increase. Likewise, a deviation of the mandibular condyle position in centric occlusion ($P \leq 0.03$) and in mouth movement ($P \leq 0.01$) was observed, which also increased with the amount of the increase in size. Positional related changes were observed in the ipsi- and contralateral side of the jaw.
CONCLUSION: There is a statistically reliable interdependence between leg length, body posture and mandibular position. This also shows that the human body is a complex system where different parts of the musculoskeletal system are interlinked and are able to influence each other.

253 EFFECT OF OESTROGEN AND LOADING TO THE AMOUNT OF OESTROGEN RECEPTOR ALPHA AND MATRIX METALLOPROTEINASE-8 IN RAT CONDYLAR CARTILAGE

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AIM: Changes in oestrogen and temporomandibular joint (TMJ) loading levels are thought to be involved in degradation of condylar cartilage. It has been suggested that matrix degradation caused by matrix metalloproteinase (MMP) is a primary event in joint diseases. The aim of this study was to examine the effect of decreased oestrogen level and altered dietary loading on condylar cartilage in the rat TMJ on the expression of oestrogen receptor alpha (ER-α) and MMP-8.
MATERIALS AND METHOD: Thirty-six female rats were divided into four groups: ovariectomized rats fed with normal diet, non-ovariectomized controls fed with normal diet, an ovariectomized soft diet group, and a non-ovariectomized control soft diet group. Ovariectomy was performed at the age of 60 days. Seven days after surgery the rats were sacrificed and prepared for immunohistochemical staining.
RESULTS: The proportional amount of MMP-8 positive cells was statistically significantly higher in the control rats fed with a normal diet than in control rats fed with a soft diet ($P < 0.05$). The proportional amount of ER-α was statistically significantly higher ($P < 0.001$) in the condylar cartilage of ovariectomized rats than in non-ovariectomized control rats both in the normal and soft diet groups. No statistically significant difference was found in ER-α staining when comparing the control rats fed a normal diet and the control rats fed with a soft diet.
CONCLUSION: Condylar cartilage is sensitive to changes in oestrogen level and loading. It seems that the expression of MMP-8 in the condylar cartilage is chiefly dependent on the level of loading. The expression of ER-α is dependent mainly on oestrogen level, not on the level of dietary loading.

254 PREVALENCE OF CLASS III MALOCCLUSIONS – IS THERE SUFFICIENT EVIDENCE?

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AIM: An Angle Class III malocclusion, commonly characterized by a negative anterior overjet, can be handicapping both functionally and socially. There is ambiguous information regarding its prevalence; most studies report Class III

malocclusions as the smallest proportion of malocclusion types in any given population. Nonetheless, Class III malocclusion patients present some of the greatest need for orthodontic treatment. Multiple epidemiological studies have documented the prevalence of Class III malocclusions in many different populations; however, and in spite of the continually increasing data on Class III malocclusion prevalence, little has been done to consolidate this information in a comprehensive and critical way. Thus, this study seeks to review the relevant literature on Class III malocclusion prevalence.
MATERIALS AND METHOD: The electronic databases, PubMed and Embase, were searched using specific inclusion criteria to obtain applicable articles; all pertinent references were also examined for acceptability.
RESULTS: A total of 21 articles were identified using the inclusion criteria. The prevalence of reported malocclusion ranged from 0 to 26.7 per cent in different populations examined. A mean prevalence of 7.8 per cent was calculated across all populations. The highest prevalence of 15.6 per cent was found among individuals of Eastern Asian descent, while Indian populations had the lowest rate at 1.1 per cent.
CONCLUSION: The prevalence of Class III malocclusions varies greatly among racial and ethnic groups. However, these findings should be interpreted with caution, as the reported prevalence data depends greatly on several factors, including sampling, population age range, and methodology for recording Class III malocclusions.

255 DEVELOPMENTAL ANALYSIS OF MANDIBULAR FOSSA CIRCUMFERENCE EMPLOYING SAGITTAL COMPUTED TOMOGRAPHIC IMAGES***

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AIM: To assess the relationship between mandibular fossa circumference developmental stage and occlusal development.
MATERIALS AND METHOD: Dried human skulls served as the experimental material; five samples were selected from each stage and a total of 50 samples were examined. Computed tomographic (CT) imaging of the mandibular fossa circumference was performed with the Somatom Emotion 6 (Siemens). Imaging conditions were as follows: X-ray tube voltage 130 kV, tube current 63 mA in bone mode, scan duration 2.7 seconds and slicing interval 2 mm. The images of the sagittal view at the midline and the axial view at the FH plane were acquired at WW3000;WL480. Analyzed images were transferred to the high-speed three-dimensional analysis device, Virtual Place Advance Plus (AZE Ltd), in order to construct images for measurement. The area and growth rate of the sagittal image and the area of the mandibular fossa circumference were then measured on the images and evaluated.
RESULTS: 1. The area of the right tuberculum articulare sagittal image at stage IA, which was approximately 0.09 cm^2, increased to approximately 0.5 cm^2 by stage VA. The growth rate at stage VA was approximately 5.6-fold based on stage IA. The area of the left tuberculum articulare sagittal image at stage IA, which was about 0.068 cm^2, increased to approximately 0.46 cm^2 by stage VA. The growth rate at stage VA was approximately 6.8-fold based on stage IA. 2. The area of the right aspect of the posterior articulare sagittal image at stage IA, which was about 0.054 cm^2, increased to approximately 0.258 cm^2 by stage VA. The growth rate at stage VA was approximately 5.5-fold based on stage IA. The area of the left tuberculum articulare sagittal image at stage IA, which was about 0.054 cm^2, increased to approximately 0.258 cm^2 by stage VA. The growth rate at stage VA was approximately 4.8-fold based on stage IA.

256 CEPHALOMETRIC ASSESSMENT OF RAPID MAXILLARY EXPANSION IN CLASS II DIVISION 1 MALOCCLUSION SUBJECTS***

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AIM: Rapid maxillary expansion (RME) is routinely used for correction of transverse maxillary deficiency, a posterior crossbite, crowding and snoring with nasal obstruction. A common secondary effect of RME is anterior mandibular sliding also necessary in Class II malocclusion correction. The aim of this study was to assess the amount of mandibular anterior sliding as a result of the use of RME, by analysis of facial profile parameters.
SUBJECTS AND METHOD: Twenty-three patients (12 females, 11 males) with a Class II division 1 malocclusion, who underwent RME. All subjects had a maxillary width deficiency, at least half a cusp distalization associated with a posterior crossbite. Their average age was 12-15 years. The subjects and/or their parents activated the screw once daily. The widening procedure continued until 3-5 mm over-expansion was obtained (in maxillary intermolar distance). To evaluate Class II malocclusion correction, the facial and occlusal improvements and the lateral cephalograms obtained before and after treatment (McNamara, Burstone and Ricketts method) were assessed. Horizontal and vertical mandibular length (Go-Pog),

Ar-Go, convexity of the skeletal profile A-Npog and soft tissue parameters chin thickness (Pog-Pog) upper and lower lip thickness (UL-E line, LL-E line) were determined.
RESULTS: RME resulted in spontaneous forward movement of the mandible and Class II correction in 14 patients (the skeletal parameters were increased). The soft tissue modifications were less in comparison with dentoalveolar and bone. The remaining nine subjects required associated Class II interarch mechanics. No significant differences were found in the soft tissue parameters following use of the Class II mechanics.
CONCLUSION: There are many favourable effects of RME in Class II division 1 malocclusion patients, one being anterior mandibular growth with less facial profile convexity.

257 OCCLUSAL RELATIONSHIPS IN THE EARLY BRONZE AGE IN SOUTH EASTERN EUROPE

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AIM: Inheritance is a significant causal factor in the aetiology of malocclusions. However, environmental factors, in particular the type of diet, also have an impact on teeth, bones, neuromuscular tissues and soft tissues. The territory of today's Serbia, in the early Bronze Age was the settlement of farmers, who domesticated plants and animals. Their diet consisted of softer food, similar to contemporary human diets. The aim of this study was to examine the occlusal relationships and presence of orthodontic anomalies in skull remains of an early Bronze Age society.
MATERIALS AND METHOD: Three hundred and twelve skulls of individuals from the necropolis in Mokrin (Serbia) dating between 2100 and 1800 BC. Well-preserved skulls, where occlusal relationships could be reconstructed were used. Analysis of sagittal and transverse relationships was undertaken. Sagittal relationships were analyzed based on Angle's classification – the relationship of the mesiobuccal cusp of the upper first molar and buccal groove of the lower molar was observed. In the transverse plane, the bucco-oral relationship of the upper and lower molars was analyzed. Malocclusions in the vertical plane were not investigated because of the *post-mortem* loss of the anterior teeth in most individuals. The Statistical Package for Social Sciences, version 12.0 (SPSS Inc., Chicago, Illinois, USA was used for statistical analysis.
RESULTS: A Class I occlusal relationship was observed in 54.5 per cent of the skulls, while 45.5 per cent had a Class II relationship. Normal transverse relationships were found in 75 per cent, while 25 per cent exhibited a unilateral crossbite.
CONCLUSION: Malocclusions were present 4000 years ago. These findings indicate that life style and dietary habits, including the type of food and its consistency, could be important factors in the aetiology of malocclusions.

258 INFLUENCE OF CORROSION OF SURFACE DEFECTS OF NICKEL TITANIUM WIRES

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AIM: During recent years, the role of saliva and fluoride has been extensively studied as corrosive agents of the surface of nickel titanium (NiTi) wires. These studies have shown its relationship with surface roughness, that acidic pH is more corrosive and that the effects are more severe depending on the manufacturer, etc. However, the mechanisms and factors involved in this process are largely unknown. Thus the objective of this study was to determine the influence of different surface defects in as- received NiTi wire in the degradation of its surface.
MATERIALS AND METHOD: In a previous study of 0.016 × 0.022 inch NiTi wires the different surface defects were established. For each of the five patterns found, five samples of each pattern were randomly selected for *in vitro* analysis following immersion in artificial saliva and hydrofluoric acid for 28 days. The surface of the samples was studied before and after using scanning electron microscopy and confocal microscopy. Quantitative analysis of the surface defects and analysis of variance of the means obtained were performed.
RESULTS: The patterns found were smooth, striped, with holes or globular, cracked and porous. The increase of defects (μm^2) and roughness, both in saliva and saliva plus fluoride were: smooth (28; 39/-0.4; 0.3), striped (26; 47/0.31, 0.87*), globular (–23; -15/-0.17; –0.19), cracked (182*, 629*/–0.1; 1.3*) and porous (18.3, 31.2/0.3, 0.5*). * = $P < 0.05$.
CONCLUSION: The smooth and globular patterns do not present a significant increase in surface defects. Conversely, the cracked pattern shows an increase in defects and roughness. The increase in roughness is not related to the increase in the number of defects.

259 ROLE OF FLUORIDE AND CARBONATED DRINKS IN THE CORROSION OF NICKEL TITANIUM WIRES

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AIM: The influence of saliva and fluoride on nickel titanium (NiTi) wires surface has been widely studied. However, the role of carbonated drinks has not been thoroughly investigated and there are no studies co-relating these corrosive agents with surface patterns based on factory defects. The objective of this research was to determine the influence of hydrofluoric acid and Coca-Cola® on the surface defects of different as received NiTi wires.
MATERIALS AND METHOD: A sample of 22 NiTi wires, 0.016 × 0.022 inches, previously studied to establish different wire patterns according to their main defects. Five samples of each wire pattern were randomly selected and placed *in vitro* with fluoride acid + artificial saliva and artificial saliva + Coca-Cola®, for 28 days. The surfaces were analysed before and after the experiment, with scanning electron and confocal microscopy. A quantitative analysis of surface defects and the medians were calculated. ANOVA was applied to evaluate the statistical significance of the means. The patterns studied were smooth, striped, with holes or globular and cracked.
RESULTS: The increase of defects in 10.000 μm^2 for artificial saliva + fluoride and for saliva + Coca-Cola® were, respectively: smooth (39/1.8); striped (47/182.5*); globular (-15/1727*); cracked (629*/1353*). The increase in roughness for saliva + fluoride and saliva + Coca-Cola® was: smooth (0.3/–0.3); striped (0.87*/0.35); globular (–0.19/0.1); cracked (1.3*/1.2*). * = *P* 0.05.
CONCLUSION: The smooth pattern showed higher corrosion resistance. The cracked pattern was the most corroded. The medium fluoride produced a greater increase in roughness, and Coca-Cola® more surface defects.

260 ELECTROMYOGRAPHIC AGE VALUES OF STOMATOGNATHIC MUSCLES

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AIM: To study the bioelectric activity of the stomatognathic muscles in average rectified value (ARV) and root mean square (RMS).
SUBJECTS AND METHOD: Thirty-five children aged 6–9 years with a physiological occlusion. The electromyographic activity of the stomatognathic muscles were determined (BKN electromyograph, Biotronic, Italy). Bioelectric activity of the temporalis, masseter, digastric and sternocleinomastoid muscles on the right and left sides was studied in three functional tests: mandibular physiologic position; physiologic occlusal position, and maximal pressure of teeth (dental arches). Summary tables were compiled from the average measurements of the age indices. The electromyographic parameters of the stomatognathic muscles were compared.
RESULTS: In the physiological relaxed position the bioelectric activity of the muscles that lift the mandible were larger than those of the muscles that descend the mandible. Bioelectric activity of lower jaw descending muscles on the left side was less than on the right side. The amplitudes of maximal single biopotentials of all muscles were equal. No change in the bioelectric activity of the muscles was found when the mandible was in a physiological occlusion (compared with a previous test). At maximal tooth pressure, muscle bioelectric activity increased 10 fold. Bioelectric activity of the lower jaw descending muscles increased: digastric on both sides up to ×7 and sternocleinomastoid up ×3 times. Amplitudes of maximal single biopotentials increased in the lower jaw lifting muscles up to ×200; in the lower jaw descending muscles up to ×6 and in the sternocleinomastoid up to ×4.
CONCLUSION: The findings show the necessity of studying different age group indices of bioelectric activity of the stomatognathic muscles by electromyography. Without exception, all bioelectric activity changes clinically observed were also tracked on the ARV and RMS indices.

261 SIGNIFICANCE OF AGE ON LOWER JAW MOTION – A THREE DIMENSIONAL STUDY

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AIM: To study the characteristics of mandibular motions and to determine the age norms of patients with a physiologic occlusion.
SUBJECTS AND METHOD: Ninety-three patients aged 7–15 years with physiological occlusion in three age groups 7–9, 10–12 and 13–15 years. Mandibular motions were studied using a Kinesiograph tracking device (Biotronic, Italy). The

following functional tests were executed: maximal descent and lift, side (lateral) motions and maximal forward mandibular movement.
RESULTS: According to age, there is an increase in the kinesiographic index in the sagittal plane for mandibular motion trajectory diagonal length and the distance of mandibular movement to the initial position. The angle between the diagonal and vertical planes did not show any difference, while the angle index at the beginning and end of descent and lifting of the mandible did not change with age. In all groups the motion ending angle was larger than the motion beginning angle. In the frontal plane the descent of the mandible motion trajectory, and the length of descent and lift trajectories increased with age. Mandibular angle indices at the beginning and end of descent and lifting did not changed with age. Graphical images of mandibular side motions were the most informative in the frontal plane. Linear and angular parameters in the age groups with this motion did not differ. Mandibular left and right motion lengths were equal. The distance of mandibular forward movement during maximal protrusion increased with age, while the descent and lift angles decreased. In the frontal plane mandibular descent during forward movement was lowest.
CONCLUSION: The present research indicates necessity of having age group indices of mandibular motions.

262 TIME-DEPENDENT BIOMECHANICAL BEHAVIOUR OF THE PERIODONTAL LIGAMENT – AN *IN VITRO* STUDY

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AIM: Initial tooth displacement, induced by orthodontic forces, can occur rapidly or slowly depending on the physical characteristics of the applied force and response of the periodontal ligament (PDL). Classic theories of tooth displacement do not consider the complex mechanical properties of the PDL, the morphology of the alveolar structure, or the magnitude of the applied force. Current knowledge indicates that there is a need to investigate how changes in stress and strain distribution of the PDL trigger orthodontic tooth movement. The aim of this study was to evaluate the biomechanical time-dependent behaviour of the PDL in relation to force application.
MATERIALS AND METHOD: Eighteen pig jaw segments were used. A linear increasing displacement of 0.1 and 0.2 mm in a time span of 5, 10, 20, 30, 60, 120, 300, 450, 600 seconds was applied to the premolar crowns. Resulting forces were measured using a three-dimensional force torque sensor during the loading phase, as well as for a period of 600 seconds after reaching full deflection. Time/force diagrams for each tooth were generated from the obtained data and maximum force as well as forces after relaxation were obtained. Means and standard deviations for each deflection/time combination were calculated.
RESULTS: Forces measured for the different specimens varied significantly and decreased with increasing loading time (mean 1.5 and 0.5 N for 5 and 600 seconds, respectively for 0.1 mm displacement), and increased with increasing displacement (4.8 and 2.6 N for 5 and 600 seconds, respectively at 0.2 mm displacement). Forces after relaxation converged to boundary values of 0.4 and 2.0 N for 0.1 and 0.2 mm displacements, respectively. Correlation of forces with root volumes or surfaces was not significant (Spearman rank test).
CONCLUSION: Variations in initial forces may be attributed to the biological tissue characteristics of the specimens and probably to the different periodontal status of the teeth rather than root geometry.

263 RELATIONSHIP BETWEEN UPPER AIRWAY WIDTH AND FACIAL GROWTH CHANGES DURING ORTHODONTIC TREATMENT OF GROWING CHILDREN

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AIM: In growing patients with malocclusions, functional assessment such as respiration is vital for the restoration of normal craniofacial growth. The purpose of this study was to evaluate how upper airway changes influence facial growth during puberty in Korean children.
SUBJECTS AND METHOD: Thirty-six patients aged 9 to 11 years (mean: 10.7 years). Cephalograms and hand-wrist radiographs were taken before treatment (T1) and after appliance removal (T2). The sample was allocated to narrow (5.2–8.6 mm), medium (8.9–11.5 mm), and wide (11.7–16.0 mm) upper airway groups according to the airway width at T1. Cephalometric measurements at T1 and T2 and growth from T1 to T2 were compared among the groups.
RESULTS: The increase in airway size in each group was 4.55, 3.84 and 1.94 mm in the narrow, medium, and wide groups, respectively, and the differences were statistically significant. The posterior face height of the subjects in the narrow group

was found to be significantly smaller than in the other two groups at T1. For growth changes from T1 to T2, the narrow group showed significantly larger values of PFH/AFH, facial axis, ANS, and Gn than the medium group. Compensatory changes in airway width and facial growth were found in the subjects with a narrow upper airway.
CONCLUSION: In young children with a constricted upper airway, surgical intervention of adenoid and tonsillar hypertrophy should be carried out with reservations, since these airway problems could improve naturally.

264 PERMANENT TOOTH-CROWN DIMENSIONS IN PREMATURELY BORN CHILDREN

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AIM: According to the literature, the scientific evidence is insufficient to answer the question as to whether premature birth causes altered tooth-crown dimensions. The aim of this study was to evaluate permanent tooth-crown dimensions in prematurely born children and to compare the findings with full-term born controls.
SUBJECTS AND METHOD: White pre-term children, 8 to 10 years of age, were selected from the Swedish Medical Birth Register. One group consisted of 36 extremely pre-term children (born before the 29th gestational week), and the other 37 very pre-term children (born during gestational weeks 29 to 32). The pre-term children were compared with a control group of 41 full-term children, who were matched for gender, age, nationality and living area. Clinical examinations were undertaken and study casts and panoramic radiographs were obtained for each child. The permanent maxillary and mandibular first molars, central incisors and laterals were measured with a digital sliding calliper on the study casts. The tooth-crowns were measured both mesiodistally and buccolingually. The examiner conducting the measurement analysis was unaware of the subject grouping.
RESULTS: The maxillary and mandibular first molars were smaller mesiodistally and buccolingually ($P \leq 0.01$) whereas the central incisors and lower laterals were smaller mesiodistally ($P \leq 0.02$) in the extremely pre-term group compared with the full-term group. A reduction in tooth size of 5-8 per cent was found between the extremely pre-term group and the full-term group. Furthermore, the maxillary first molars and mandibular left first molar were also smaller mesiodistally ($P \leq 0.035$) in the extremely pre-term group compared with the very pre-term group.
CONCLUSION: Premature birth is associated with reduced tooth-crown dimensions of the permanent teeth, and the more pre-term the birth the smaller the tooth-crown dimensions.

265 THE EFFECTS OF FACEMASK/BITE BLOCK THERAPY WITH OR WITHOUT RAPID PALATAL EXPANSION

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AIM: There are a number of treatment approaches regarding orthopaedic treatment of Class III malocclusions. To control the sagittal discrepancy, the use of the protraction facemask (FM) with or without rapid maxillary expansion (RME) for treating Class III malocclusion has gained popularity. Control of the vertical skeletal relationships is important in orthopaedic treatment of Class III malocclusions with a FM. It has been shown that avoiding backward rotation of the mandible is crucial to prevent relapse after early orthopaedic Class III treatment. The aim of this study was to compare the effects of a FM in combination with a mandibular bite block (FM/BB) or with RME as a bonded device (RME/FM) in patients with Class III malocclusion.
SUBJECTS AND METHODS The FM/BB sample included 22 subjects [12 girls, 10 boys, average age before treatment (T1) 8.7 ± 1.2 years, mean age after active treatment (T2) 10.4 ± 1.3 years, mean treatment duration 1.7 ± 0.8 years]. The RME/FM sample comprised 17 subjects (10 girls, 7 boys, average age at T1, 7.8 ± 1.8 years and at T2, 9.3 ± 1.9 years). The mean duration of observation was 1.5 ± 0.6 years. Lateral cephalograms obtained at T1 and T2 were evaluated. T2-T1 changes in the two groups were compared with an independent sample *t*-test ($P < 0.05$).
RESULT: Comparison of the two treatment protocols showed that there were no significant differences for any measurements in either the sagittal or vertical planes from T1 to T2.
CONCLUSION: FM in combination with different types of full-coverage occlusal splints results in similar dentoskeletal outcomes regardless of the presence or absence of RME. Both the BB appliance and the splinted RME limited posterior rotation of the mandible.

266 A SYSTEMATIC REVIEW OF THE CORRELATION BETWEEN THE STOMATOGNATHIC SYSTEM AND BODY POSTURE

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AIM: Correlations between the stomatognathic system and whole-body posture has recently been reported. Among the different recording methods used is surface electromyography. This method is able to monitor the muscle activity of both the stomatognathic system and other areas of the body. The aim of this systematic literature review was to assess the scientific evidence for detectable correlations between the stomatognathic system and whole-body posture as investigated through surface electromyography.
MATERIALS AND METHOD: A literature survey was performed using the Medline database, covering the period from January 1966 to September 2009, and using the medical subject headings. After selection, seven articles qualified for final analysis.
RESULTS: Only one study was judged to be of medium quality, with all the rest classified as of low quality design. None of the studies included had a follow-up. Overall, all of the studies reported detectable correlations between the stomatognathic system and body posture for at least one of the parameters used. However, after reappraisal of most of the data provided in these studies, a weak correlation that reached biological relevance is apparent. Therefore, with limitations due to the poor methodological quality of the published studies, a correlation between the stomatognathic system and whole-body posture can be detected, at least under experimental conditions.
CONCLUSION: While more investigations with improved levels of scientific evidence are needed, the current evidence does not support either the existence of clinically significant correlations between the stomatognathic system and whole-body posture.

267 UNILATERAL POSTERIOR CROSSBITE CORRECTION IN THE MIXED DENTITION – A 3-YEAR FOLLOW-UP

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AIM: To compare and evaluate long-term stability of crossbite correction with a quadhelix or expansion plate in the mixed dentition.
SUBJECTS AND METHOD: In this randomised controlled study 35 patients with a unilateral posterior crossbite were treated with either a quadhelix or an expansion plate. The inclusion criteria were mixed dentition, unilateral posterior crossbite, no sucking habits or previous orthodontic treatment. Stability was evaluated after 3 years by study cast measurements. Twenty subjects with normal occlusion were included as controls. Success rate, maxillary and mandibular transverse dimensions, overjet, overbite and arch length were registered.
RESULTS: Stability was equal for the two treatment methods. Small, albeit significant, differences between the groups were assessed with reference to transverse dimensions. No significant difference was seen for overjet and overbite. The treated patients never reached the same transverse width as the normal control group.
CONCLUSION: There was no difference in long-term stability of posterior crossbite correction with a quadhelix and expansion plate. Three years post-treatment, the maxillary width was still greater in the control group than in the treated group.

268 PERCEPTION OF PAIN DURING ORTHODONTIC TREATMENT

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AIM: To investigate the intensity, location and duration of patient discomfort, following insertion of orthodontic appliances.
SUBJECTS AND METHOD: Thirty-two females and 25 males (mean age: 15.5 years) treated with fixed appliances. They were given oral and written instructions on how to complete a questionnaire, which consisted of eight questions. The patient was requested to respond to each question by placing a mark along a 10 cm long visual analogue scale. The questionnaire was to be filled out 4 hours after the appointment and then at 24 hourly intervals for the next 7 days.
RESULTS: The majority of patients experienced pain 4 hours after archwire placement, which peaked at 24 hours and then declined. The pain usually lasted 2-3 days and gradually decreased in its intensity by day 5 or 6. Patients reported more pain experience in the anterior than in the posterior teeth, because of the differences in root surface area. The overall findings indicate that analgesics are still the main treatment modality to reduce orthodontic pain. There were no differences between females and males in the evaluation of their facial and dental appearance. The influence of pain on diet was significant.

269 CONDYLAR TRACINGS IN CLASS III MALOCCLUSION SUBJECTS BEFORE AND AFTER ORTHOGNATHIC SURGERY

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AIM: To longitudinally evaluate the condylar tracing characteristics (length, morphology, superimposition, deviations, sagittal condylar inclination and Bennet angle) recorded with computerized axiography of patients with a severe Class III malocclusion before and after orthognathic surgery and orthodontic therapy.
SUBJECTS AND METHOD: Eleven subjects with mandibular prognathism (6 males, 5 females, mean age ± standard deviation 23.10 ± 3.13 years) scheduled for combined orthodontic-surgical treatment. Computerized axiography was recorded with a Cadiax® Diagnostic axiograph, connected to a condylograph facebow, and Gamma Dental Software for data storage and analysis before (T0) and after (T1) therapy. Statistical analysis was performed with the chi square test to evaluate T0-T1 differences of length, morphology, superimposition, deviations, sagittal condylar inclination and Bennet angle.
RESULTS: There was a significant improvement at T1 of all parameters: length ($P < 0.05$), normal morphology ($P < 0.05$), superimposition ($P < 0.01$), deviations ($P < 0.01$), sagittal condylar inclination ($P < 0.001$), and Bennet angle ($P < 0.01$).
CONCLUSION: Temporomandibular joint (TMJ) border movements after surgery not only improved morphology, but also showed a significant change ($P < 0.001$) in sagittal condylar inclination during protrusion (T0: 27.5 ± 6.9°, T1: 46.9 ± 6.5°, normal values 52 ± 7°) meaning that functional movements of the TMJ are influenced by surgery and orthodontics in severe Class III patients. Further controls and long-term evaluation are necessary to confirm the results.

270 REVERSE-SEQUENCING CHEWING PATTERNS BEFORE AND AFTER CLASS III ORTHOGNATHIC SURGERY

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AIM: Reverse-sequencing chewing patterns are highly dyskinetic cycles characterized by asymmetric neuromuscular function. They occur with high frequency in patients with a posterior crossbite. This longitudinal study analyzed the prevalence of reverse-sequencing chewing cycles before and after orthognathic surgery and orthodontic therapy of severe Class III patients.
SUBJECTS AND METHOD: Eleven subjects with mandibular prognathism (6 males, 5 females, mean age ± standard deviation 23.10 ± 3.13 years) scheduled for combined orthodontic-surgical treatment. The chewing cycles were recorded with a kinesiograph (K7-I, Myotronics Inc. Tukwila, Washington, USA) and analyzed with custom-made software for data storage and subsequent analysis before (T0) and after (T1) treatment, and at a three-year follow-up (T2). Statistical analysis was performed with the chi square test to evaluate the differences between T0-T1 and T0-T2.
RESULTS: The percentage of reverse-sequencing chewing cycles significantly decreased with both the soft and hard boluses after therapy (T0-T1 $P < 0.01$) and at the 3 year follow up (T0-T2 $P < 0.05$). The total number of chewing cycles increased after therapy with both the soft and hard bolus (T0-T1 $P < 0.01$; T0-T2 $P < 0.01$).
CONCLUSION: Combined orthodontic-surgical treatment not only corrects the malocclusion, but also improves masticatory function, decreasing the reverse sequencing chewing cycles and enhancing the total number of chewing cycles. Masticatory function improvement was stable at T2.

271 EVALUATION OF ORAL HYGIENE IN PATIENTS TREATED WITH REMOVABLE APPLIANCES

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AIM: To evaluate oral hygiene and oral hygiene index (OHI) values in 72 patients aged 7 to 13 years, treated with removable appliances.
MATERIALS AND METHOD: Dental instruments were to assess oral hygiene during two control visits. Three teeth in the maxilla (labial surfaces) and three teeth in the mandible (lingual surfaces) on the opposite side were examined. OHI values were measured and the results were summed and divided by the number of surfaces. The correct tooth brushing technique was shown using models and a toothbrush. Each patient was provided with toothpaste (Elmex) for home use. Oral hygiene and tooth brushing technique were evaluated again using the OHI after 2 months.
RESULTS: The average OHI was 0.83 (0.93 in boys; 0.75 in girls). The average OHI after 2 months was 0.63 (0.74 in boys; 0.53 in girls). According to Warsz *et al*., the OHI value in children without proper dental care was 0.32 (0.25 in girls, 0.4 in boys). These OHI values were lower than those found in the present study.
CONCLUSION: The OHI was higher in boys than in girls. The OHI value after 2 months was lower both in boys and in girls. No correlation between the OHI and patient age was found.

272 META-ANALYSIS OF STUDIES ON PAEDIATRIC CRANIOMANDIBULAR DISORDERS

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AIM: The signs and symptoms of temporomandibular disorders (TMD) in children have been intensively studied. A mainly high, but variable, prevalence of TMD is reported in the literature, but it remains unclear whether TMD in children and adolescents should be considered a major health problem. The aim of this meta-analysis was to evaluate the incidence of paediatric craniomandibular disorders.
MATERIALS AND METHOD: Four hundred and ninety four articles identified from PubMed were collected and 97 were selected by applying the following criteria: subject's age 0–14 years; condition not treated; report published after 1990; more than 100 subjects surveyed; and TMD evaluated with auscultation, muscle palpation, and mandibular movement capacity.
RESULTS: The reported incidence of paediatric TMD was very high, at 27.3 per cent. Children with TMD can present with bruxism, onychophagy, speech disorders, partial inability to open the mouth, mastication difficulties, and malocclusions.
CONCLUSION: The identification and recognition of factors such as malocclusions and parafunctions are considered fundamental to early diagnosis of problems of the temporomandibular joint, which is the most effective way to avoid dysfunction of the stomatognathic system.

273 VALIDITY OF UPPER AIRWAY ASSESSMENT IN CHILDREN

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AIM: Lateral cephalometric radiography is a conventional orthodontic method used for determining craniofacial morphology and possible upper airway obstruction. Assessment of pharyngeal obstruction is particularly important in children with breathing difficulties. The aim of this study was to evaluate the possibility of using two-dimensional (2D) lateral cephalograms to identify pharyngeal obstruction in relation to three-dimensional magnetic resonance imaging (MRI) and clinical observation of tonsillar size.
SUBJECTS AND METHOD: Thirty- six children (19 males, 17 females, mean age 7.3 years, range 4.8–9.8 years) with sleep-disordered breathing diagnosed by nocturnal polygraphy. Pharyngeal airway was imaged with a low field open configuration magnetic resonance scanner. An otorhinolaryngological clinical examination was carried out and lateral skull radiographs were taken and measured.
RESULTS: Nasopharyngeal cephalometric variables had a significant positive correlation with the minimal cross-sectional nasopharyngeal airway area (MRI). From oropharyngeal cephalometric variables, retropalatal measurements correlated with MRI findings. Both the MRI and cephalometric technique showed the narrowest pharyngeal measurement to be located in the retropalatal region. Clinical assessment of tonsillar size correlated inversely with MRI findings such as minimal retropalatal cross-sectional airway area ($P = 0.000$), minimal retroglossal cross-sectional airway area ($P = 0.015$) and intertonsillar airway width ($P = 0.000$). Cephalometric soft palate and tonsillar area correlated with clinical tonsillar size ($P = 0.001$). The results can be explained by anatomical and postural factors.
CONCLUSION: Lateral cephalometric radiography is a useful screening tool when evaluating nasopharyngeal and retropalatal airway size. However, much of the retroglossal oropharyngeal information is missing in the antero-posterior 2D view. Clinical inspection of oropharynx and tonsillar size is a relatively reliable method when oropharyngeal airway size is examined.

274 DIFFERENCES IN SOFT TISSUE ANALYSIS BETWEEN CONVENTIONAL AND COMPUTERIZED TRACING METHODS

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AIM: To evaluate the accuracy of cephalometric soft tissue measurements using computerized tracing of direct digital radiographs in comparison with hand tracing of digital radiographic printouts.
MATERIALS AND METHOD: Thirty pre-treatment cephalometric digital radiographs were traced using the Vistadent OC 1.1 computer software program (group 1) and their conventional radiographic printouts were traced manually (group 2) by the same investigator. The soft tissue analyses of Epker and Holdaway were carried out using both methods. Measurement reproducibility

was evaluated by calculating intraclass correlation coefficients (ICC), and paired *t*-tests were used to compare differences in individual measurements between the methods. Differences greater than 0.05 were considered to be statistically significant.
RESULTS: ICC were higher than 0.85 for both methods. Soft tissue cephalometric measurements using the analyses of Epker and Holdaway were reproducible for both tracing methods ($P > 0.05$).
CONCLUSION: Despite minimal discrepancies in measured values between conventional hand-tracing and the computerized method, any differences were minimal and clinically acceptable.

275 VERIFYING THE TRACING OF TRUE HORIZONTAL AND TRUE VERTICAL USING THE INTRACRANIAL REFERENCE PLANE

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AIM: Any morphometric analysis is based on the construction of reference lines. The problem is which of them should be used for cephalometric measurements. The true horizontal (TH) and true vertical (TVL) lines presuppose accuracy in taking lateral cephalograms in the natural head position (NHP). The aim of this research was to determine which intracranial plane shows the best correlation with TH.
MATERIALS AND METHOD: Profile photographs and lateral cephalograms of 71 patients with malocclusions were taken in the NHP (25 patients had a Class I, 25 a Class II and 21 a Class III malocclusion). The following lines were constructed: Frankfort horizontal traced through the soft (FH1) and hard tissue (FH2) landmarks, TH, the TVL and the optical plane (Opt). The angles measured were: FH1/FH2; FH2/TH; FH2/Opt; Opt/TH; Opt/TVL and N-S/TH.
RESULTS: There was no statistically significant difference between the groups. Frankfort horizontal (FH1 and FH2) were not identical; the mean value of FH1/FH2 angle was 5.87 ± 1.02 degrees. FH2 had a different position according to TH (FH2/TH = 5.03 ± 3.79°). Opt plane was almost parallel to TH (Opt/TH = 0.14 ± 0.35°). The average mean value of the OptL/TVL angle was 89.86 ± 0.35 degrees and of N-S/TH angle –9.1 ± 4.07 degrees.
CONCLUSION: Application of Opt as the intracranial reference plane helps prevent errors in tracing TH and TVL.

276 TREATMENT EFFECTS ON THE SOFT TISSUE PROFILE IN PATIENTS TREATED WITH THE HERBST APPLIANCE

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AIM: To study soft tissue profile changes during Herbst appliance treatment of patients with distal occlusion.
MATERIALS AND METHOD: Profile photographs and lateral cephalograms of 36 patients aged 12-24 years with distal occlusion were taken in the natural head position; mean treatment time was 11 months. To prevent maxillary molar distalization and consolidation of the upper dental archwire, brackets were used. Standard cephalometric landmarks were used to construct the reference lines and measurements. The patients were divided into three groups according to the position of the maxillary incisors: group I, patients with incisor retrusion (U1/NL >75°); group II, with a normal position of the incisors (75° ≥ U1/NL ≤ 65°) and group III, with incisor protrusion (U1/NL <65°).
RESULTS: There was a significant decrease of ANB angle (1.68 ± 0.83°, $P < 0.05$) while U1/NL angle increased (11.22 ± 4.46°, $P < 0.01$) in group I. Changes of C/sn/UL angle were not statistically significant ($P > 0.05$). Furthermore that group of patients had a gl/sn/pg angle of –3.90 ± 1.81 degrees ($P < 0.05$), while UL/sn/pg angle and UL-B increased (–32.03 ± 13.33°, $P < 0.01$; –1.29 ± 0.65 mm, $P < 0.05$ correspondingly). In group II the decrease of ANB angle (5.11 ± 0.70° to 3.50 ± 0.58°, $P < 0.05$) was typical, gl/sn/pg angle did not change, the increase of UL/sn/pg angle was not statistically significant ($P > 0.05$). U1/NL angle decreased in group III (7.88 ± 3.95°, $P < 0.05$) but gl/sn/pg angle did not change ($P < 0.05$) and the increase of UL/sn/pg angle was not statistically significant ($P > 0.05$)
CONCLUSION: Treatment planning for patients with distal occlusion should take into consideration maxillary incisor position. Patients with maxillary incisor retrusion demonstrate a statistically significant improvement of aesthetic parameters during orthodontic treatment.

277 KNOWLEDGE ON BIOSTATISTICS OF ORTHODONTIC POSTGRADUATE STUDENTS IN EUROPE

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AIM: To explore the level of knowledge in biostatistics of orthodontic postgraduate students.
MATERIALS AND METHOD: A four part questionnaire, which included a knowledge test on biostatistics and epidemiology, was developed and distributed to postgraduate programme directors of 21 European universities in 10 countries who delivered it to students; the questionnaire was completed during an in-class examination. The frequency distributions of demographic characteristics were examined, and the percentages of participants who agreed or strongly agreed with each attitudinal statement were calculated; percentages of participants who felt fairly to highly confident for each confidence statement were also determined. Knowledge scores were calculated as the percentage of correct answers; missing values were counted as wrong answers. Data were analyzed with the Student's *t*-test or one-way analysis of variance, and multiple linear regression modelling was employed to determine the adjusted/unconfounded effect of possible knowledge score predictors.
RESULTS: One hundred and twenty seven orthodontic students from a total of 129, responded to the questionnaire. The mean correct answers of the participants were 43.8 per cent with a 95 per cent confidence interval (95% CI) of 40.2-47.3 per cent. This score was not influenced by gender, years elapsed from graduation, other advanced degree or year of study; the sole parameter, which seemed to influence this score was attendance at a biostatistics/epidemiology course (51.9 versus 39.5% score of participants who had previously taken a course versus those who had not, $P < 0.001$). A surprising finding was the inability of the responders to identify the appropriate use of a chi-square test (11.8%, 95% CI 6.1-17.5%).
CONCLUSION: Knowledge on biostatistics of orthodontic postgraduate students in Europe is only influenced by previous relevant education and should be considered inadequate.

278 ROOT RESORPTION IN ORTHODONTICS: COMPARISON OF TWO TREATMENT TECHNIQUES

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AIM: Root resorption is a iatrogenic problem associated with orthodontic treatment. The low-friction Synergy (SY) system allows the use of light forces compared with the conventional straightwire (SW) technique that requires heavier forces. The aim of this study was to compare root resorption after treatment with the conventional SW technique and the SY system.
MATERIALS AND METHOD: Pre- and post-treatment radiographs of 32 patients (16 SW, 16 SY) were analyzed. The radiographs were standardized and image distortion was compensated for. Measurements were undertaken by the same operator of root length (apex-cementoenamel junction) and tooth length (apex-crown point). ANOVA tests were used to study the influence of gender and possible individual predisposition.
RESULTS: The SY system appeared to cause more frequent (SY 46.4%, SW 35.7%), though apparently less, severe resorption. Considering tooth length before and after treatment, canines and premolars appeared to show some increase, indicating a possibly reduced risk of damage in immature teeth. The anterior segments were more affected, with the upper lateral incisors showing the greatest root loss (4.3%). No correlation between gender and root damage was observed. The different distribution of resorption within individuals in the two groups appeared to indicate some predisposition to root resorption, more frequently observed in the SW patients. Considering the suggested threshold of 2.5 mm as a clinically significant indication of resorption, 13 per cent of the teeth in the SY group were shortened above this value, 18 per cent in the SW group. In the SW group the roots in the posterior segments presented more significant resorption. In the SY group tooth damage was greater in males.
CONCLUSION: Less severe root damage could be expected with the use of the light-force low-friction SY system. As undetectable individual predisposition could be present in some cases, clinicians should always apply light forces independent of the type of mechanics used.

279 CERVICAL VERTEBRA ANATOMY IN PATIENTS WITH NORMAL OCCLUSION AND CLASS III MALOCCLUSION

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AIM: The first cervical vertebra represents the transition between the skull and axial skeleton. Therefore, the dimensions of this vertebra could reflect aspects of both the facial skeleton and the cervical column. The aim of this study was to compare the dimensions of the first and second cervical vertebra, intervertebral space, head posture and anterior and posterior face height in children with a normal occlusion and Class III malocclusion.
MATERIAL AND METHOD: Lateral cephalometric radiographs of 100 patients of both genders, aged 10–13 years. Fifty had a normal occlusion, skeletal Class I, and 50 a Class III malocclusion and skeletal Class III. On each radiograph five

variables for the cervicovertebral anatomy, three for the intervertebral space, five for head posture, seven linear and angular mandibular variables and anterior and posterior face heights were measured.
RESULTS: Children with a Class III malocclusion had forward mandibular rotation and horizontal type growth. The anterior height of atlas, the dorsal heights of atlas and axis, and the height of dens axis were highly significantly larger ($P < 0.001$) than in the Class I group. The intervertebral space showed weak significant differences ($P < 0.05$). Children with a Class III malocclusion did not have an extended head posture (the craniovertical (NSL/VER) and the craniocervical (NSL/OPT) angles were highly significantly smaller than in the Class I group ($P < 0.001$), while OPT/HOR was significantly increased in the Class III group ($P < 0.01$).
CONCLUSION: Children with a Class III malocclusion show forward mandibular rotation with horizontal growth of the mandible, larger dimensions of the first and second cervical vertebrae, a small craniocervical angle and flexion of the head.

280 A COMPARATIVE STUDY OF LOWER THIRD MOLAR SPACE IN SKELETAL CLASS III AND CLASS II ANOMALIES

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AIM: Customarily it is considered that in Class III anomalies mandibular macrognathia provides sufficient space for the eruption of the lower third molars, while in Class II anomalies the lack of space is due to micrognathia. However, the opposite situation could be encountered, as the space available for the eruption of the lower third molar depends not only on mandibular length, but also on other developmental skeletal and dental characteristics. The aim of this research was to perform a comparative study on the eruptive perspective of the third molar among subjects with skeletal Class III and Class II anomalies.
SUBJECTS AND METHODS: Two patient groups were selected, based on mandibular development criteria: 21 patients with mandibular prognathia (Angle Class III) and 27 patients with mandibular micrognathia (Angle Class II). Measurement of available space for the third molars (measured on profile cephalograms and dental pantomograms) was conducted between the Class II/Class III subjects, hypodivergent/hyperdivergent sub-samples in each sample and between groups of patients with the same rotational pattern in the two samples.
RESULTS: Space corresponding to the lower third molar did not display a statistically significant difference between the two samples as, despite mandibular macro/micrognathia, each sample contained subjects with/without adequate space available for the lower third molars.
CONCLUSION: Several interconnected factors influence third molar eruption and alignment, including mandibular base dimension, alveolar bone perimeter, lower arch dental perimeter and facial growth rotation pattern.

281 CONE BEAM COMPUTED TOMOGRAPHY OF THE TEMPOROMANDIBULAR JOINT IN THE SURGICAL TREATMENT OF CLASS III ANOMALIES

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AIM: A bilateral sagittal split osteotomy (BSSO) is one of the most frequently used surgical procedures for correcting mandibular prognathia. It has been widely accepted that maintaining the proximal mandibular segment in its pre-operative condylar position contributes substantially to the stability of the surgical result and reduces the adverse effects on the temporomandibular joint (TMJ). The aim of this research was to evaluate TMJ changes following orthognathic surgery in subjects with severe Class III anomalies.
SUBJECTS AND METHOD: Twenty young adults with severe Class III anomalies, who had received combined orthodontic and orthognathic surgical treatment. Cone beam computed tomograms (CBCT) of the TMJs were obtained pre- and post-surgery. Patient positioning parameters were defined in order to obtain the same axial sections on the CBCTs at the two time points, thus enabling comparative analysis. Based on the measuring method on conventional radiographs described by Pullinger and Hollinger, the distances from the centre of the condyle to the glenoid cavity border were measured at 0, 30, 60, 120, 150 and 180 degrees.
RESULTS: Comparative statistical analysis of the data revealed changes in the position of the condyle in the glenoid cavity 6 weeks post-surgery compared with pre-surgery, but without statistical significance (except for the left side at the 30 degree evaluation).
CONCLUSION: It is important for the results of surgery to be verified through a standardized CBCT method, in order to appreciate the quality of surgical intervention. The adaptive capacity of the TMJs may compensate for minor changes.

282 ASSESSMENT OF THE OCCLUSAL CANT IN THE FRONTAL PLANE

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AIM: While facial asymmetry is detected, to some degree, even in 'normal' subjects, its quantification is of particular interest in patients seeking orthodontic treatment. Some asymmetric features might be masked by soft tissue or postural habits and, in the absence of thorough examination, become apparent only during the finishing stages of treatment. The aim of this research was to evaluate the cant of the occlusal plane in patients seeking orthodontic treatment, and to verify the existence of significant angular differences between patients with a unilateral/bilateral crossbite compared with those with a neutral transverse occlusion.
MATERIALS AND METHOD: Initial posteroanterior (PA) and lateral cephalograms of 28 consecutive adult subjects were traced and angular and linear cephalometric measurements were obtained (including SNA, SNB, occlusal and mandibular angles, A0-B0 distance on the lateral cephalogram and maxillo-mandibular/midline angle and cant of the occlusal plane on the PA cephalogram). The patients were divided into three groups, based on the lateral transverse occlusal relationship (neutral, n = 18, unilateral crossbite n = 7, bilateral crossbite n = 3).
RESULTS: Three subjects in the neutral group had no occlusal cant. The angulation of the occlusal plane ranged from 2 to 9 degrees (average 4.3°). The average subsample occlusal plane angle was 3 degrees for the neutral, 7 degrees for the unilateral crossbite and 4.5 degrees for the bilateral crossbite. There were no statistically significant differences between subsamples, due to the small number of subjects.
CONCLUSION: In order to better plan and manage orthodontic treatment, determination of the occlusal cant should be routinely performed, especially in subjects with transverse jaw discrepancies, where it might also serve as benchmark for treatment results.

283 CEPHALOMETRIC ASSESSMENT OF CHANGES IN THE FACIAL SKELETON IN CHILDREN WITH MANDIBULAR PROGNATHISM

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AIM: To evaluate changes in the morphology of the facial skeleton in children with clinically diagnosed mandibular prognathism.
SUBJECTS AND METHOD: Thirty-five children with mandibular prognathism ranging in age from 6 to 15 years. The cephalometric examination was carried out on lateral cephalogram of the head by means of 19 angular and 18 linear measurements. The measurements were compared with developmental norms formulated by Droschl, and statistically evaluated with a Student's *t* and Wilcoxon's tests.
RESULTS: Among the cranial angles the most significant changes were noticed on sella turcica (NSAr), which decreased on average by 3.5 degrees and gonial angle (ArGoMe) that increased by 4.5 degrees. The angles defining the sagittal position of the mandible in relation to the base of the anterior cranial fossa (SNB) increased by 3.5 degrees, SNPog increased by 3.9 degrees, the angle defining the sagittal relationship between the mandible and the maxilla (ANB) was reduced by 3.7 degrees, and the angle illustrating the vertical relationship between them (ML-NL) increased by 3.7 degrees. The linear measurement of mandibular base length showed a mean increase of 6 mm (from 2 to 16 mm) in relation to the norm in all subjects. In 15 subjects the mandibular ramus was also lengthened. Maxillary base length showed a shortening in 11 subjects. Vertical linear measurements revealed an increase in lower face height in all subjects.
CONCLUSION: Children with mandibular prognathism display excessive sagittal growth of the mandibular body, often accompanied by lengthening of the mandibular ramus.

284 A TWO-JAW ORTHODONTIC APPLIANCE FOR A CLASS III MALOCCLUSION PATIENT TREATMENT

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AIM: To improve methods of orthodontic treatment in children with a Class III malocclusion combined with early extraction of molars.
SUBJECTS AND METHOD: Forty patients aged 6–9 years with a Class III malocclusion combined with early molar extraction. Clinical, anthropometric, morphometric and roentgenologic methods were used. Space deficiency for premolars was estimated and space in the extraction region was measured using the Michigan University scheme. A multifunctional

two-jaw orthodontic prosthetic device for Class III and deep-bite treatment (patent 12307620 from 10 October 2007) was used. The appliance consisted of two basic plastic plates (upper and lower), functional, fixed and strength elements and contained artificial teeth to replace the missing molars. The upper and lower basic plates were connected by Class III elastics.
RESULTS: The occlusal anomaly was corrected. Orthodontic treatment improved interpersonal relationship and occlusal function.

285 ORTHODONTIC FEATURES IN CEREBRAL PALSY

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AIM: Cerebral palsy (CP) refers to anyone of a number of neurological disorders that appear in infancy or early childhood and permanently affect body movement and muscle coordination. The aim of this study was to evaluate the relationship between cerebral palsy and orthodontic defects and the presence of atypical swallowing.
MATERIALS AND METHOD: The clinical records of 36 patients with CP aged from 2 to 24 years. The data were compared with those of a randomly selected control group (CG). The clinical parameters investigated were dental Class, crossbite, overbite, dental crowding and atypical swallowing.
RESULTS: 1) Class I: CP 27.8 per cent, CG 55.6 per cent; Class II: CP 72.2 per cent, CG 30.6 per cent; Class III: CP 0 per cent, CG 13.9 per cent. 2) Crossbite: CP 8.3 per cent, CG 30.6 per cent; 3) Normal overbite: CP 55.6 per cent, CG 77.8 per cent; 4) Open bite: CP 38.9 per cent, CG 11.1 per cent; 5) Deep bite: CP 5.6 per cent, CG 11.1 per cent; 6) Dental crowding: CP 13.9 per cent, CG 30.6 per cent; 7) Atypical swallowing: CP 58.2 per cent, CG 27.8 per cent.
CONCLUSION: CP patients must have a dental check-up starting from an early age in order to control the risk of developing a malocclusion; most of all in relation to the high incidence of Class II malocclusions and skeletal open bites.

286 CEPHALOMETRIC PARAMETERS AND SPEECH ABILITY IN DOWN SYNDROME

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AIM: To determine statistically significant correlations among craniofacial characteristics of subjects affected by Down syndrome (DS), which is the most common chromosomal defect, and their oro-facial muscle function and speech ability.
SUBJECTS AND METHOD: Thirty-one patients (15 females, 16 males), aged from 15 to 30 years. They were all affected by DS and presented average mental delay (IQ between 35 and 55). Sagittal skull radiographs were obtained and cephalometric analysis was performed by the same person. The following parameters were measured: SNA, SNB, ANB, IMPA, N-S, S-Ar, Go-Me, Ar-Go, N-S-Ar, S-Ar-Go, Ar-Go-Me, Björk ∑, N-Me, S-Go, SN-GoGn, SN-Sna/Snp, Sna/Snp-Go/gn, Ls-L-PgC, Li-L-PgC. In addition, in the study group oro-facial muscle function and speech ability tests were undertaken. Nemoceph software was used for computer cephalometric evaluation. The subjects were divided into two subgroups based on the standard deviation (SD) of the cephalometric landmarks. Those in the range of ±1 SD had a value of 1 and outside this range a value of 0. One group had cephalometric values between 5 and 11 and the other group between 12 and 18. A Student's *t*-test was used for statistical evaluation of quantitative variables.
RESULTS: A statistically significant correlation was found between the improved cephalometric parameters of the first group and the numeric values obtained for oro-facial muscle function and speech ability tests ($P = 0.05$). There was also was a statistically significant correlation between the poorly defined cephalometric parameters of the second group and the numeric values obtained for oro-facial muscle function and speech ability tests ($P = 0.05$).
CONCLUSION: The development of the skull and face of DS patients is highly related to oro-facial muscle function and speech ability. Early physiotherapy, speech therapy, dentofacial orthopaedics and orthodontics have a direct impact on the quality of life of DS patients.

287 MICRODAMAGE IN THE ALVEOLAR PROCESS AFTER ORTHODONTIC TOOTH MOVEMENT

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AIM: Microdamage plays a decisive role in bone remodelling and has recently been described in the pig in combination with orthodontic tooth movement (Verna and Melsen). The aim of this study was to investigate the maxillary alveolar process of the rat for microdamage after orthodontic tooth movement and its relationship with orthodontic force application.

MATERIALS AND METHOD: In 24 male Wistar rats (10 weeks old) all three maxillary molars on the right side were moved mesially by means of a nickel titanium coil spring that was fixed to the upper incisors and delivered a force of 25 cN. The rats were randomly allocated to four groups of six animals and forces were applied for 1, 2, 4 or 7 days. The left side served as a control. After cautious preparation, the specimens were stained *en bloc* with basic fuchsin and slices cut parallel to the mesial root of the first molar. The specimens were examined under a microscope with transmission and epifluorescence light for determination of microdamage. In addition, the number of microcracks and their length was determined and differences were examined for significance by means of the Wilcoxon test ($P < 0.05$).
RESULTS: Microdamage could be detected as diffuse microdamage and as microcracks on both sides of the maxilla and in all animal groups. The average length of the microcracks ranged between 47 and 70 µm, and their density between 0.7 and 1.6 mm^2 microcracks. Although the absolute number of microcracks was more frequent on the experimental side, there was no significant difference, either between the sides or between the groups.
CONCLUSION: Microdamage represented as microcracks and diffuse microdamage can be found in the maxillary alveolar process independent of orthodontic loading. A significant accumulation of microcracks on the pressure side could not be confirmed under these experimental conditions.

288 DEFORMATION AND DEACTIVATION CHARACTERISTICS OF NICKEL-TITANIUM WIRES

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AIM: To quantify, *in vitro,* permanent deformation and the force-deflection-rate of preformed nickel-titanium (NiTi) wires during the preliminary alignment phase.
MATERIAL AND METHOD: Five specimens of each NiTi archwire [SmartClip™ Nitinol Classic 0.012 and 0.014 inch and Nitinol heat-activated 0.014 inch (3M Unitek), Damon™ Align SE200 0.012 and 0.014 inch and CuNiTi 0.014 inch (Ormco), Biostarter® 0.012 and 0.014 inch (Forestadent), Sentalloy® 0.014 inch (GAC)] were inserted into a static testing device simulating malpositioned teeth. The deflection ranged from 6 to 1 mm. Permanent deformation was studied by scanning the wires after thermocycling of one day, 14 days and 4 weeks. Force measurements of all 0.014 inch wires (three samples each) were performed at 37°C by simulating a three-bracket relationship deflecting the wire 5, 4, 3, 2, and 1 mm. Similar to the clinical situation, the wire was first inserted into the lateral brackets and then activated into the central malpositioned one. During its gradual levelling, the electronic measuring device recorded the force level at every 0.1 mm step. Data were analyzed by one-way ANOVA and Fisher's protected least significant difference interval, calculated at $\alpha = 0.05$.
RESULTS: Throughout the entire study period, no clinically relevant, permanent deformation was detected for any of the NiTi archwires. However, three of the five Damon CuNiTi specimens were fractured after the 4 week period. Due to the described activation of the wire, the initial vertical force levels seemed very high on the central force sensor (390-520 cN). After 0.3 mm of deactivation (cf. biomechanical properties of the periodontal ligament), all wires reached their martensitic plateau (except Nitinol classic). These force levels ranged from 110 cN (Sentalloy) to 160 cN (Damon Align) at an initial deflection of 3 mm. Regarding the force levels of the martensitic plateau, Nitinol classic and Sentalloy showed statistically significant differences to the other tested NiTi wires.

289 EVALUATION OF MICROLEAKAGE WHEN BRACKETS ARE CURED FROM DIFFERENT SIDES

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AIM: Metal brackets do not conduct light as well as ceramic brackets during light curing, which may cause incomplete adhesive polymerization. In previous studies, higher microleakage was reported for metal brackets at the gingival sides. The purpose of this *in vitro* study was to investigate if curing the bracket-adhesive complex through different sides; gingival, occlusal and both mesial and distal, will affect the amount of microleakage at the gingival and the occlusal sides of the brackets.
MATERIALS AND METHOD: Forty-five freshly-extracted human maxillary premolar teeth divided into three equal groups: group 1 cured at the occlusal side, group 2 cured at the gingival side and group 3 at both the mesial and distal sides. The dye penetration method was used for microleakage evaluation. Microleakage was determined under a stereomicroscope between the enamel-adhesive and bracket-adhesive interfaces. Statistical analysis was performed using Kruskal-Wallis and Wilcoxon tests.
RESULTS: When the gingival and occlusal sides were compared, gingival scores were found to be significantly higher for group 1 ($P < 0.05$) for both interfaces. According to multiple group comparisons, statistically significant differences were found at the gingival side for the enamel-adhesive interface ($P < 0.05$) and bracket-adhesive interface ($P < 0.01$).

CONCLUSION: Curing the bracket-adhesive complex through different sides affected the amount of microleakage at the gingival side.

290 OCCLUSAL PLANE AND ORTHOPAEDIC TREATMENT OF CLASS III MALOCCLUSIONS – A CEPHALOMETRIC STUDY

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AIM: Consistent with other authors (Tanaka and Sato, 2008) it is considered that the cant of the occlusal plane (OP) should be considered as an aetiologic factor in the correction of the malocclusion. Indeed, Class III malocclusions present an OP more or less inclined backward and downward and orthopaedic correction should not only address maxillary protraction but also correction of the orientation of the OP. The aim of this study was to cephalometrically evaluate re-orientation of the OP and the skeletal modifications induced by a bonded acrylic-splint associated with a rapid palatal expander and a Delaire facemask.
SUBJECTS AND METHOD: Thirty patients (mean age 8 years) in the early mixed dentition with a skeletal Class III malocclusion caused by maxillary retrognathism. For each patient a lateral cephalogram was taken before treatment (T0) and after appliance removal (T1; mean treatment time 8. 5 months). A digitzed Delaire cephalometric analysis was carried out.
RESULTS: The T1 cephalometric values showed a significant forward displacement of the maxilla, a clockwise rotation of the OP, a consistent correction of the Class III relationship and an increased profile convexity.
CONCLUSION: The main objective of orthopaedic treatment of Class III malocclusions is not only to protract the maxilla but also to ensure that the cant of the OP is compatible with physiological mastication, which is essential for a long-term stability. It is easier to achieve when the OP is short, i.e. in young patients.

Tanaka E M, Sato S 2008 Longitudinal alteration of the occlusal plane and development of different dentoskeletal frames during growth. American Journal of Orthodontics and Dentofacial Orthopedics 134: 602. e1–11

291 COMPARISON OF BOND STRENGTH OF EIGHT CONTEMPORARY ORTHODONTIC ADHESIVE SYSTEMS

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AIM: Bond failure of brackets can significantly increase chair-side time, treatment time and efficiency. Therefore it is necessary to find an ideal combination of adhesive and bracket system. The purpose of this study was to compare the shear and tensile bond strengths of eight common adhesive systems for bonding in orthodontics.
MATERIALS AND METHOD: One hundred and sixty freshly extracted bovine mandibular permanent incisors randomly divided into eight groups. Self-ligating aesthetic Damon 3 brackets (Ormco, Orange, California, USA) were bonded using the following adhesive systems: Quick Bond (chemically and light-cured; Forestadent, Pforzheim, Germany), Blugloo (Ormco), Enlight LV (Ormco), Kurasper F (Kuraray Dental, Frankfurt, Germany), Transbond LR (3M Unitek, Monrovia, California, USA), Light Bond (Reliance Orthodontic Products, Itasca, Illinois, USA), and Fuji Ortho LC (GC America, Alsip, Illinois, USA). After 24 hours, half of each group was debonded to measure shear bond strength (SBS) and half to measure tensile bond strength.
RESULTS: Blugloo showed the highest SBS values, whereas Transbond LR and Quick Bond (chemically and light-cured) had the lowest. Tensile strength was the highest with Fuji Ortho LC and lowest with Quick Bond (chemically and light-cured) and Kurasper F. The tensile strength of light-cured Quick Bond was approximately 47 per cent lower than that of Fuji Ortho LC.
CONCLUSION: Blugloo, Fuji Ortho LC, Light Bond, and Enlight LV are among the materials of choice for bonding fixed orthodontic appliances to teeth. All bond strength values were clinically satisfactory except for the tensile strength of chemically and light-cured Quick Bond and Kurasper F.

292 BONE GRAFTING FOR ORTHODONTIC PURPOSES

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AIM: Bone is a dynamic tissue that is resorbed and remodelled by osteoblast-osteoclast interaction. In special cases, e.g. bone grafting of periodontal defects, cysts or alveolar clefts, tooth movement into such a grafted region is desired. Here, bone substitutes (BS) that are resorbed by osteoclastic cells (OC) and subsequently replaced by newly formed bone would be desirable to avoid side effects e.g. root resorption. Historically the resorption capacity of BS was tested in histological animal studies. There are only few approaches to test biodegradation *in vitro*. The aim of this study was to develop a new method to quantify biodegradation of BS by OC.
MATERIALS AND METHOD: OC were cultivated in the presence of RANKL and M-CSF on NanoBone®, a BS which has been described for complete biodegradation by OC in histological sections. The calcium content of the media was determined by inductively coupled plasma mass spectrometry followed by a visualization of the cells on the BS was analysed by scanning electron microscopy. Hydrochloric acid and basal cell media served as the control.
RESULTS: Compared with the control, the calcium concentration decreased as an initial effect after contacting the BS. A strong liberation of calcium from the BS mediated by OC was observed over the next 14 days.
CONCLUSION: By developing this method it is possible to give answers to the questions: Is it possible to cultivate OC on respective BS? Are they inert for hydrolytic processes and may they be biodegraded by OC?

293 ANALYSIS OF SUPPORTING AREAS AND ANGLES ON DENTAL PANTOMOGRAMS USING A NEW PROGRAM

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AIM: To test a new computer program to determine whether measurements of supporting areas on dental pantomograms (DPT) or on a model, and angles on DPT and on lateral cephalogram (LCG) give identical results.
SUBJECTS AND METHOD: Fifty patients (20 males, 30 females). To determine the size of the supporting areas on DPT the new computer program, fr-Win 7.0, was used. Gonion- and basic angles were measured on the DPT and LCG, and the data were compared with each other.
RESULTS: The size range of supporting areas measured on DPT and on model was in exact agreement. With a mean of 0.829, Pearson's coefficient of correlation confirmed a significant relationship between the two methods. The size of gonion angle determined on LCG was in exact agreement with that measured on the DPT. Pearson's correlation coefficient, with a mean of 0.8285, showed a significant relationship between the two methods. The 90 per cent confidence interval (CI) of differences in measurements on LCG of the right and left gonion angles on DPT in equivalence region is evidence for equally exact angle measurements on DPT and LCG. The size of basic angle determined on LCG was in exact agreement with that measured on DPT. Pearson's correlation coefficient had a mean of 0.877. The 90 per cent CI of difference of the measurements on LCG to the right and left basic angles on DPT lies in the equivalence region, the angle measurements on the DPT and the LCG agree with each other.
CONCLUSION: With the new computer program exact measurement of supporting areas can be made, which are identical with those taken on a model. The DPT can be used for measurements of gonion and basic angles.

294 ASSESSMENT OF THE PERMANENT DENTITION IN ADULTS WITH AN IDEAL OCCLUSION

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AIM: It has been suggested that the permanent dentition should be evaluated using angular parameters Po-N-I and Po-N-M (Persin, 2009). Angle Po-N-I characterizes the position of interincisor point I with regard to the PoN reference line and angle Po-N-M the position of the occlusal contact point (M) between the upper and lower first molars with regard to the PoN reference line. The aim of this study was to evaluate the permanent dentition in adults with an ideal occlusion, using these parameter angles.
SUBJECTS AND METHOD: Forty-five adults, aged 19 to 25 years, with an ideal occlusion. Plaster casts were obtained and measured. Angular measurements were obtained from lateral cephalograms. Correlation and statistical analyses were undertaken.
RESULTS: The average means of the parameters were 52.3 ± 2.6 degrees (PoNI) and 76.3 ± 1.0 degrees (PoNM). Correlations between parameters, characterized by the sum of the mesiodistal widths of the teeth and angles, PoNI, PoNM were high.
CONCLUSION: The use of the parameters Po-N-I and Po-N-M is recommended for assessment of the permanent dentition in adults with an ideal occlusion.

295 AN *IN VITRO* STUDY OF FRICTION OF CONVENTIONAL LIGATURES WITH SELF-LIGATING BRACKETS

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AIM: The overall resistance to sliding in orthodontic appliances is a combination of classic friction, archwire-bracket binding, and archwire notching. The aim of this study was to compare the frictional force generated by self-ligating (SL) and standard (S) brackets coupled with stainless steel (SS) wires when conventional elastomeric (E) or SS ligatures (L) were used.
MATERIALS AND METHOD: Four types of brackets were selected, one standard (Standard Boston, Leone), one passive SL (Damon 3MX, Ormco) and two active SL (InOvation R, GAC; Time 3, American Orthodontics). For each type of bracket one molar tube and two upper premolars were used in combination with three different sizes of wire (0.016×0.022, 0.017×0.025 and 0.019×0.025 inch SS). Testing was performed with an Instron 3344 machine on brackets bonded with an epoxy adhesive to a Perspex block. Each bracket/wire combination was tested with EL and SSL. Tests performed with SL brackets were also carried out without conventional ligatures. ANOVA and Tukey tests were used to analyze the results for the different archwire-bracket-ligature combinations.
RESULTS: The lowest friction values were registered for the SL method. No significant differences were found in active SL bracket/ 0.016×0.022/EL or SSL assembly when compared with S bracket /0.016×0.022/EL combination. Active SL bracket/0.017×0.025 or 0.019×0.025/SSL showed significantly higher frictional force values than the S bracket for the same combinations. The passive SL bracket showed significantly lower friction values than the S bracket for each archwire/ligature assembly.
CONCLUSION: The use of SSL on active SL brackμets produced a significantly higher level of frictional force than in combination with the S bracket for the 0.017×0.025 and 0.019×0.025 archwire. Standard ligatures in combination with SL brackets could be used to obtain anchorage in the dental arch.

296 STRONTIUM DIMINISHES DELETERIOUS EFFECTS OF RUNX2 HAPLOINSUFFIENCY IN HUMAN OSTEOBLASTS

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AIM: Runx2 is an important transcription factor for osteoblast differentiation as it promotes expression of osteoblast markers, such as alkaline phosphatase (ALP) or osteocalcin (OCN). Heterozygous mutations of Runx2 cause cleidocranial dysplasia (CCD), due to the low functional activity of this gene. This congenital disease is responsible for patent fontanels and supernumerary teeth, as well as aplasia or hypoplasia of the clavicles. In a cell biological trial the ability of strontium to activate remaining functional Runx2 protein was examined. This activation was proven by determination of gene expression of ALP and OCN and by estimation of biomineralization of the extracellular matrix (ECM).
MATERIALS AND METHOD: Runx2+/- osteoblasts were isolated from human alveolar bone of a CCD patient. Osteoblasts were grown in the presence or absence of strontium for 10 days. Total RNA isolation and real time polymerase chain reaction were performed according to molecular biology standard protocols. Biomineralization assay was performed according to Gregory *et al*. (2004).
RESULTS: Strontium-exposed Runx2+/- osteoblasts exhibited statistically significantly enhanced expression of ALP ($P = 0.02$) and OCN ($P = 0.049$) in comparison with non-exposed Runx2+/- osteoblasts. The results of the gene expression study were counter-checked using a biomineralization assay, where strontium exposed adherent cells exhibited statistically significant ($P = 0.002$) enhanced biomineralization of the ECM.
CONCLUSION: An improved effect of biomineralization in strontium-exposed Runx2+/- osteoblasts was observed, which might have promising potential in minimizing the disease pattern of CCD.

297 STRONTIUM COUNTERACTS TOOTH RESORPTION BY INHIBITING EXPRESSION OF RANKL IN PERIODONTAL LIGAMENT CELLS

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AIM: The function of the periodontal ligament (PDL) includes the attachment of the tooth in the alveolar bone, and the sensation of mechanical strain, as well as the support of alveolar bone formation and resorption when the tooth is moved by an orthodontic force. The effect of strontium in PDL cells regarding cytotoxicity and expression of RANKL was examined. So far, the effect of strontium has been exclusively studied in osteoblasts, where strontium enhances osteoblastic replication and activity, while counteracting the expression of RANKL. In this investigation the ability of strontium to inhibit the

expression of osteoclastogenesis promoting cytokines, such as soluble Receptor Activator of NF-κB Ligand (sRANKL), in PDL fibroblasts (cells) was examined. Moreover, PDL cells were incubated with different concentration of strontium and cell viability determined in order to study the optimal concentration of strontium.
MATERIALS AND METHOD: PDL cells were isolated from the root of an extracted tooth. A force was applied *in vitro* on PDL cells to stimulate the expression of osteoclastogenesis promoting cytokines. Strontium-exposed PDL cells were employed in order to examine the effect of strontium on sRANKL expression in PDL cells. Expression of mRNA was determined by means of real time polymerase chain reaction, while protein expression of the cytokines was determined by enzyme-linked immunosorbent assay.
RESULTS: The treatment of pressed PDL cells with strontium resulted in a statistically significant down-regulation of osteoclastogenesis promoting cytokines on mRNA and protein level. Molar concentration of strontium above 10 mM exhibited cytoxic effects in the PDL cells.
CONCLUSION: Strontium diminishes RANKL production in PDL cells. This might have clinical interest regarding tooth movement and inhibition of root resorption.

298 PRIMARY VERSUS PERMANENT DENTITION ANCHORAGE IN EARLY CLASS III ORTHOPAEDIC TREATMENT

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AIM: The most appropriate timing for maxillary orthopaedic treatment in a Class III malocclusion subject is the first phase of the mixed dentition. A facemask (FM) and rapid palatal expander (RPE) are reported to be the most effective therapy for maxillary sagittal and transverse expansion. Some authors report that primary teeth can support the orthopaedic load. The purpose of this preliminary study was to evaluate the skeletal effects in two groups of young Class III young patients, treated using RPE and FM anchored on first permanent molars or on primary teeth in the mixed dentition group.
MATERIALS AND METHOD: Lateral cephalograms taken before (T0) and after (T1) treatment. Cephalometric analysis was based on 11 measurements. Two statistical analyses were undertaken, a paired *t*-test was performed to evaluate changes during T0 to T1 in each group and an unpaired *t*-test to study intergroup comparison.
RESULTS: No statistical significance was found at T0 between the two groups in distribution and treatment time. SNA, ANB and AoBo significantly increased in both groups during the treatment period, while only the primary group showed a significant improvement in facial convexity (ANPog). The mandibular plane (SN^GoGn) did not change significantly.
CONCLUSION: Following RPE and FM therapy in early mixed dentition, maxillary advancement could be more effective using primary teeth as anchorage. A further advantage could be the prevention of any risk of damaging already erupted permanent teeth or dentoalveolar compensation.

299 HYPERDIVERGENT CLASS III AND MAXILLARY HYPOPLASIA: IS FACEMASK THERAPY NECESSARY?

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AIM: Approximately one-third of Class III malocclusions involve a hypoplastic maxilla, often combined with a hyperdivergent growth pattern. The purpose of this study was to compare the skeletal effects in two groups of young Class III hyperdivergent patients treated using a rapid palatal expander (RPE) and a Delaire facemask, or only RPE.
MATERIALS AND METHOD: Each appliance was anchored on the second primary molars and two lateral cephalograms were taken before (T0) and after (T1) the selected treatments options. Twelve cephalometric measurements were made at T0 and T1 and two statistical analyses were performed. A paired *t*-test to evaluate changes during T0 and T1 in each group and an unpaired *t*-test to study intergroup comparison.
RESULTS: There was no statistical difference between the two groups at T0. At T1, SNA, ANB, AoBo and NAPog showed a different improvement in group A compared with group B.
CONCLUSION: Both treatment options are effective. Clinically the main difference in choosing RPE and a Delaire facemask or only RPE, is the evaluation of facial convexity.

300 THE ROLE OF MODERN THREE-DIMENSIONAL IMAGING IN ORTHODONTIC DIAGNOSIS AND TREATMENT PLANNING

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AIM: The information obtained from conventional two-dimensional radiographs is to enable an accurate and complete orthodontic-orthopaedic treatment plan to be formulated. Three-dimensional (3D) imaging provides more detailed information, particularly of the maxillofacial area, allowing the design of a more precise and predictable treatment plan. The aim of this research is to describe the possible fields of use of 3D imaging in orthodontics and to outline the correct role, advantages and possible limitations of the new technologies of imaging and analysis.
MATERIALS AND METHOD: Medline, Science Direct, the Cochrane collaboration and the Blackwell DSynergy were all used to access published journals on the key words of orthodontic diagnosis, treatment plan, cone beam computed tomography, cephalometric analysis, 3D imaging. Using the available search engines, numerous studies were found relevant to the topic. The different applications of 3D imaging technologies in orthodontic were analysed, together with related clinical cases.
RESULTS AND CONCLUSION: The possibilities for application of the new imaging technologies are numerous and they can significantly improve the quality of treatment. The information on teeth, soft and hard tissues, upper respiratory tract and on the relationship between the different structures of the head and neck are more detailed and give many opportunities for in-depth diagnosis. The large amount of information available should be standardized and selected to be interchangeable between different operators.

301 INFLUENCE OF FUNCTIONAL APPLIANCES ON POSTURAL BALANCE IN CHILDREN WITH MALOCCLUSION

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AIM: To define the influence of removable functional appliances in children with malocclusions.
SUBJECTS AND METHOD: Twenty-six children, aged 8-12 years divided into three groups: group 1 (control) 10 children with normal occlusion; group 2, eight children with a distal occlusion (Angle Class II), orthodontically treated with the pre-orthodontic trainer, and group 3, eight children with distal occlusion, orthodontically treated with a removable functional appliance (Persin). Tests for postural balance (stabilometry) were performed during functional rest and with the teeth tightly closed in an upright stance, with/without the removable functional appliances *in situ*.
RESULTS: In group 1, no significant stabilometric changes were detected. In groups 2 and 3 there was a significant deterioration in postural balance when compared with the functional rest position; the 'passed distance' increased 1.3 fold, the 'sway area' 1.5 times and the 'surface of ellipses' 3.3 times. Stabilometric examination of groups 2 and 3 showed improvement of postural balance with functional appliances. In both groups 2 and 3 the passed distance decreased 1.3 times. The sway area decreased 1.2 times in group 2, and 1.3 times in group 3 and the surface of ellipses decreased by 1.9 times and 2.7 times, respectively.
CONCLUSION: Tightly closed teeth in children with normal occlusion did not significantly influence postural balance, while in children with distal occlusion (Angle Class II) this resulted in a significant deterioration in postural balance. Removable functional appliances (pre-orthodontic trainer and Persin's appliance for distal occlusion) significantly improved postural balance.

302 PATHWAYS BETWEEN SUBJECTIVE ORAL HEALTH, FACIAL PAIN, TEMPOROMANDIBULAR DISORDERS AND OCCLUSAL FEATURES

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AIM: To examine the pathways between subjective oral health, facial pain, temporomandibular joint disorders (TMD) and occlusal features in patients with severe malocclusion.
SUBJECTS AND METHOD: Ninety-four adults (mean age 38 years, 64% female, 36% male) referred for orthodontic or surgical-orthodontic treatment. All had severe, diagnosed malocclusions with considerable functional disorders. Subjective oral health was measured with the Oral Health Impact Profile-14, facial pain using a visual analogue scale, TMD with Helkimo's clinical dysfunction index and occlusal features with the Peer Assessment Rating Index. A hypothetical model of the interrelationships between these factors was constructed based on the conceptual model of biological, behavioural and psychosocial consequences of oral diseases. The associations were studied with path analysis.
RESULTS: In contrast to the hypothetical model, among females the occlusal features were not directly associated with subjective oral health but the association was mediated via facial pain. Among males the occlusal features were directly

associated with subjective oral health. Females reported poorer subjective oral health, higher pain levels and had more severe TMD than males, but the gender difference was statistically significant only for pain and TMD.
CONCLUSION: TMD, occlusal features, and facial pain are associated with subjective oral health among patients with severe malocclusions, but the association of the occlusal features to oral health differ between genders. Therefore, these associations should be studied separately among genders.

303 A CLINICAL STUDY OF THE DELAYED ERUPTION OF THE MAXILLARY FIRST MOLAR***

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AIM: The first molar is the key of the occlusion. However few cases have been reported regarding congenitally missing and delayed eruption of the maxillary first molars. The aim of this study was to investigate the longitudinal formation of the maxillary first molars that were considered to be delayed in terms of eruption.
MATERIALS AND METHOD: Delayed eruption of the maxillary first molars was defined as a delay in formation 2 years later than average development. Longitudinal panoramic radiographs of 100 teeth from 53 subjects with delayed maxillary first molar eruption and without genealogical disease. The formation of the teeth was evaluated according to the method of Moorrees.
RESULTS: Forty-seven subjects (89%) had bilateral delayed maxillary first molar eruption; six (11%) were unilateral. Thirty-nine subjects (74%) had an Angle Class III, four (8%) an Angle Class I, and two (4%) an Angle Class II. Eighty-three teeth (83%) were erupted at R1/2 stage of Moorrees development, all teeth were erupted at R3/4.
CONCLUSION: The delayed maxillary first molars were erupted until R3/4 stage of Moorrees development. It is suggested that this investigation was useful for making the treatment plan in the mixed dentition.

304 QUALITY AND VARIATION IN ORTHODONTIC POSTGRADUATE EDUCATION IN EUROPE

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AIM: Clinical excellence in orthodontics begins with quality in orthodontic education. At present, postgraduate education in orthodontics varies throughout Europe both in duration and content, hence presumably in quality. The purpose of the study was to identify existing disparities in European orthodontic postgraduate education.
MATERIALS AND METHOD: An inquiry was conducted during two European Postgraduate Student Orthodontic Society meetings in 2008 and 2009. One hundred and fifteen postgraduate students volunteered to answer a comprehensive questionnaire concerning their current education including admission criteria, clinical training, theoretical education and terms of completion. Descriptive statistics were applied to the data.
RESULTS: Thirty-eight institutions in 23 countries were represented. The number of residents in a department ranged from 3 to 100. The education was full-time for 93 per cent of the students. The terms of completion included a thesis for 83.3 per cent, and a final examination for 81.6 per cent. The duration of the programmes ranged between 2 and 5 years. The number of started patients ranged from 4 to 200 and the number of finished cases from 0 to 198. Chair time as the first operator was reported by 94.8 per cent. Of these, 1.7 per cent had less than 5 hours/week and 67.7 per cent more than 20 hours/week as first operator. Mandatory theoretical lesions were reported by 90.3 per cent of respondents. Of these 8.1 per cent had less than 2 hours/week and 20 per cent more than 20 hours/week.
CONCLUSION: The data revealed inconsistencies with respect to hours of presence, chair time, number of patients, theoretical lessons and terms of completion, indicating substantial disparities in orthodontic training for European postgraduate students. The study serves as a starting point for further investigations, with the ultimate aim to promote standardization and overall quality improvement of postgraduate orthodontic education in Europe.

305 PROFILE CHANGES AFTER MAXILLARY POSTERIOR IMPACTION

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AIM: The treatment of long face patients is considered difficult and a large number require orthognathic surgery: The aim of this study was to evaluate and predict profile changes after Le Fort 1 osteotomy, including maxillary posterior impaction.

SUBJECTS AND METHOD: Fifteen patients (12 females, 3 males, mean age 24.2 years) with a Class II division 1 malocclusion and an open bite (more than 4 mm). In three patients the second premolars had been extracted while in 12 patients no extractions had been performed. After bonding with a 0.022 standard edgewise system, levelling, aligning and arch decompensation, all patients underwent a Le Fort 1 osteotomy for maxillary posterior impaction. Pre- and post-operative lateral cephalograms were evaluated, and analyzed by Wilcoxon test.
RESULTS: Go-GN/SN and nasolabial angle were decreased 3 ± 0.5 ($P < 0.01$) and 1.4 ± 1.6 ($P < 0.8$) degrees, respectively. The lower lip was shortened 3.2 ± 0.1 mm ($P < 0.003$) and its protrusion was reduced 1.6 ± 0.5 mm ($P < 0.02$). Upper lip length decreased 0.4 ± 2 mm ($P < 0.3$) and its protrusion was decreased 1.2 ± 0.2 mm ($P < 0.2$). Anterior face height decreased, 5.9 ± 1.4 mm ($P < 0.001$).
CONCLUSION: After maxillary posterior impaction, anterior face height, GO-GN/SN, lower lip length and lower lip protrusion, were significantly decreased. Upper lip length, nasolabial angle and upper lip protrusion did not change significantly.

306 MECHANICAL PROPERTIES OF NICKEL-TITANIUM ARCHWIRES AFTER USE IN THE ORAL ENVIRONMENT

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AIM: Knowledge of the mechanical properties of nickel-titanium (NiTi) archwires is essential for management of orthodontic therapy with fixed appliances. Loading of periodontal tissues with too heavy forces may result in either complications or delayed tooth movement. The properties of orthodontic archwires may be affected by the temperature of the oral cavity, which is usually significantly decreased in mouth-breathers; these properties may also change permanently in the oral cavity. The aim of this research was to assess the activation and deactivation forces of NiTi archwires.
MATERIALS AND METHOD: Thirty samples of Titanol superelastic, copper NiTi 35°C and NeoSentalloy, diameter and cross-section equal to 0.016 and 0.016 × 0.022 inch, were tested after 4-6 weeks orthodontic application *in vivo*. For laboratory evaluation, a three-point bending test at 30°C was used. The control group consisted of 90 as-received archwires.
RESULTS: The distribution of activation and deactivation forces showed a comparable tendency. Independent of diameter or cross-section, the values gradually increased during activation and decreased during deactivation. They were ranked in decreasing sequence: Titanol superelastic, NeoSentalloy, copper NiTi 35°C. The deactivation forces increased in the 0.016 × 0.022 NeoSentalloy and 0.016 Titanol superelastic and decreased in the 0.016 × 0.022 Titanol superelastic. The results did not allow exact definition of the mode of changes in deactivation forces evaluated after orthodontic application.
CONCLUSION: As the mechanical properties of *in vivo* applied archwires change unpredictably, long-term research is required to establish their clinical use in the oral environment. The results of this study showed that archwires with a round diameter release deactivation forces optimal for orthodontic displacement.

307 ACCURACY OF MECHANICAL TORQUE LIMITING GAUGES FOR MINI-SCREW PLACEMENT

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AIM: To determine and compare the accuracy of four available mechanical torque limiting gauges (MTLGs) for mini-screw placement.
MATERIALS AND METHOD: The torque output of six randomly obtained MTLGs, either of the screwdriver or torque ratchet type of four miniscrew manufacturers (AbsoAncor, Spider Screw, Tomas pin and Lomas orthodontic mini Anchor System). Mounted on a joint, a universal testing machine applied a perpendicular force to a lever arm with a crosshead speed 1.0 mm/minute. For each device, 10 repetitions of the corresponding target torque level were recorded after initial sterilization and after 5, 10, 20, 50 and 100 times to evaluate their potential influence on MTLGs. The breakpoints (Ncm) were calculated for comparison of the groups. Descriptive statistics and mean breakpoints values for each MTLG were computed and compared with the reference values indicated on the respective torque gauges provided by the manufacturer.
RESULTS: The mean torque values for the AbsoAnchor MTLG device was significantly below torque levels, but provided consistent torque values. At higher torque levels, all but one obtained values for the Spider Screw. The ratchet type of MTLGs (Tomas pin, Lomas orthodontic mini Anchor System) yielded statistically significant different mean breakpoints than the indicated limits. Each individual MTLG produced, independently, constant breakpoint torque values, but differed

significantly from each other. For all but the Spider Screw MTLG, the sterilisation process had a statistically significant different influence at the various breakpoint torque levels.
CONCLUSION: Compared with the manufacturers' preset torque levels, significant variations were observed between individual devices. The torque output of each individual device deviated in varying degrees from target torque values and was influenced to various degrees by the sterilization process over time.

308 THE PREDICTION OF FUTURE ORTHOGNATHIC SURGERY NEED IN CHILDREN

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AIM: In a previous multicentre study a total 88 patients with a Class III malocclusion were grouped into orthopaedic/orthodontic (n = 65) and surgery patients (n = 23) according to their records after puberty. Discriminant analysis (DA) and logistic regression (LogR) were applied to 20 landmarks of the patients cephalograms before puberty to identify dentoskeletal variables, which provided the best group separation, respectively best predictability of group membership. Both models were highly significant ($P < 0.001$), classifying over 93 per cent of the patients correctly. The extracted variables were identical for both procedures Wits appraisal, palatal plane angle (NLNSL) and individualized inclination of the lower incisors (M1MLind). Equation for DA 2.277 ± 0.492 Wits +0.116 NLNSL –0.056 M1MLind; score = –0.653. Equation for LogR -7.968 - 1.323 Wits - 0.363 NLNSL + 0.153 M1MLind; score = 0.5.
To prove the formulas and their predictive value cephalograms of 94 newly recruited patients with a Class III from different private orthodontic offices were evaluated according to the same criteria as above. Sixty-two were non-surgery, 32 surgery cases.
RESULTS: The new group showed a significantly worse overall classification (65% compared with the formula for the DA, and 84% for LogR). In DA analysis the non-surgery cases were classified correct in 67 per cent correct whereas for LogR correction classification was found for 89 per cent (former study 95% for DA, 98% for LogR). Surgery cases reached 63 per cent for DA and 75 per cent for LogR (former study 87% DA, 82% LogR). The reasons for the reduction in the predictive value might be due to the independent new patient group, not following the inclusion criteria as strictly and different treatment procedures in the various private offices.

309 NASOLABIAL ANGLE VARIATIONS DUE TO UPPER INCISOR TORQUE AND POSITIONAL CHANGES

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AIMS: To find a direct relationship between pre-and post-treatment changes on upper incisor position and angle, and the modifications on the nasolabial angle inn non-extraction orthodontic cases.
SUBJECTS AND METHOD: One hundred patients aged from 17 to 30 years, all orthodontically treated without extractions. Lateral teleradiographs from before and after treatment were cephalometrically measured. The points and planes for the following measurements were drawn: upper incisor angle based on the maxillary plane (ANS-PNS/SI), upper incisor anteroposterior position based on a plane perpendicular to the Frankfort horizontal plane that crosses point N (N⊥Po-Or) and nasolabial angle (me-sn-ls).
RESULTS: Based upon the differences pre- and post-treatment (final minus the beginning teleradiograph measurements), the nasolabial angle changed when there were modifications of the upper incisors.
CONCLUSION: There is an inverse relationship between nasolabial angle and upper incisor position (the farther distance between the upper incisor and the N⊥Po-Or, the smaller the nasolabial angle) as well as between nasolabial angle and upper incisor angle (more incisor torque results in a smaller nasolabial angle).

310 EARLY TREATMENT OF UNILATERAL POSTERIOR CROSSBITE – AN ELECTROGNATHOGRAPHIC EVALUATION

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AIM: Occlusion is an important factor that affects chewing. Unilateral posterior crossbite (UPXB) patients exhibit asymmetry in motion of the mandible during mastication. The aim of this study was to investigate the characteristics of common chewing cycles in the primary dentition in children with a UPXB, when chewing gum on the UPXB side and on the non-UPXB side.

SUBJECTS AND METHOD: Thirty children with UPXB (5.42 ± 1.2) and 30 children (5.38 ± 1.4) with a normal primary occlusion. Chewing movements were recorded with an electrognathographic (Sirognathograph) and computer analysing system (COSIG II). The chewing patterns were averaged and analysed in the frontal and in the sagittal projection planes and compared using a Student's *t*-test ($P < 0.05$) with respect to the relationship between chewing pattern and occlusion before (T0) and after (T1) treatment, and after retention (T2).
RESULTS: Children with a UPXB opened their mouths wider and had chewing cycles orientated more posteriorly at T0. They also had a shorter rest position in maximal intercuspation and more frequently reverse directed chewing cycles on the UPXB side. At T1, children with a UPXB showed more anteriorly orientated chewing cycles in the sagittal projection plane. At T2 no statistically significant differences between the sides in UPXB children and the control group were found.
CONCLUSION: Early treatment is recommended to normalize the masticatory chewing cycle pattern, to ensure normal chewing function and development of the orofacial system.

311 HUMAN MASTICATORY MUSCLE DIMENSIONS AND VERTICAL FACE HEIGHT – A MAGNETIC RESONANCE IMAGE STUDY

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AIM: The vertical facial dimension in humans varies considerably between individuals. The masticatory muscles have been hypothesized to play a major role in vertical facial development. Published studies show a positive correlation ($P \leq 0.05$) between masticatory muscle volume and cross-sectional area with anterior face height, while some authors found otherwise. These studies used radiographs and computer tomography that exposed subjects to unnecessary radiation. The aim of this research was to explore the relationship between volume and area of masticatory muscles (masseter, medial pterygoid and lateral pterygoid) and anterior face height using magnetic resonance images (MRI).
MATERIALS AND METHOD: MRIs of 40 healthy subjects (13 females, 27 males, age range 20-38 years). Computer algorithms for accurate automated image segmentation were used to create patient-specific masticatory muscle models. The volume and maximum cross-sectional area of each masticatory muscle were calculated. Linear measurements of the soft tissue of anterior and lower face height were also measured. The relationship between the maximum cross-sectional area and volume of the masticatory muscles and anterior and lower face height was analyzed using Spearman's rank correlation coefficient. All measurements for the first 20 subjects were repeated and intra-examiner reliability was determined using a Bland-Altman plot.
RESULTS: No statistically significant correlation was found between masticatory muscle volume and area with lower or anterior face height. The Bland-Altman plot showed good intra-examiner reliability.
CONCLUSION: No conclusive evidence was found for a positive relationship between masticatory muscle volume and maximum cross-sectional area with vertical facial dimensions. However, subcutaneous tissue, especially at the chin area, may affect face height measurements and influence the accuracy of the results.

312 SEGMENTAL MANDIBULAR DENTOALVEOLAR DISTRACTION: AN OPTION TO EXTRACTION THERAPY

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AIM: In the craniofacial region, osteodistraction can be applied to patients with facial anomalies to lengthen either one or both jaws, or a single piece of bone such as a segmental distraction of the anterior dentoalveolar process. This procedure includes four steps: pre-surgical orthodontics, banding of the distractor, osteotomy and movement of the alveolar process, and tooth movement into the created space. The aim of this presentation is to show that osteodistraction is a reliable therapy for patients with skeletal or dentoalveolar discrepancies.
MATERIALS AND METHOD: A lingual arch with a two screw-type expander mechanism was bonded on the first molars and lower incisors. Activation started one week after the osteotomy and ended when the required space was gained. After two months, the teeth were moved into the new bone.
RESULTS: Four adult patients with dento-skeletal Class II malocclusions were successfully treated with osteodistraction. The required space corrected lower crowding of 6 mm in one patient; Class II molar and incisor crowding associated with a biretrusive profile in another; allowed treatment of a Class II division 2 in a patient with a retroalveolar process and previous mandibular trauma; and improved severe crowding and overjet in the last patient.
CONCLUSION: In appropriate cases, segmental osteodistraction can offer a quick biological advantage and good aesthetic results.

313 FORCE SYSTEM OF REVERSE CURVE NICKEL TITANIUM WIRES IN CONVENTIONAL AND SELF-LIGATING BRACKETS

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AIM: To comparatively evaluate the intrusive forces and buccolingual moments generated at the maxillary incisors by a 0.017 × 0.025 inch reverse curve nickel titanium (NiTi) wire using self-ligating and conventional appliances.
MATERIALS AND METHOD: Ten 0.017 × 0.025 inch reverse curve NiTi wire specimens were used with each of the following 0.022 inch bracket systems: Titanium Orthos™, In-Ovation R™ and Damon System 3MX™. The wires were inserted on bracketed maxillary Frasaco models, segmented mesially to the canines. Simulated intrusion from 0.0-1.0 mm was performed on the Orthodontic Measurement and Simulation System, which recorded the intrusive forces and the buccolingual moments at 0.05 mm increments. The data were analyzed by means of ANOVA and Scheffe test.
RESULTS: The intrusive forces were significantly different between all bracket types. The highest force was recorded with the conventional brackets (8.2 N), followed by the Damon 3MX™ (6.3 N) and the In-Ovation R™ (5.5 N) system. The moments were found to be significantly different between the conventional and self-ligating brackets but not between the two types of self-ligating brackets. The highest moments were recorded with the self-ligating brackets (16.6-16.9 Nmm), followed by the conventional brackets (10.8 Nmm).
CONCLUSION: The intrusive forces exerted on the incisors by the 0.017 × 0.025 inch reverse curve NiTi wire specimens in unlevelled dental arches were beyond biologically safe limits. Lower intrusive forces but higher buccolingual moments were recorded with the self-ligating brackets in comparison with the conventional brackets. These findings could be attributed to the different ligation methods as well as to the width differences between the various bracket types.

314 THE TEMPOROMANDIBULAR JOINTS IN PATIENTS WITH SAGITTAL MALOCCLUSIONS

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AIM: To investigate the temporomandibular joints (TMJ) using computed tomography (CT) in patients with sagittal malocclusions.
SUBJECTS AND METHOD: Eighty-seven patients aged between 7 and 38 years. The form of the glenoid cavity, its width and depth, as well as the form of the articular head of the mandibular bone and the size of the space between the head and the cavity in the anterior, middle and posterior areas were assessed together with the degree of displacement of the articular head prior to, during, and at various periods following treatment.
RESULTS: In the initial occlusion 33 per cent of cases had a mandibular shift. While compensatory mechanisms were involved, in the stable occlusion, it tended to increase changes in the joint (29%) – decompensation. Treatment was planned having regard to the functional state of the TMJ.
CONCLUSION: Functional and aesthetic optimum appearances with a, harmonious profile, facial symmetry, multiple interdigitation, creation of balanced occlusion and adequate dentoalveolar height in lateral and anterior areas were formed.

315 A NEW DIAGNOSTIC APPROACH TO ORTHODONTIC PATIENTS

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AIMS: Knowledge of aetiology and correct diagnosis of malocclusions are keys to optimal treatment and treatment outcome. It has been suggested that morphological cervical vertebral column deviations (MCVCD) are important for aetiology, diagnosis and correct treatment of orthodontic patients. The aims of this presentation are to: 1) describe the prevalence and patterns of MCVCD, 2) analyse associations between MCVCD, the craniofacial skeleton and head posture, and 3) elucidate the aetiology behind the associations between MCVCD and the craniofacial skeleton.
MATERIALS AND METHOD: Profile radiographs of individuals with a neutral occlusion (n = 21), severe skeletal malocclusions (n = 170) and condylar hypoplasia (n = 11). Material from human triploidy foetuses (n = 8) and mouse embryos (n = 4). The radiographic methods consisted of visual assessment of the cervical vertebral column and cephalometric analysis of the craniofacial skeleton. Histological methods consisted of histochemical and immunohistochemical analyses.

RESULTS: Different prevalences and patterns of MCVCD were seen in the various skeletal malocclusions that were associated with a large cranial base angle, retrognathia of the jaws, and an altered head posture. The results from the histological studies on prenatal materials further elucidated these findings.
CONCLUSION: These new results are important for diagnostics and aetiology and thus for optimal treatment of orthodontic patients. It is recommended that particular attention is paid to the cervical vertebral column area when analysing profile radiographs and to include any MCVCD in diagnostics and treatment considerations and in the evaluation of the aetiology behind malocclusions in orthodontic patients.

316 DENTO-SKELETAL EFFECTS OF RAPID MAXILLARY EXPANSION WITH THE FERRO PROTOCOL

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AIM: Rapid maxillary expansion (RME) is a procedure indicated in growing subjects to correct dentoskeletal transverse discrepancy. Usually skeletal and dental changes are reported. More skeletal changes can be achieved when the expansion is performed after suture opening as recommended by the Ferro Expansion Protocol (FEP). The aim of this study was to compare the transverse skeletal and dental changes in a group of patients with posterior crossbite before and after FEP, with those derived from a normal growth group using postero-anterior (PA) cephalometric radiographs.
MATERIALS AND METHOD: Data from PA cephalograms of 21 patients (17 girls, 4 boys) with a posterior crossbite were compared with those from an age-matched normal growth group. The patients were treated with Hyrax-type RME activated until correction of the crossbite and then used as retainer. The mean age at T0 was 8 years 10 months and at T1, 10 years 8 months. Sixteen reference points were used and eight variables were studied consisting of six skeletal and two dental measurements. A Student's *t*-test was used to compare the differences between groups, and the effects of the FEP on skeletal and dental structures.
RESULTS: The FEP group showed statistically significant changes in latero- and medial-orbital, latero-nasal, maxillary, and upper and lower molar widths. When compared with other studies, skeletal changes were greater than dental changes.
CONCLUSION: There was some evidence that expansion after opening suture produced by the FEP, may result in more significant transverse skeletal increments than dental movements.

317 IS CARIES IN THE EARLY MIXED DENTITION A PREDICTOR OF CARIES RISK DURING ORTHODONTIC TREATMENT?

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AIM: During orthodontic treatment with fixed appliances oral hygiene is difficult and mineral loss may occur. Patients with a high caries risk should be identified before the start of orthodontic treatment. The objective of the present study was to evaluate if caries in the pre-treatment early mixed dentition is a predictor for the development of caries in the permanent dentition during orthodontic treatment.
MATERIALS AND METHOD: The orthodontic database of the University of Geneva was searched for consecutive patients who started treatment in the early mixed dentition and finished treatment in the permanent dentition during 2003–2008. Forty-one patients with pre- and post-treatment radiographs were included. The overall mean treatment duration, generally two-phase, was 46 months. Bitewings and dental pantomograms were evaluated and the DMFT index was calculated.
RESULTS: The initial DMFT was 5.5 (SD = 3.7) and final DMFT 3.0 (SD = 3.2). Pre-treatment, 54 per cent of primary molars were affected by caries, followed by 27.4 per cent of the first permanent molars. Post-treatment, 41.4 per cent of the permanent first molars had carious lesions or fillings. A significant correlation was found between caries experience in the early mixed dentition and that during orthodontic treatment ($r = 0.47$, $P = 0.002$).
CONCLUSION: Children with high caries activity before treatment are exposed to a higher risk of developing carious lesions during orthodontic treatment. It is advised that these children should undergo an extended prophylaxis programme before and during orthodontic treatment.

318 WHICH FACIAL PROFILES MOSTLY DISCRIMINATE PERCEPTION OF MALE AND FEMALE ADOLESCENTS?

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AIM: Adolescence is the age of sexual development and of seeking partners, and perception of facial attractiveness plays an important role in the process. Therefore orthodontist must be aware of facial profile preferences as therapy can alter the attractiveness of the lower facial third. The aim of this research was to establish which facial profiles mostly discriminate perception of male and female adolescents.
SUBJECTS AND METHOD: A random sample of 1089 adolescent (450 males, 639 females) aged 15–19 years (16.3 ± 0.4) from 12 secondary schools in Zagreb, Croatia. Eight profile distortions for each gender, morphed by a digital imaging technique, were assessed for attractiveness by each adolescent and scored from 1 to 8. Multivariate discriminant analysis was used for statistical evaluation.
RESULTS: In general male and female adolescents had similar facial profile preferences. A straight profile was considered the most attractive for both genders. Both bimaxillary alveolar protrusive and retrusive profile were equally attractive among male profiles, but for female profiles thicker rather than flat lips were significantly more attractive. An extreme convex profile was the least attractive, but a mild convex shape was more preferable than a concave shape. According to canonical discriminant function, males and females were mostly discriminated in attractiveness scores of bimaxillary alveolar retrusion and mandibular retrognathism in female profiles, and a combination of maxillary prognathism and mandibular retrognathism in both male and female profiles. Compared with males, females were less tolerant of retrusive lips in females and convex profiles in both males and females.
CONCLUSION: Due to facial profile preferences in borderline cases, it would be wise to treat female patients non-extraction, while for male patients the decision regarding extractions can be more easily decided.

319 mRNA EXPRESSION OF REGULATORY AND GROWTH FACTORS IN OROFACIAL MUSCLES OF DYSTROPHIC MICE

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AIM: Activity of muscle regulatory factors (MRFs) and mechano growth factors (MGFs) increase in regenerating muscle. Little is known about their precise role and particularly their mRNA expression in the masticatory muscles of mdx mice [an animal model of Duchenne muscular dystrophy (DMD)]. Elucidating some aspects of the process of regeneration in the mdx mice may be relevant for a better understanding of DMD. The aim of this investigation was to study gene expression of MRFs and MGFs in mdx mice masticatory muscles as possible indicators of muscle response to dystrophic changes.
MATERIALS AND METHOD: In masticatory muscles of male and female mdx mice the mRNA expression of MRF and MGF was determined by quantitative RT-polymerase chain reaction (mdx versus controls; 100 days old, each group n = 10).
RESULTS: Quantities of mRNA of insulin-like growth factor-1, MGF and MyoD1 in mdx mice were found to be comparable with the controls. Decreased myostatin mRNA was found in mdx masseter (MAS) and tongue (TON) (3- and 2-fold, $P < 0.005$ and < 0.05). Inversely, the myogenin mRNA was increased in mdx MAS (6-fold) and temporal (TEM) muscles (2.5-fold) (both $P < 0.05$). An unequal expression of MRFs was found between the genders. Myogenin and MyoD1 mRNA was increased in mdx female MAS (2-fold and 11-fold, $P < 0.01$ and $P < 0.001$, respectively). In male mdx mice mRNA myostatin in TEM was decreased (10-fold) as compared with the male control mice.
CONCLUSION: Myogenin and myostatin may play an important role in the regeneration process in mdx mouse masticatory muscles that could be regulated by a sex-hormone dependent mechanism.

320 *IN VITRO* INVESTIGATION OF THE TENSILE BOND STRENGTH OF THREE DIFFERENT BRACKET TYPES

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AIM: To compare, *in vitro,* the tensile bond strength (TBS) and debonding characteristics [Adhesive Remnant Index (ARI) scores] of metal, ceramic, and polycarbonate brackets.
MATERIALS AND METHOD: Forty-five freshly extracted bovine teeth, divided into three equal groups, were ground flat (grit 600) and used as substrate for bracket bonding. Mini Twin metal brackets (Ormco Corporation), Allure ceramic brackets (Dentsply GAC International), and Elegance polycarbonate brackets (Dentaurum) were bonded according to the manufacturers' instructions. After 30 second etching with 37 per cent phosphoric acid, the enamel was washed for 20 seconds and dried for 10 seconds. Brackets were bonded with the Padlock bonding system (Reliance) and light cured for 10 seconds with a visible curing unit (Satelec). After 1 hour the specimens were debonded in a tensile mode using a universal

testing machine (Instron) with a crosshead speed of 1 mm/minute. ARI scores were assessed after debonding with a ×25 magnifying microscope.
RESULTS: Significant differences ($P < 0.01$) in TSB were found between metal (4.8 ± 0.6 MPa), ceramic (9.2 ± 1.9 MPa) and polycarbonate (3.6 ± 1.3 MPa) brackets. Lower ARI scores were found for polycarbonate brackets than for the other groups ($P < 0.01$).
CONCLUSION: Higher forces are needed for debonding ceramic brackets than for metal or polycarbonate brackets. Polycarbonate brackets showed significantly less residual resin after debonding than metal or ceramic brackets. Bracket material and geometry appear to play a significant role in debonding characteristics. Changing these properties may improve bonding properties.

321 ALLERGIES IN ORTHODONTICS – FACTS AND MYTHS

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AIM: Allergies are a rare occurrence in the orthodontic office. However, widespread use of nickel in cosmetic jewellery and body piercing, as well as the use of new materials, such as latex, has resulted in an increase in allergic occurrences among the general population and subsequently in orthodontic patients. The aim of this study was to review the major sources of allergens in the orthodontic practice and propose alternatives for a safer treatment and working environment.
MATERIALS AND METHOD: Literature review was performed using the PubMed and KoBSON websites. Ten articles and several book chapters were analyzed.
RESULTS: According to the literature review, allergic reactions to orthodontic materials are classified as Type I and Type IV (hypersensitivity). Both types of allergic reactions require several prolonged contacts with allergens. Dental materials that could act as allergens are metals, polymers and latex. Materials causing Type IV allergic reactions contain polymerized materials and/or catalysts, and are most commonly used in prosthodontics, orthodontics and restorative dentistry. Materials containing latex, which are used in orthodontics, were shown to be strong inductors of Type I allergic reactions.
CONCLUSION: Toxicity, allergenic potential and biocompatibility vary in different materials. Metals that are most commonly suspected to cause allergic reactions during orthodontic treatment are nickel and chrome. In patients allergic to those metals, arches containing nickel and/or chrome should be avoided or covered with plastic protectors. Increased allergenic potential in contemporary orthodontic practice could also be attributed to latex. Intraoral elastics and elastic ligatures that contain latex have relatively less potential to cause allergies than extraoral elastics. In such cases non-latex elastics should be used. Another problem is sensitisation of orthodontists and their assistants to latex. Special attention should be paid to such cases, since latex is the only material used in orthodontic practice that could cause anaphylactic shock.

322 RATE OF DISTALIZATION IN CLASS II SUBJECTS USING HIGH PULL HEADGEAR

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AIM: To evaluate the amount of distalization of the upper molars in patients with crowding using high pull headgear.
SUBJECTS AND METHOD: Ten children with an Angle Class II malocclusion aged from 11 to 13 years with insufficient space in the lateral part of upper dental arch. The facebow was adjusted so that the point of the acting force would go through the centre of resistance of the first upper molar – as close as possible to trifurcation of its roots. The level of the measured force was 450 g per side. The patients used the headgear for 12–14 hours per day. Control visits with measurement of the acting force were conducted at four to six week intervals. Active treatment was for a period of five to seven months. An untreated control group with the same malocclusion was evaluated. Dental casts were made and comparable measurements were carried out before and after treatment for the following distances: between the mesial side of the first upper molar to the incisive papilla on left and right side; between mesial side of the upper first molar to mesial angle of central incisor n left and right side and between mesial side of the first upper molar to distal side of the lateral incisor in left and right side respectively.
RESULTS: The average increase in the distance between the mesial of the upper first molar to the incisive papilla was 1.27 mm. For the mesial angle of the central incisor the average value was 1.73 mm. For the distal side of the lateral incisor the average distance was about 2.33 mm.
CONCLUSION: High pull headgear is an alternative solution to other methods of distalization.

324 CERVICAL VERTEBRAL MATURATION STAGES AND CALCIFICATION OF THE MANDIBULAR SECOND MOLAR

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AIMS: To investigate the relationship between the calcification stages of the mandibular second molar and skeletal maturity based on analysis of panoramic and cephalometric radiographs, respectively. A further aim was to determine if panoramic radiographs might be valuable for assessment of mandibular growth potential.
MATERIALS AND METHOD: Cephalometric and panoramic radiographs of 260 subjects (158 females, 102 males) ranging in age from 10 to 14 years. In each case the cervical vertebral maturation (CVM) and dental maturation stages of the lower second molar were determined. The frequency of occurrence of each of the six cervical stages (CS1-CS6) in both the female and male group and the corresponding dental calcification stage of the mandibular second molar was recorded.
RESULTS: CS3 and CS4, comprising the interval of maximum mandibular growth, were observed in 51 per cent of females and 31 per cent of males. In the female sample, CS3 was correlated with stage F of molar calcification (51%), CS4 was related to F or G stage (37 and 44%, respectively). For males CS3 was related to F or G stage of molar calcification (47 and 35%) and CS4 to stage G or H (61 and 26%). Molar calcification stage F in the female group was correlated with CVM stages CS3 and CS4 (64%) and stage G to CS4 and CS5 (72%). In the male group dental stage F was related to CVM stage CS1 and CS2 (72%) and stage G to CS2, CS3 and CS4.
CONCLUSION: Mandibular second permanent molar calcification stages on panoramic radiographs may be a useful indicator of the pubertal growth spurt. For the majority of female subjects dental calcification stage E was observed before, and stage G after the pubertal growth spurt. For males dental stages E and F occurred mostly before the growth peak.

325 CORRELATION OF INCISOR INCLINATION AND THE SAGITTAL POSITION OF THE JAWS IN CLASS III SUBJECTS

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AIM: To determine whether a correlation exists between inclination of the maxillary and mandibular incisors and the sagittal position of the jaws in subjects with Class III malocclusions.
MATERIALS AND METHOD: Fifty profile cephalograms of subjects with a Class III malocclusion. The inclination angles of the upper and lower incisors (I/SP and i/MP) were analyzed, as well as their correlation with the angles of maxillary and mandibular prognathism (SNA, SNB). The radiographs were divided into two groups, depending on the size of SNA and SNB (group I with smaller and group II with larger than standard values).
RESULTS: A weak, negative correlation was found between maxillary incisor inclination angle and maxillary prognathism angle in both groups (SNA >82°, r = –0.53, SNA < 82°, r = –0.34). A weak, negative correlation of the lower incisor inclination angle to the mandibular prognathism angle existed only when the values were less than 80 degrees (r = –0.45).
CONCLUSION: Incisor inclination can be conditioned by the sagittal position of the jaws in subjects with a Class III malocclusion, which is of significance for treatment planning.

326 *IN VITRO* CORROSION BEHAVIOUR OF LINGUAL ORTHODONTIC ARCHWIRES

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AIM: To investigate the *in vitro* electrochemical corrosive behaviour of archwires used in lingual orthodontics and to determine if corrosion affects the phase transition temperatures of nickel-titanium (NiTi) and copper-nickel-titanium (CuNiTi) archwires.
MATERIALS AND METHOD: Six different types of archwires were used: Respond, D-Rect, stainless steel (SS) 0.016, SS 0.016 × 0.022, Titanium molybdenum (TMA) 0.016, 0.016 NiTi and 0.017 × 0.017 35°C CuNiTi (Ormco Corp., Glendora, California, USA). Corrosion tests were performed following ISO-standard 10993-15:2000. Differential scanning calorimetry (DSC) was performed on NiTi and CuNiTi archwires of as-received samples, samples immersed for 30 days, and corroded samples. Scanning electron microscopic (SEM) images were obtained to examine surface changes before and after corrosion testing.

RESULTS: SEM analysis showed that all as-received samples had manufacturing defects. The SS archwires showed an Ecorr around –600 mV with the exception of 0.016 SS archwire that was found to be the less resistant to corrosion with an Ecorr of –845 mV. The titanium alloy archwires showed a higher resistance with Ecorr values around 1000 mV. DSC testing detected a rhombohedral phase (R-phase) in NiTi archwires but not in CuNiTi wires. A difference of 2°C to 3.5°C to the manufacturer's claim was found in the as-received and polarized samples, respectively.
CONCLUSION: The archwires tested showed similar corrosion resistance as those used in conventional orthodontics. The 0.016 SS archwires were found to be the less resistant to corrosion. An R-phase was detected for the NiTi archwires but not for the CuNiTi samples. No major differences were observed between groups concerning phase transformation temperatures.

327 IS A SECULAR TREND IN CRANIAL FORMATION AN EXPLANATION OF THE INCREASE IN MALOCCLUSIONS?

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AIM: The increasing prevalence of malocclusions is characteristic for recent populations. The aim of this study was to compare craniofacial and dental characteristics of contemporary and historical populations and elucidate some aetiological aspects of malocclusion.
SUBJECTS AND METHOD: A contemporary cohort of 703 university students and three historical samples (73 skulls from the 9th, 344 skulls from 10th–14th and 210 skulls from 14th–18th centuries) were examined. Measurements of craniometric and anthropometric points were undertaken. The width of the jaws was examined in Pont's points. Björk's method for epidemiological registration of malocclusion was used and teleroentgenograms were examined.
RESULTS: Broader dental arches, regardless of the type of skull, and a significantly lower frequency of serious malocclusions were found in the historical population.
CONCLUSION: The increase in severe malocclusions in the contemporary population is most probably caused by civilising factors than by secular trends in the formation of skull.

328 CRANIOFACIAL MORPHOLOGY IN SLEEP APNOEA PATIENTS WITH DIFFERENT CERVICAL COLUMN FUSIONS

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AIMS: Scientific investigations have not revealed a definitive aetiological and morphological background for patients with sleep apnoea (OSA), and it has not been possible to subclassify craniofacial phenotypes and relate these to specific aetiological factors. The aims of this study were to subgroup patients with OSA according to cervical column morphology and to analyze craniofacial profiles and head posture in the different groups.
SUBJECTS AND METHOD: The OSA group consisted of 16 females and 75 males. Craniofacial profiles and head posture were examined for 74 of the males. OSA was diagnosed by overnight polysomnography. The control group comprised 15 females and six males. Lateral profile radiographs in standardized a head posture were taken. Visual assessment of the cervical column and standardized cephalometric analyses was performed. The male OSA group was divided into four groups according to fusions in the cervical vertebrae: group I, no fusions; group II, fusion C2 and C3; group III, occipitalization; group IV, block fusion.
RESULTS: In the OSA group 46.2 per cent had fusion anomalies. As 14.3 per cent in the control group had fusion anomalies, significantly more fusion anomalies were seen in the OSA group. In the male OSA group no significant differences in craniofacial morphology and head posture were seen between groups I and III. Between groups I and II a significant difference was seen in jaw relationship and between groups I and IV anterior face height and head posture deviated significantly.
CONCLUSION: Morphological deviations of the upper cervical vertebrae are associated with deviations in the craniofacial profile. OSA individuals with block fusions in the cervical vertebrae differed significantly in craniofacial profile and head posture compared with other OSA patients.

329 BUCCALLY BLOCKED OUT CANINES – CLINICAL EVIDENCE OF THE THREE-BRACKET RELATIONSHIP

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AIM: Clinical observation of the levelling and aligning of buccally blocked out canines. It was hypothesized that, due to the theory of the three-bracket relationship, space opening should be a combination of protrusion of the anterior segment and distal movement of the lateral segment.
SUBJECTS AND METHOD: Ten patients with blocked out canines in the upper jaw were bonded with self-ligating brackets (Damon III) and a 0.014 inch Copper-NiTi wire was used for the whole levelling period. To follow the movement of the teeth, special marks were set on the archwire mesial to the bracket of the lateral incisor and distal to the bracket of the first premolar. Photographs of were taken every 4 weeks. Plaster casts were made every 8 weeks and the wire was removed and reactivated in tempered water. Three-dimensional scans of the plaster casts were used for superimposition. Additional measurements were performed on two-dimensional occlusograms.
RESULTS: Distal movement of the first premolars occurred and reached values up to 4.08 mm (SD 0.47 mm), while mesial movement of the lateral incisors was within 1.96–2.76 mm (SD 1.16 mm). For unilateral blocked out canines, distal movement of the first premolar on the side of the blocked out canine showed the highest values.
CONCLUSION: Space opening in situations of buccally blocked out canines takes place by mesial movement of the lateral incisors as well as distal movement of the first premolars. Therefore these canines should be immediately bonded and integrated in the fixed appliance to take advantage of the special geometry and favourable vertical and horizontal forces due to the three-bracket relationship.

330 FINITE ELEMENT ANALYSIS OF ORTHODONTIC IMPLANTS WITH DIFFERENT DESIGNS

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AIM: To comparatively investigate the effect of various designs on the biomechanical properties of the orthodontic implant/bone interface.
MATERIALS AND METHOD: Finite element models of three different types of orthodontic implants were used. The orthodontic implants had different neck designs but were of the same length and were subjected to the same orthodontic force. The first two models simulated commercially available orthodontic implants, while the third was a modification. The stress and strain at the interface between the implant and bone were evaluated using COSMOSM™ software.
RESULTS: Maximum stresses were always located around the neck of the implant, in the marginal bone. The modified implant design resulted in improved distribution of the stress at the neck/alveolar bone interface.
CONCLUSION: The design of orthodontic implants has a significant influence on primary stability and in achieving clinical success.

331 PULPAL REACTION TO LOADING APPLIED TO UPPER TEETH IN PATIENTS WITH CLASS II MALOCCLUSIONS

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AIM: Orthodontic therapy with fixed appliances results in exposure of teeth to continuous forces for a long period of time. Orthodontic force influences the pulp condition of the teeth. The most representative indicator of pulpal vitality is estimation of the function of the pulpal vascular system. Reliable evaluation of microcirculation *in vitro* can be carried out using laser Doppler flowmetry. The aim of the study was to compare the perfusion in pulpal blood vessels of the upper incisors and canines in patients with a Class II malocclusion treated with edgewise appliances, with or without extractions.
MATERIALS AND METHOD: Forty-eight upper anterior teeth of young adults. Straightwire appliances were used for both group of patients, treated either with extractions or by mandibular advancement using Class II elastics. Perfusion was estimated using a laser Doppler flowmeter, MBF3D, and model P13 probe.
RESULTS: A statistically significant blood-flow decrease during orthodontic treatment was found in the pulp of all examined teeth. There was a significant correlation between the type of loading and blood flow for the lateral incisors in patients treated with extractions, and for the canines in patients treated with mandibular advancement.
CONCLUSION: During orthodontic treatment functional changes occur in the pulpal vascular system. The tooth with the most intense pulp reaction to loading depends on the treatment mechanics.

332 EFFECTIVENESS OF COMBINED SURGICAL-ORTHODONTIC TREATMENT: CEPHALOMETRIC ANALYSIS

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AIM: To analyse the facial skeleton of patients with a skeletal Class III malocclusion treated according to a combined surgical-orthodontic protocol.
MATERIALS AND METHOD: Thirty cephalograms of patients with a skeletal Class III malocclusion taken before treatment and 12 months post-surgery. The cephalograms were analyzed using the methods of Steiner (modified by Kamìnek), Schwarz and Harvold. The results were statistically analysed using a Wilcoxon test. The level of significance was set at $P < 0.05$.
RESULTS: Statistically significance improvements regarding angles was observed: enlargement of SNA of 2.68 degrees (±4.27), $P = 0.005$; reduction of SNB of 5.52 degrees (±2.84), $P = 0.000$; enlargement of ANB of 8.26 degrees (±4.25), $P = 0.000$; increase of Wits measurement of 10.33 mm (± 4.63), p = 0.000; increase in maxillary I-NS by approximately 5.30 degrees (±2.91), $P = 0.005$; increase in I ML of about 6.36 degrees (±4.25), $P = 0.000$. There was also a statistically significant reduction in mandibular length gain which was evaluated according to Schwarz (average 4.72 mm; $P = 0.000$) and Harvold (average 6.67 mm; $P = 0.005$) analyses. In addition, there was an elongation of the maxilla estimated according to Schwartz (average 4.21 mm, $P = 0.012$) and Harvold (average 3.9 mm; $P = 0.008$) analyses.
CONCLUSION: The cephalometric measurements showed the efficiency of surgical treatment. The first stage of orthodontic treatment was adequate, because effective dentoalveolar decompensation was carried out.

333 EFFECTS OF VASCULAR ENDOTHELIAL GROWTH FACTOR ON MC3T3-E1 CELL LINE†

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AIM: Bone support and blood supply are necessary for effective orthodontic tooth movement. Osteogenesis and angiogenesis are closely correlated. Vascular endothelial growth factor (VEGF) is believed to play a critical role in skeletal development including mandibular condylar growth, by enhancement of angiogenesis. This aim of this study was to investigate whether VEGF has any direct effect on increasing bone cell activity, in an attempt to better understand how VEGF promotes bone remodelling.
MATERIALS AND METHOD: A preosteoblastic cell line, MC3T3-E1, was cultured with and without VEGF *in vitro*. The cells in both the control and test groups were collected at different culture time points of 24, 48 and 72 hours (n = 3 for each time point). Real-time polymerase chain reaction (PCR) was carried out to quantify the expressions of two markers related to bone formation [alkaline phosphatase (ALP) and osteocalcin (OCN)] and two factors related to osteoclastogenesis [osteoprotegerin (OPG) and receptor activator of nuclear factor kappa ß ligand (RANKL)] at the mRNA level.
RESULTS: The expression of OPG significantly decreased by 7 per cent compared with the control at 24 hours ($P < 0.001$), while it increased by 133 per cent at 72 hours ($P < 0.001$). RANKL remained unchanged at all three time points ($P > 0.05$). ALP was upregulated by 73 per cent at 24 hours ($P < 0.001$), but decreased by 14 and 41 per cent at 48 and 72 hours, respectively ($P < 0.05$). OCN showed the same trend of expression change as that of OPG, which was down-regulated by 41 per cent at 24 hours but upregulated by 149 per cent at 72 hours ($P < 0.001$).
CONCLUSION: VEGF promotes bone remodelling by direct effects on osteoblastic cells via regulating gene expressions of ALP, OCN and OPG.

†Winner of the W J B Houston Poster Research Award

334 TESTING THE FIDELITY OF IMPRESSION MATERIALS USED IN ORTHODONTICS

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AIM: Impression materials used in orthodontic practice may suffer multiple modifications of physical and dimensional parameters. These modifications, not obvious to the naked eye, may lead to significant defects in removable orthodontic devices. This study aimed to compare *in vitro* the dimensional fidelity and stability of impression materials either silicone or polymeric materials used in orthodontic practice.

MATERIALS AND METHOD: Testing was carried out in accordance with the standard SR EN 4823:2002, using a fidelity testing device constructed on a stainless steel test block. The fidelity of elastomeric impression materials were determined both qualitatively and quantitatively using an electronic microscopy (ESEM XL30) at × 300000 magnification. Qualitative analysis of the material fidelity of the elastomeric sample refers to the reproduction test of details (measures of width on the block test, and statistical analysis, ANOVA), at the same standard, and qualitative analysis, at the linear dimensional variation.
RESULTS: Different results were recorded for the qualitative and quantitative fidelity of elastomeric impression materials, as well as for the models (rough and extra rough gypsum). Thus, for quantitative and qualitative analysis of fidelity of recent generations of elastomeric, silicone and polieteric impression materials, measurements were obtained by electronic microscope using the environmental scanning electron microscopy technique. The device used proved not to be precise which was confirmed by the electronic microscope findings.
CONCLUSION: The degree of fidelity of the detail reproduction is different from an impression material to another one used in this study. Thus, the most suitable samples were identified to be using condensation silicones.

335 COMPOSITE OCCLUSAL BITE BLOCKS BONDED WITHOUT LIQUID RESIN

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AIM: Liquid resin in bonding composite has been identified as a major irritant in human cell culture. However, liquid resin is assumed to play a critical role in composite adhesion to enamel by forming resin tags to mechanically interlock with acid-etched enamel prisms. By bonding occlusal bite blocks to enamel surfaces without the use of liquid resin, mechanical interlocking between the liquid resin tags and acid-etched enamel prisms should not exist to enable the bite blocks to resist heavy functional occlusal forces. Survival analysis of a case series of composite bite blocks bonded without liquid resin will demonstrate if mechanical interlocking is critical in the mechanism of enamel adhesion. The aim of this study was to evaluate the role of mechanical interlocking in the mechanism of enamel adhesion of composite resin *in vivo*.
SUBJECTS AND METHOD: Twenty-three patients had bilateral occlusal bite blocks bonded on the posterior teeth to raise the bite during fixed orthodontic therapy. Depending on the individual clinical situation and enamel quality, the choice of the occlusal surfaces of teeth for the bite blocks bonded without liquid resin included 55 and 65 (1 case), 17 and 27 (1 case), 16 and 26 (14 cases), 35 and 45 (1 case) and 36 and 46 (6 cases). The service durations of the occlusal bite blocks recorded were analyzed using the Kaplan Meier product limit method.
RESULTS: Twenty-two of the 23 patients (95.7%) experienced no failure of the bilateral occlusal bite blocks. Forty-five of 46 (97.8%) occlusal bite blocks lasted up to the end of their intended treatment purposes. They remained on average for 27.8 months (range 1.5 to 29.0 months), and the only failure occurred at 1.5 month. The failed bite block was replaced to finish the treatment (additional 3.1 months).
CONCLUSION: This clinical trial demonstrates that mechanical interlocking does not seem to have a critical role in the mechanism of enamel adhesion *in vivo*.

336 MANAGEMENT OF SKELETAL CLASS III PATIENTS

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AIM: To assess the management of skeletal Class III malocclusion patients from 2006-2009.
SUBJECTS AND METHOD: Twenty-five patients (14 females, 11 males) with a Class III skeletal malocclusion, aged 6 to 23 years. Lateral cephalometry was used to establish the skeletal pattern before and after treatment. Skeletal vertical and horizontal relationships were evaluated according to Tweed, Sassouni and Hasund/Segner. The Statistica 7.0" program, applying the principal component analysis (PCA) and the Varimax method, were used to determine the correlation between different variables.
RESULTS: Associated anomalies were present (mandibular shift 20%, asymmetries 20%, crowding 40%, canine impaction 4%, open bite 4%, tooth transposition 4%). Nineteen patients (76%) were treated without extractions; six (24%) with extractions (premolars or first molars). Six patients (24 per cent) had orthodontic treatment and orthognathic surgery. The PCA method suggested that anterior face height, Wits appraisal, SNA, antero-posterior intermaxillary relationship (ANB), IMPA, FMIA and overjet vary according to the profile type (Sassouni) and Z angle; SNB, SNA and age according to lower face angulation (NSL-ML) and FMA, NL-ML and gonial angle (Ar-Go-Me) according to SNB angle.

CONCLUSION: Stepwise analysis influences the individual treatment of skeletal Class III malocclusions, which predicts the option for orthodontic treatment or combined orthodontic and orthognathic treatment. Treatment planning is more difficult with the increased degree of skeletal and dental contribution to the malocclusion. The option for a surgical or non-surgical approach is challenging, depending on the extent of the skeletal deformity, the degree of dental and soft tissue compensations, and the patient's concern.

337 PULPAL REPAIR AFTER SUBCUTANEOUS TRANSPLANTATION OF CRYOPRESERVED IMMATURE TEETH IN RATS

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AIM: Pulpal tissue of an immature tooth with an open apex can maintain its viability during cryopreservation. However, pulpal tissue reactions after autotransplantation of cryopreserved teeth are not yet well understood. The purpose of this study was to evaluate *in vivo* whether revascularisation after transplantation of cryopreserved immature teeth occurs, comparable with non-cryopreserved transplanted teeth.
MATERIALS AND METHOD: In 24, four-week-old Wistar rats the first and second maxillary molars were extracted bilaterally. In 12 rats, the molars were cryopreserved before transplantation (test group). In the remaining 12 rats, the molars were transplanted subcutaneously in the abdomen immediately after extraction (control group). Material was collected for the test and control animals at intervals of 1, 2, 4 and 10 weeks after transplantation, and histological examination was performed.
RESULTS: In the first week after transplantation, degeneration of the original pulpal tissue was observed in the test and control teeth. At the root apex, repair started by ingrowth of highly vascular granulation tissue. Two weeks after transplantation, ingrowth of new connective tissue was observed at the apex originating from the adjacent periodontal tissues. In the cryopreserved teeth degenerated pulpal tissue was still present coronally, while in most of the control teeth the newly formed connective tissue had replaced the original degenerated tissue. Cellular mineralized tissue at the apex and dentine-like tissue in the root canal were present in most of the controls, while these tissues were rarely seen in the test teeth. At week 4, these differences were still recognizable, but in general bone-like and dentine-like hard tissues increased in the root canal and coronal pulp of all the teeth. At week 10, no differences between the test and control teeth were observed.
CONCLUSION: Regeneration of pulpal tissue after autotransplantation of cryopreserved immature teeth was similar to immediately transplanted teeth, although the healing process was slower.

338 THREE-DIMENSIONAL MOVEMENT OF THE MAXILLARY FIRST MOLAR WITH THE QUADHELIX APPLIANCE***

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AIM: To investigate three-dimensional (3D) movement of the maxillary first molar with a quadhelix appliance.
MATERIALS AND METHOD: Fifty-two dental models obtained before and after treatment of 26 patients treated with the quadhelix appliance in two orthodontic offices. Surface images of the models were obtained using a laser scanner (Vivid 9i, Konica Minolta, Tokyo, Japan). The reference plane (X-Y plane) on each surface image was at the anterior point of the incisive papilla and the top of right and left mesio-lingual cusps of the maxillary first molar. The mesio-lingual cusp of the maxillary first molar was set as the origin. 3D changes of the other cusps were analyzed during treatment.
RESULTS: The mesio-buccal cusp of the maxillary first molar was moved 0.58 mm distally, 0.81 mm buccally, and extruded 0.20 mm. For the disto-buccal and disto-lingual cusps movement was 0.12, 0.80, 0.15 and 0.48, 0.10, 0.041 mm, respectively. While the same movement pattern was observed, the amount of tooth movement was different in the two orthodontic offices. This may have been due to the different treatment objectives.
CONCLUSION: The maxillary first molars were inclined buccally and rotated distally. The centre of rotation was observed around the mesio-lingual cusp.

339 ASSESSMENT OF THREE METHODS TO ASSESS PLAQUE LEVELS AND WHITE SPOT LESIONS

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AIM: Demineralisation during fixed appliance treatment is estimated to affect between 2-96 per cent of patients. It is frequently subclinical but can progress to irreversible lesions requiring restoration. Early detection is vital to institute

appropriate management of this reversible condition. Quantitative light induced fluorescence (QLF) has the ability to detect subclinical mineral loss by quantiating changes in the autoflouorescence of enamel. However, it is expensive and requires sophisticated computer software. Toothcare™ is a simple, inexpensive hand held device that has the potential to be 'home-based' allowing monitoring of plaque and early demineralisation. The aim of this study was to compare the effectiveness of Toothcare™ with QLF to identify plaque and demineralisation in orthodontic patients. The comparison was with QLF and clinical photographs.
MATERIALS AND METHOD: Patients undergoing fixed orthodontic treatment were consecutively recruited. At each of four routine appointments, the buccal surfaces of six anterior teeth were assessed for the presence of plaque and demineralisation using white light, QLF and Toothcare™. Plaque was scored using a modification of the Sillness and Löe plaque index; demineralisation was recorded as lesions per patient.
RESULTS: The overall mean observed plaque scores were highest for Toothcare™ at all visits 8.35 [Standard deviation (SD) 7.23, 95% confidence interval (CI) 1.32] followed by white light 3.81 (SD 4.13, 95% CI 0.75). QLF obtained the lowest plaque scores overall 0.71 (SD 1.2 95% CI 0.22). QLF measured statistically significantly more demineralised lesions than white light 0.72 (SD 1.12, 95% CI 0.2) compared with 0.12 (SD 0.43, 95% CI 0.08).
CONCLUSION: Toothcare™ did not demonstrate demineralisation when compared with white light and QLF. Toothcare™ did however demonstrate plaque more readily than white light and QLF; it was simple and easy to use at the chairside with few time implications.

340 USE OF AN ER,CR:YSGG, WATERLASE LASER IN ORTHODONTIC PATIENTS WITH GINGIVAL OVERGROWTH

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AIM: Gingival overgrowth is frequently encountered among patients undergoing fixed orthodontic appliance treatment causing aesthetic and functional problems. Gingivectomy using a surgical laser followed by a strict oral hygiene regimen is one recently adopted treatment measure. The aim of this study was to evaluate the application of an Er,Cr:YSGG, waterlase laser in the treatment of overgrown gingivae in patients undergoing fixed orthodontic treatment.
SUBJECTS AND METHOD: Twenty-two patients (10 males, 12 females, mean age 16.5 years) who had gingival overgrowth. One hundred and eighty anterior teeth with gingival overgrowth were selected for laser surgery. At baseline, each patient received initial periodontal therapy and also maintained the recall programme after surgery. Prior to surgery, the depth of the pocket was measured and the patient was instructed to rate their level of pain on a visual analogue scale (VAS) over time. Gingivectomy and gingivoplasty was performed with an Er,Cr:YSGG, waterlase laser under topical anaesthesia with Tac 20 per cent Alternate (Professional Arts Pharmacy, Baltimore, Maryland, USA) for 5 minutes before surgery. VAS score was rated during surgery and post-operatively. Pocket depth measurement was carried out immediately after surgery and repeated.
RESULTS: Statistically significant changes were found in pocket depth scores (mean reduction 2.8 mm, Student's *t*-test and ANOVA, $P < 0.005$). Recurrence was observed in 30 of 180 surgical sites (16.7%) or three out of 22 patients (13.6%) at 3 months following surgery. The mean VAS score was 3.2 during surgery. No patient required analgesia after surgery.
CONCLUSION: The Er,Cr:YSGG, waterlase laser is effective in the treatment of gingival overgrowth associated with fixed orthodontic treatment. A significant reduction in pocket depth and evident pain control can be achieved intra- and post-operatively.

341 EFFECT OF DIET HARDNESS ON MANDIBULAR CONDYLAR CARTILAGE METABOLISM†

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AIM: To study the effect of diet hardness on mandibular condylar cartilage catabolism markers. It was hypothesized that the change of diet hardness causes significant changes in proteolytic enzyme expression and cartilage composition.
MATERIALS AND METHOD: Seventy-two female Sprague Dawley rats were exposed to different dietary hardness, from soft to hard. MMP-3, -8 and TIMP-1 expression, cartilage thickness, cell count and expression of type-II collagen were studied and the condyles were examined at 30, 50 and 200 days.
RESULTS: A change of diet from soft to hard caused a significant decrease in the number of MMP-3, MMP-8 and an increase in TIMP-1 positive cells. The ratio of MMP-3 and TIMP-1 immunopositive cartilage cells remained similar in all age groups, whereas the number of MMP-8 positive cells decreased with age. Cartilage thickness and area of type II collagen positive staining were significantly affected by diet hardness.

CONCLUSION: A soft diet during growth increases collagenolytic activity and may increase the vulnerability of the condylar cartilage.

†Winner of an EOS Poster Award

342 THE PREVALENCE OF WHITE SPOT LESIONS AFTER ORTHODONTIC FIXED APPLIANCE THERAPY

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AIM: White spot lesions (WSL), an undesirable side-effect of orthodontic treatment, are the result of prolonged plaque accumulation around the elements of fixed appliance. The prevalence of WSL after orthodontic therapy is reported to be 50-97 per cent. Laser fluorescence measurement (DIAGNOdent; DD) is an additional diagnostic measure for quantification of carious lesions. The aim of this study was to determine the prevalence of WSL after orthodontic fixed appliance therapy and to complement the findings of visual examination with DD measurements.
SUBJECTS AND METHOD: Forty-four patients who had finished fixed appliance therapy were consecutively included, with 1177 teeth examined. Visual examinations were first performed on wet surfaces; three surfaces per tooth were examined: mesiobuccal, buccal and distobuccal. The same procedure was repeated after air-drying with compressed air for 5 seconds. Lesions were classified according to the criteria of Ekstrand *et al*. (1997), modified by Aljehani *et al*. (2006). Lesions with enamel breakdown or greyish discolouration (code 3) were restored. DD was used to assess the lesions coded 1 and 2.
RESULTS: Mouth and tooth prevalence of WSL were 90.1 and 39.2 per cent, respectively. WSL were detected on 543 (15.4%) of all inspected surfaces; 124 (22.8%) were coded 1, 403 (74.2%) were coded 2 and 16 (3.0%) were coded 3. The average DD readings for WSL coded 1 and 2 were 1.5 (SD 2.5) and 4.6 (SD 7.1), respectively; the corresponding ranges were 0–20 and 0–43, respectively.
CONCLUSION: In the examined population, the prevalence of WSL after orthodontic treatment with fixed appliances was high, as assessed by visual examination, complemented with DD measurements.

343 ARRESTED ERUPTION OF THE PERMANENT LOWER SECOND MOLAR

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AIM: To investigate craniofacial morphology, the frequency of dental anomalies, and the inclination of the lower second molar (LM2) and the adjacent first molar in patients with arrested eruption of LM2. The overall goal was to elucidate the aetiology of arrested tooth eruption and to present the characteristics of these patients in order to improve diagnosis and treatment planning.
MATERIALS AND METHOD: Radiographs of 20 patients with arrested eruption of LM2, aged 13 to 19 years. Seventeen cephalometric variables were evaluated on lateral cephalograms. The frequencies of dental anomalies of the retained LM2 (crown and root morphology) and of the inclination of LM2 were evaluated on dental pantomograms.
RESULTS: Patients with arrested eruption of LM2 had an increased sagittal jaw relationship. The mandibular prognathism was less, the mandibular gonial angle smaller, the mandibular alveolar prognathism enlarged and the maxillary incisor inclination less than in the reference group. This group of patients had a more frequent occurrence of morphological tooth anomalies, such as root deflections, invaginations and taurodontism. There was no agenesis of the lower third molar. There was no association between the degree of inclination of the LM2 and that of the first molar in the same region.
CONCLUSION: Craniofacial morphology and deviations in the dentition are associated with arrested eruption of LM2. It is important to evaluate these conditions in future diagnosis and treatment planning of patients with arrested eruption of LM2.

344 PREVALENCE OF DIFFERENT CLASS III MALOCCLUSIONS AND THE TIMING OF TREATMENT

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AIM: To determine the prevalence of different types of Class III malocclusions in Slovenia in the primary and mixed dentitions.

SUBJECTS AND METHOD: Seventy-two patients with Class III malocclusions referred between 2004–2005 were examined at the beginning of treatment. For each patient an anamnesis, a clinical examination, facial photographs, study casts and radiographs (panoramic and lateral cephalographs) were obtained and analyzed.
RESULTS: Most of the Class III malocclusions (74%) were a combination of dentoalveolar and skeletal; in only 4 per cent was the malocclusion dentoalveolar. Twenty-nine per cent of the subjects had a retrognathic maxilla and orthognathic mandible. In 32 per cent treatment was started before 10 years of age, in 54 per cent of patients between 10 and 18 years, and in 14 per cent after 19 years. The patients in the last group needed a combination of orthodontic treatment and jaw surgery to correct the malocclusion.
CONCLUSION: Most of the patients with Class III malocclusions had a combination of a dentoalveolar and skeletal Class III malocclusion. The majority were not directed on time for orthodontic treatment and therefore treatment planning was more demanding and expensive, treatment time was longer, and the stability of achieved result could be questionable.

345 ASSESSMENT OF THE PHARYNGEAL AIRWAY IN SURGICALLY CORRECTED CLASS III PATIENTS

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AIMS: Surgical procedures that reposition the facial skeleton alter the soft tissues that are attached to the bone in order to effect facial changes. One aspect of this surgery is the effect of skeletal movements on posterior airway space. Most pharyngeal airway studies have been evaluated in mandibular set back procedures. The purpose of this research was to determine the effect of orthognathic surgery on pharyngeal airway in Class III patients, to compare the results of different surgical techniques, and to determine the change at the position of hyoid bone.
SUBJECTS AND METHOD: Forty-eight Class III adult patients, nine of whom of were treated with maxillary advancement (MA), seven with mandibular set-back (MS), and 32 with bimaxillary (BM) surgery. Cephalometric records were taken before treatment, after surgery and about 1 year after surgery (end of treatment). The pharyngeal airway was assessed using planimetric and linear measurements. For statistical analysis, a. repeated analysis of variance Bonferroni test were used.
RESULTS: No differences were found at the position of the hyoid bone. The nasopharyngeal area was significantly increased in all groups. Oropharyngeal area, SPSS and IPS parameters were significantly decreased after MS. In the BM and MA groups, PPS was significantly increased, IPS was significantly decreased, and differences were detected in the oropharyngeal and hypopharyngeal areas. Maximum contraction was seen in the MS group.
CONCLUSION: Different surgical procedures result in different effects on pharyngeal airway space.

346 THE TRANSVERSE SAGITTAL MAXILLARY EXPANDER: A CEPHALOMETRIC INVESTIGATION IN GROWING PATIENTS

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AIM: To cephalometrically evaluate the skeletal and dental effects of the transverse sagittal maxillary expander (TSME) in children with maxillary hypoplasia.
SUBJECTS AND METHOD: Fifty patients of both genders, aged from 6 to 15 years, with a maxillary crossbite caused by basal apical narrowness treated with the TSME. For each patient lateral cephalometric analysis was undertaken before treatment and at the end of the retention period. Changes during the observation period were calculated and statistically analyzed.
RESULTS: SNA and ANB angles showed a non-significant increase during treatment. SNB angle increased. SN-GoGn increased in most of the patients but no statistically significant modifications were found. SN-SNP.SNA showed a non-statistically significant rotation. The vertical dimensions (S-Go, N-Me) also showed a non-significant modification during treatment. The linear measurement SNP-A showed a statistically significant increase, indicating that the dentoalveolar maxillary process moved anteriorly because of the force delivered by the sagittal screws during active growth. A significant and statistically significant increase in I^SN and I^FH angles was observed. Overjet changed from negative to positive in all patients.
CONCLUSION: The TSME can produce skeletal changes due to the transverse force, and dentoalveolar modification due to the sagittal component that can increase the available arch length resulting in correction of maxillary hypoplasia. The non-significant increase in the anterior vertical dimension may also suggest the use of the TSME in patients with an anterior open bite.

347 EFFECTIVENESS OF THE TRANSPALATAL ARCH – A COMBINED CLINICAL AND EXPERIMENTAL STUDY

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AIMS: Transpalatal arches (tpa) have long been used for orthodontic treatment. They can minimize undesirable side-effects during treatment, add to anchorage, and allow for active tooth movement with reciprocal or asymmetric mechanics. The purpose of this study was to analyse the forces and moments delivered by the TPA of the 'Precision Lingual Arch System' advocated by Burstone (0.032 × 0.032 inch TMA) and to clinically verify the predicted tooth movement.
MATERIALS AND METHOD: Two types of activation were investigated bilateral expansion (six cases) and unilateral expansion with torque application (four cases). Forces and moments produced at the attachments by the two different activations were determined using the Orthodontic Measurement and Simulation System (OMSS). The OMSS is based on the principle of the two-tooth model and allows forces and moments acting on two teeth to be measured simultaneously and the tooth movement resulting from this force system to be simulated. Silicon impressions of 10 patients were taken before and 12 weeks after insertion of the TPA. The casts were scanned with a laser scanner and the exact tooth movement was calculated and compared with the simulated tooth movement delivered from the OMSS. For the two types of activation, the TMA TPAs were adjusted to deliver forces of about 4 N.
RESULTS: Analysis of the changes pre- to post-treatment showed expansion up to 4 mm during a time period of 12 weeks for the bilateral cases. In all unilateral cases, the achieved tooth movement was in good correlation with the tooth movement predicted in the OMSS simulations. In all cases, vertical and/or sagittal side-effects were negligible.
CONCLUSION: The intended tooth movement, as well as the results of the simulation, were in good correlation with the clinically achieved tooth movement. A treatment time of 12 weeks was not sufficient for complete correction of the transverse discrepancy.

348 CEPHALOMETRIC EVALUATION OF PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA

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AIM: To evaluate the cephalometric features of patients with obstructive sleep apnoea (OSA), and to elucidate the relationship between cephalometric variables and severity of the apnoea-hypopnoea index (AHI).
SUBJECTS AND METHOD: Ninety-three patients with OSA, diagnosed by overnight polysomnography, were classified into three subgroups according to the AHI: mild (5–15, n = 24), moderate (16–30, n = 35) and severe (>30, n = 34) OSA. Twelve cephalometric measurements were carried out for all patients to clarify the relationship between cephalometric variables and the severity of AHI. One-way analysis of variance, Mann Whitney *U,* Pearson correlation test and stepwise regression analysis were performed with the Statistical Package for Social Sciences, version 16.0 (SPSS Inc., Chicago, Illinois, USA).
RESULTS: Most male patients (38%) were classified with severe OSA and most females as moderate OSA (40.9%). IAS, MaxSoftPalate, SNGoGn, HyoidMPPerp variables were found to be higher in subjects of both genders with severe OSA. IAS, MAS, MaxSoftPalate and HyoidMPPerp variables were positively correlated with AHI ($P < 0.001$ and $P < 0.05$), however SPAS was negatively correlated ($P < 0.05$). Stepwise regression analysis; mean SaO_2, arousal index, Body Mass Index and MAS were included in the model to estimate AHI properties with R square 67 per cent ($P < 0.01$).
CONCLUSION: The values of IAS, MaxSoftPalate, SNGoGn and HyoidMPPerp increased with the severity of OSA. However, the cephalometric variables used to estimate AHI severity had no role in males, but PNStoPA had an influence in females. Overall, the cephalometric measurements used in this study had limited accuracy in estimating AHI severity in both genders.

349 THREE DIMENSIONS OF THE MAXILLA IN UNILATERAL VERSUS BILATERAL CANINE IMPACTION

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AIM: The canines play an integral role in functional occlusion and an aesthetic smile. Both of these are compromised by impactions. Although maxillary width has been investigated in association with canine impaction, no comparison has been

made between unilateral versus bilateral groups. The aim of this study was to compare positional variation, length and arch width of the maxilla in unilateral versus bilateral impaction groups.
SUBJECTS AND METHOD: A search of all orthodontic clinic records at Columbia University was performed. Subjects were selected with the criteria of a minimum age of 12.5 years, unerupted maxillary canines, no previous orthodontic treatment and non-syndromic patients or those with congenital defects. The age range for the unilateral (66 subjects) and bilateral (35 subjects) groups were from 12.5-28.5 years and 12.6-26.8 years, respectively. The comparison group with a mild Class I malocclusion (83 subjects) ranged from 12.5-21.2 years. Statistical analysis consisted of a two-sample *t*-test.
RESULTS: The unilateral versus bilateral group was not statistically different when assessed in the transverse dimensions. The difference was –1.2 mm in premolar width, and –0.6 mm in molar width. Maxillary position or length was not significantly different in either group and was similar to the non-impaction Class I group. Since the sagittal relationship of the maxilla in the canine impaction groups was very similar to the norms, the use of headgear in the treatment of canine impaction, as suggested in the literature, should be carefully considered in the absence of other indications.
CONCLUSION: Unilateral and bilateral impaction patients do not differ in anterior or posterior arch width. Absence of over-retained primary canines in unilateral impaction patients may cause a slight collapse of premolar width. Maxillary position and transverse dimension do not appear to influence the presence of either unilateral or bilateral canine impaction.

350 INCIDENCE OF OROFACIAL CLEFTS IN THE CZECH REPUBLIC FROM 2000-2006

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AIM: Orofacial clefts are the most common craniofacial congenital birth defect. There is a wide variation in incidence of various cleft anomalies between different populations and genders. The aim of this study was to determine an incidence of orofacial cleft defects in the Czech Republic among infants born during 2000-2006.
MATERIALS AND METHOD: Data were collected from the Institute of Health Information and Statistics, Czech Statistical Office and Czech Health Statistics Yearbooks. The incidence of orofacial cleft anomalies and gender differences in live born infants were calculated.
RESULTS: There were a total of 1086 infants with an orofacial cleft among 673,802 of newborns between 2000-2006. The incidence of orofacial cleft defects was on average 1.61 per 1000 live births. The incidence of a cleft lip was 0.38, of a cleft palate (CP) 0.67 and of a cleft lip and palate (CLP) 0.55 per 1000 live born infants. There were almost twice as many boys with a cleft lip (169 boys, 90 girls, incidence 0.49 and 0.28, respectively per 1000 live births) and CLP in girls (248 boys, 126 girls, incidence 0.71 and 0.39, respectively per 1000 live births). The overall number of boys and girls with a CP was 231 and 222, respectively (incidence 0.67 in boys and 0.68 in girls per 1000 live births).
CONCLUSION: The incidence of orofacial clefts in the Czech Republic among infants born during 2000-2006 was lower than that reported in previous studies (1.74 per 1000 newborns) from 1962-1996, oscillating with small deviations around 1.61 per 1000 live born infants. Boys are affected with orofacial clefts more frequently than girls, with the exception of CP patients, where both genders are equally affected. Despite the rising birth rate in the Czech Republic during 2000-2006, the incidence of orofacial clefts in the time period remained stable.

351 TONGUE VOLUME AND POSTERIOR AIRWAY SPACE CHANGES IN CLASS III TWO JAW ORTHOGNATHIC SURGERY

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AIM: A Class III skeletal dentofacial deformity may be the result of mandibular prognathism and/or maxillary deficiency. Surgical correction of Class III deformities can be achieved by mandibular set-back alone, maxillary advancement, or combined bimaxillary surgery. The posterior airway space is delimited by hard and soft tissues with anomalies that may produce alterations in volume. The purpose of this study was to evaluate changes in airway space after surgical correction of a Class III skeletal dentofacial deformity and to determine if orthognathic surgery alters airway space and improves obstructive sleep apnoea.
SUBJECTS AND METHOD: Twenty-four Class III patients (19 females, 5 males), 10 mandibular set-back or maxillary advancement patients (mean age 19.6 years) and 14 bimaxillary surgery patients (mean age 21.6 years). Lateral cephalometric radiographs were traced before and 6 months after surgery. Steiner and McNamara analyses, posterior airway (PNS-PPW1, SPT-PPW2, E-PPW3, PNS-SPT) and tongue volume measurements (TH, Tt-Eb) were performed. The data obtained was analyzed statistically by repeated measurement analysis of variance and Duncan's test.

RESULTS: The interaction between group and treatment time was statistically significant regarding PNS-PPW1 measurement ($P < 0.05$) that demonstrated that the change in PNS-PPW1 dimension was statistically different between the groups during treatment. Before treatment, PNS-PPW1 was statistically different between the treatment groups ($P < 0.05$) and it increased in the bimaxillary surgery group after surgery ($P < 0.05$). The difference between the groups was statistically insignificant regarding SPT-PPW2, E-PPW3, PNS-SPT and TH measurements. However, Tt-Eb was statistically different between the groups post-surgery ($P < 0.01$).
CONCLUSION: Surgical correction of a Class III skeletal dentofacial deformity alters posterior airway dimensions.

352 INVESTIGATION OF MANDIBULAR ROTATION WITH VARIOUS CEPHALOMETRIC PARAMETERS

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AIM: The most commonly used measurement to determine the vertical position of the mandible in cephalometric analysis is GoGn/SN angle. Gonial angle is an alternative to this measurement. The aim of this study was to evaluate the indicative factors of mandibular rotation (GoGn/SN, GoMe/FH, gonial angles) and the relationship between them.
SUBJECTS AND METHOD: Sixty-nine patients who had completed growth and who did not have craniofacial deformities or congenitally missing teeth. Twenty-four were skeletal Class I (ANB between 0-4°), 20 skeletal Class II (ANB >4°) and 25 skeletal Class III (ANB <0°). Measurements were considered on the pre-treatment lateral cephalometric radiographs.
RESULTS: For GoGn/SN angle, the smallest values were observed in the Class I group, while the largest values were in Class II group. GoMe/FH angle was increased in Class I, Class II and Class III cases, whilst gonial angle was increased as Class I, Class III and Class II respectively. As GoGn/SN angle was associated with the location of Nasion, it may not reflect the actual position of the mandibular plane.
CONCLUSION: GoMe/FH angle is more reliable in determining the vertical position of the mandible.

353 THE DYNAMIC FOURTH DIMENSION IN IMAGING AND ITS RELATION TO CRANIAL INCLINATIONS

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AIM: Since the concept of natural head posture (NHP) was introduced, many studies have advocated its use in cephalometric investigations of craniocervical and craniovertical relationships. NHP is a dynamic concept and is successfully recorded as such in a dynamic and continuous manner using inclinometers. The aim of this study was to evaluate how these raw dynamic inclinometer readings are related to craniovertical (SN-VER) and craniocervical (SN-CVT) measurements and whether the inclinometer readings could be used to determine these measurements without the use of cephalometric radiographs.
SUBJECTS AND METHODS: NHP lateral cephalograms of 16 subjects (average age 19.1 ± 4.9 years) were traced and the relationship of the sella-nasion (SN) line with the inclination of the cervical column (CVT) and the true vertical (VER) were measured. The correlations of these measurements with the available dynamic inclinometer readings were calculated.
RESULTS: There were very weak correlations between the inclinometer readings and SN-VER ($r = 0.261$) and SN-CVT ($r = 0.382$) measurements.
CONCLUSION: Within the limitations of this study the findings suggest that raw dynamic inclinometer readings and craniovertical or craniocervical inclinations are not interchangeable and these raw readings cannot be used to determine these relationships.

354 EFFECTS OF CONTINUOUS AND INTERMITTENT CONTROLLED FORCES ON CANINE DISTALIZATION

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AIM: The duration of force application is an important factor, together with the magnitude of force, in stimulating osteoclastic activity. There is still ambiguity about whether continuous or intermittent orthodontic forces produce more efficient canine distalization. The aim of this study was to evaluate the effects of continuous and intermittent orthodontic forces on canine distalization and to compare the effectiveness of laceback ligatures with that of superelastic nickel titanium (NiTi) closed coil springs.

SUBJECTS AND METHOD: Ten subjects for whom fixed orthodontic treatment was planned with the extraction of first premolars to resolve crowding in the upper and/or lower arches. Stainless steel direct-bonded Roth brackets (0.018 inch) were used. For canine distalization, superelastic NiTi closed coil springs generating a force of 125 g were used on one side while lacebacks made of 0.010 inch wire were used on the contralateral side. Lateral cephalometric and panoramic radiographs and dental casts were used to evaluate the dental changes. Wilcoxon test was applied to determine the differences between pre- and post-distalization mean values and the mean differences between the groups.
RESULTS: The duration of distalization was significantly shorter ($P < 0.001$) and mesiopalatal rotation of the anchorage molar was significantly greater in the coil spring group ($P < 0.05$). No significant differences were observed in the amount of canine distalization, amount of molar mesialization, distal tipping of the canine, or mesial tipping of the molar.
CONCLUSION: The intermittent forces created using laceback ligatures proved to be effective for canine distalization and resulted in less mesiopalatal rotation of the anchorage molars. This, however, required double the time for the same amount of canine distalization compared with continuous forces using NiTi closed coil springs.

355 EFFECTS OF AMORPHOUS CALCIUM PHOSPHATE CONTAINING COMPOSITE ON ENAMEL DEMINERALIZATION

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AIMS: To evaluate the *in vivo* effects of an amorphous calcium phosphate (ACP) containing orthodontic composite in reducing enamel demineralization around orthodontic brackets, and to compare it with a control.
SUBJECTS AND METHOD: Fourteen orthodontic patients divided into two equal groups; they received brackets on all first premolars, bonded with either Aegis Ortho® (Bosworth Co.), an ACP containing orthodontic composite (experimental group), or Concise® (3M Dental Products), a resin-based orthodontic composite (control group). After 30 days, the teeth were extracted, longitudinally sectioned, and evaluated by superficial microhardness analysis. The determinations were made at the bracket edge cementing limits and at occlusal and cervical points 100 and 200 µm from the edge. In all of these positions, indentations were made at depths of 10, 20, 30, 50, 70, and 90 µm from the enamel surface. Analysis of variance (ANOVA) and Tukey *post hoc* test was used. The statistical significance level was set at $P < 0.05$.
RESULTS: ANOVA showed statistically significant differences for position, material, depth, and their interactions ($P = 0.000$). The multiple comparison test showed that the ACP containing orthodontic composite was significantly more efficient than the control composite, reducing enamel demineralization in almost all evaluations ($P = 0.000$).
CONCLUSION: ACP containing orthodontic composite for bonding orthodontic brackets successfully inhibited demineralization *in vivo*. This effect was localized to the area around the brackets and was statistically significant after 30 days.

356 MAXILLARY ARCH WIDTH AND PALATAL DEPTH IN PATIENTS WITH MARFAN SYNDROME

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AIM: Marfan syndrome (MFS) is a connective tissue disorder with autosomal dominant inheritance that affects, *inter alia*, the musculoskeletal apparatus and also the hard palate. The aim of this study was to quantify the morphological changes of the palate in subjects with MFS compared with a control group.
SUBJECTS AND METHOD: Thirty-two adult patients (13 males, 19 females) with MFS aged between 18 and 60 years. Thirty-six adults without any syndromic diseases (15 males, 21 females) aged between 25 and 41 years served as the control group. Study casts were obtained for all subjects. The palates were analyzed by applying the following four parameters: maxillary interpremolar and intermolar widths, palatal depth and its ratio to the maxillary molar width according to Hsu. Intergroup differences were tested using the independent *t*-test.
RESULTS: Interpremolar and intermolar width showed highly statistically significant differences between the two groups. Interpremolar (MFS group 32.9 mm, control group 35.8 mm) and intermolar widths (MFS group 41.0 mm, control group 46.1 mm) were significantly reduced in the MFS group. The differences in palatal depth were also statistically significant. Patients with MFS showed an increased palatal depth in comparison with the controls (MFS 18.9 mm, control group 18.0 mm).

CONCLUSION: The connective tissue disorder in patients with MFS affects the interpremolar and intermolar width as well as palatal depth. All dimensions were statistically significantly reduced. The high-arched and small palate must be discussed as a co-factor in the increased clockwise rotation of the mandible that has been described in previous studies.

357 QUANTITATIVE ASSESSMENT OF RELAPSE AFTER RAPID MAXILLARY EXPANSION

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AIM: Rapid maxillary expansion (RME) is a method of enlarging the upper dentoalveolar arch, primarily involving the jawbone mass, with possibilities of application in all subjects with a narrow arch associated with a lack of space, regardless of the existing dento-maxillary anomalies (Angle Class I, II or III malocclusion). The purpose of this research was to assess the degree of relapse present 6 and 12 months after the active phase of RME.
SUBJECTS AND METHOD: Fifty-two patients selected according to the following criteria: aged 10-18 years; use of the same disjunctor fixed on the first permanent molars and premolars or on the first primary molars; widening the arch by 0.9-1.2 mm using RME; activation of the screw once a day (for 4-5 weeks); a 3-month period with the disjunctor *in situ* and a 9-month retention period with a rigid transpalatal arch. To determine arch enlargement and the degree of relapse, intermolar distance was measured. The degree of relapse was assessed by comparing measurements taken 3 months after disjunction (when the transpalatal arch replaced the disjunctor) and at 6 and 12 months, after retention (transpalatal arch).
RESULTS: The average degree of relapse at 6 months was 2.8 mm and at 12 months 3.1 mm.
CONCLUSION: The degree of relapse after RME is significant, even with a retention period of 12 months (disjunctor + transpalatal arch), mainly due to the secondary effect of coronal vestibular expansion when applying RME.

358 EFFECT OF CASEIN-PHOSPHOPEPTIDE AMORPHOUS-CALCIUM-PHOSPHATE FLUORIDE PASTE ON PLAQUE COMPOSITION AFTER ORTHODONTIC TREATMENT

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AIM: Casein-phosphopeptide amorphous-calcium-phosphate fluoride paste (CPP-ACP-F) may promote remineralization of white spot lesions (WSL) by supplying bioavailable calcium and promoting a healthier plaque. The aim of this pilot study was to test the effect of CPP-ACP-F versus a placebo paste on plaque composition after fixed-appliance therapy in patients with multiple WSL after orthodontic treatment.
SUBJECTS AND METHOD: Plaque composition was determined at debonding in 34 adolescent orthodontic patients. Patients with multiple WSL were given CPP-ACP-F (n = 10) or a placebo (n = 10) to use once-a-day at bedtime. WSL were determined by quantitative light-induced fluorescence. Bacterial counts in plaque composition were determined (anaerobic, 37°C, 72 hours) on blood agar (total counts), BHI (pH 5, aciduric bacteria), Rogossa (lactobacilli) and TYCSB (*S. mutans*).
RESULTS: The number of WSL at debonding was comparable: CPP-ACP-F 86; placebo 97. Total counts for all groups and times were 5.107 CFU. Aciduric bacteria and *S. mutans* comprised 46 and 11.5 per cent of plaque in the caries group compared with 26 and 3.2 per cent in the caries-free group ($P < 0.05$). After 3 months, aciduric bacteria and *S. mutans* in the CPP-ACP-F group reduced significantly to 25.6 and 3.8 per cent ($P < 0.05$) but were stable for the placebo group. Small colonies of lactobacilli were found that comprised 0.1 per cent of the total flora.
CONCLUSION: Plaque flora in orthodontic patients contained a large proportion of acidic bacteria. The level of cariogenic bacteria had not reduced in the placebo group 12 weeks after debond. CPP-ACP-F contributes to a healthier plaque composition. A longer follow-up to investigate the effect of CPP-ACP-F on lesion reduction is indicated.

359 DIMENSIONAL CHANGES OF THE MAXILLARY APICAL BASE IN UNTREATED CLASS I SUBJECTS

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AIM: To assess maxillary apical base dimensional changes from the primary to the permanent dentition in untreated Class I subjects.
MATERIALS AND METHOD: Maxillary plaster casts of 38 patients were obtained from the material of a growth study carried out in the 1960s and assessed using Digimodel®. Inclusion criteria were high quality study casts with a full buccal sulcus corresponding to the following stages of dental development full primary dentition (T1; erupted first permanent

molars allowed), early mixed dentition (T2) and permanent dentition (TR3; eruption of all permanent teeth mesial of the first permanent molar). The apical base was defined as a line running through the most concave point of the buccal sulcus in the region of the tooth apices. The apical base measurements were: 1) molar width (MW), the point just mesial of the first permanent molar (or distal of the second premolar), 2) canine width (CW), measured at the buccal cusp tip, 3) the circumference of the outline running from the first molar to the contralateral molar and, 4) the surface of this area enclosed by the molar width line.
RESULTS: T1-T2, MW and CW increased by 5 and 11 per cent, respectively. No decrease in any measurement was found. Circumference measurement remained constant, the surface measurement decreased by 10 per cent. T2-T3, MW did not change, circumference and CW decreased by 8 and 10 per cent, respectively, while CW returned to its original value. The surface decreased by 42 per cent.
CONCLUSION: Over time, MW increased first and then decreased, to end below the T1 value. For CW, a small increase was seen, ending below the T1 value. Circumference remained constant from T1 to T2 and ended below its T1 value. The surface measurement showed a decrease over time, to end around 50 per cent of its T1 value.

360 RELATIONSHIP BETWEEN ROOT RESORPTION AND DENTAL ANOMALIES

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AIM: To determine the relationship between root resorption and the presence of tooth agenesis and pipette-shaped roots.
MATERIALS AND METHOD: The dental anomalies (agenesis and pipette-shaped roots) and root resorption were assessed on panoramic radiographs of 88 patients [27 males, 61 females, mean age 28.7 (SD = 11.3 years)]. The random selection of patients was based on a number of inclusion criteria (e.g. 15 years or older, no previous fixed appliance treatment, good quality panoramic radiographs and visibility of the periodontal ligament of every tooth, and edgewise fixed appliance treatment with a duration of 18 months or more). A pipette-shaped root was defined as drawn by Levander and Malmgren (1988). Agenesis of a tooth was assessed on the panoramic radiograph and from the patient's dental history. Root resorption was calculated as the difference between root length before and after treatment, with and without a correction factor (crown length post-treatment/crown length pre-treatment). If one of the four upper incisors showed root resorption of 2.3 mm or more with both formulas the patient was scored as having root resorption.
RESULTS: Chi-square tests indicated that there was no relationship between root resorption and agenesis ($P = 0.885$) or between root resorption and pipette-shaped roots ($P = 0.800$).
CONCLUSION: It was not possible to confirm a relationship between root resorption and dental anomalies, such as agenesis and pipette-shaped roots. Panoramic radiographs might be unsuitable for the assessment of root resorption.

Levander E, Malmgren O 1988 Evaluation of the risk of root resorption during orthodontic treatment: a study of upper incisors. European Journal of Orthodontics 10: 30–38

361 RE-BOND STRENGTH OF THE BONDED LINGUAL WIRE RETAINER

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AIM: Although orthodontic retainers fail frequently, there is no optimal procedure for re-bonding. The aim of this *in vitro* study was to evaluate the initial bond strength and re-bond strength of retainers bonded to enamel surfaces with and without composite remnants.
MATERIALS AND METHOD: The initial bond strength and re-bond strength of Pentaflex lingual wire retainers bonded with Excite and Tetric Flow were determined. The retainers were bonded on three different surfaces; (i) clean enamel, (ii) enamel on which the composite had been removed by a tungsten carbide bur, and (iii) enamel with cured composite remnants. Bond strength was determined with a cantilever/tensile bond strength test (in N) with a repeated crossover design where each tooth was re-bonded twice and tested three times ($n = 6 \times 19$). Fracture was evaluated using the adhesive remnant index (ARI).
RESULTS: Comparison of mean bond strengths did not show significant differences for the three different enamel surfaces, but the specimens with the cured composite remnants showed a higher standard deviation. ARI scores showed that 96.5 per cent of bond fractures occurred at the retainer/resin interface. The standard deviations for the re-bonded on composite remnants indicated that leaving composite remains on the surface will lead to a clinically less reliable and less effective

bond. In contrast to the *in vitro* ARI score, the clinical ARI scores also showed failure at the resin/enamel interface. This type of failure is most likely caused by wet bonding conditions.
CONCLUSION: To achieve optimal bonding properties for re-bonding, the enamel surface should be free of old composite remnants bonded in a moisture-free environment.

362 ASSESSMENT OF CROWDING WITH A SELF-LIGATING SYSTEM IN NON-EXTRACTION THERAPY

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AIM: To evaluate three-dimensional tooth changes in patients with severe upper and lower crowding treated with the Damon® system (D3, Ormco, Orange, California, USA) without extractions or approximal enamel reduction.
SUBJECTS AND METHOD: Twenty-two patients (14 females, 8 males) were examined by two experienced orthodontists. The digital models obtained were analyzed with the OrthoProof® software (Nieuwegein, Netherlands) determining 72 parameters in the upper and 67 parameters in the lower arch. In addition lateral cephalograms of the patients were investigated with the Onyx Ceph® software (Chemnitz, Germany) analyzing 28 cephalometric parameters. With all gained data, superimpositions were made for graphical representation of the changes regarding the dental arch and the cephalometric tracing. Statistical analysis was performed using the Statistical Package for Social Sciences, version 15 0 (SPSS Inc., Chicago, Illinois, USA).
RESULTS: Strong interrater correlation was found between the measurements of both examiners ($P < 0.001$ ranging between 0.83-0.96). There was no correlation regarding initial upper and lower crowding between the initial and final measurements for proclination. For protrusion, a correlation was present between arch expansion and protrusion of the upper ($P < 0.05$) and lower ($P < 0.01$) incisors. However, the changes concerning the position of the upper anterior teeth showed more variability, indicating that the space needed to correct the crowding was created by other mechanisms, in particular by expansion. The soft tissues, i.e. the lip profile, mainly followed the upper anterior teeth.
CONCLUSION: Non-extraction therapy with the Damon® system was effective within biological limits and with positive effects on the soft tissues.

363 MATHEMATICAL APPRAISAL OF ARCH FORM IN SUBJECTS WITH CROWDING TREATED NON-EXTRACTION

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AIM: To evaluate tooth changes, with appraisal of arch form, pre- and post-treatment of 22 patients with severe upper and lower crowding treated with the Damon® system (D3, Ormco, Orange, California, USA) without any extractions or approximal enamel reduction.
MATERIALS AND METHOD: The digital models obtained were analyzed with the OrthoProof® software (Nieuwegein, Netherlands) to investigate tooth movements. On each tooth at least one reference point was located before treatment. Through these points a curve was then fitted. After treatment a new curve was fitted through the new positions of the reference points. Movement of the teeth was measured by numerically computing the area between the two curves using the octave numerical package (www.gnu.org/software/octave) in order to estimate expansion. This was done by numerically integrating the difference between the two spline interpolated curves whose origin is centred between the two anterior incisors. Statistical analysis was performed using Statistical Package for Social Sciences, version 15 0 (SPSS Inc., Chicago, Illinois, USA).
RESULTS: Significant increases in upper arch length and width were noted after correction of crowding. Both molar distalization and incisor protrusion contributed to the increase in arch length. A mean expansion of 1.08 (8%), 1.04 (lower) and 1.12 (upper) was calculated.
CONCLUSION: During correction of upper arch crowding using the non-extraction Damon® technique, arch perimeter gain is due to an increase in both arch length and posterior arch width. Arch form could be reconstructed using the above method based on the given parameters.

364 A DIAGNOSTIC PERFORMANCE STUDY ON OVERJET IN CLASS II MALOCCLUSION SUBJECTS

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AIM: To evaluate the associations between an increased overjet and other dentoskeletal characteristics of Class II division 1 malocclusion subjects in the mixed dentition.
SUBJECTS AND METHOD: Nine hundred mixed dentition subjects observed by clinical inspection, analysis of dental casts, and lateral cephalograms. Overjet used as the diagnostic indicator (overjet ≥7 mm) was evaluated in relation to other Class II dentoskeletal features (Class II molar and canine relationships, and skeletal Class II relationship). Diagnostic performance was assessed by odds ratio and positive likelihood ratio within a Bayesian statistical approach.
RESULTS: The diagnostic performance of overjet with regard to the other dentoskeletal components of Class II malocclusion was not significant.
CONCLUSION: When used as an isolated occlusal feature, overjet is not a valid diagnostic indicator of a Class II division 1 malocclusion. Discrimination between clinical conditions showing an isolated overjet from a comprehensive Class II malocclusion during diagnosis, treatment planning, and the analysis of treatment outcomes is recommended.

365 NON-CONVENTIONAL BRACKETS VERSUS LIGATURES FOR THE ALIGNMENT OF BUCCALLY DISPLACED TEETH

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AIM: To analyze the forces released by four types of passive stainless steel self-ligating brackets and by two non-conventional elastomeric ligature-bracket systems when compared with conventional elastomeric ligatures on stainless steel brackets during alignment of buccally displaced teeth.
MATERIALS AND METHOD: A model consisting of five brackets (from second premolar to the central incisor) was used to assess the forces released by the seven different bracket-ligature systems with 0.012 or 0.014 inch superelastic wires in the presence of various amounts of buccal canine displacement (1.5 to 6.0 mm). Comparisons between the different types of bracket/wire/ligature systems were performed with three-way ANOVA with Tukey's *post hoc* test ($P < 0.05$).
RESULTS: For buccal misalignments of 1.5 and 3.0 mm, both low-friction and conventional systems released forces for bracket alignment ranging from ~30 to ~160 g. In presence of a large amount of buccal displacement (4.5 or 6.0 mm), the low-friction systems produced significant force, while this dropped to 0 g for the conventional system.
CONCLUSION: Non-conventional elastomeric ligature-bracket systems produce levels of force available for tooth movement that are similar to those generated in the presence of passive self-ligating brackets.

366 THE EFFECT OF QUERCETIN ON SOX9 AND COLLAGEN II EXPRESSIONS IN SPHENO-OCCIPITAL SYNCHONDROSES

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AIM: Quercetin is a flavonoid phytoestrogen that stimulates osteoblasts. Spheno-occipital synchondrosis is an important growth centre of the craniofacial skeleton; its growth affects the positions of both the maxilla and mandible, sagittally and vertically. It is important to identify chemicals that affect its growth. The objective of this study was to investigate the effect of quercetin on growth of the spheno-occipital synchondrosis by measuring the expressions of Sox9 and type II collagen, using an *in vitro* mouse model.
MATERIALS AND METHOD: A total of 50 spheno-occipital synchondroses and surrounding tissue dissected from 1-day-old male BALB/c mice were randomly assigned to a control and experimental group. Each group was subdivided into five different time points (6, 24, 48, 72 and 168 hours) and each subgroup contained five synchondroses. In the experimental group, the spheno-occipital synchondroses were immersed in Biggers, Gwatkin, Judah tissue culuture medium (BGJb) and 1 mM quercetin solution. In the control group, the spheno-occipital synchondroses were immersed in the BGJb medium. Tissue sections were subjected to immunohistochemical staining for quantitative analysis of Sox9 and type II collagen expression, using image analyzer.
RESULTS: There was a statistically significant increase of 32.3 per cent ($P < 0.001$) in the expression of Sox9 in the experimental group compared with the control group at 24 hours. Furthermore, there was a statistically significant increase of 23.0 per cent ($P < 0.001$) in the expression of type II collagen in the experimental group compared with the control group at 72 hours.
CONCLUSION: Quercetin increased the growth response of spheno-occipital synchondrosis through increasing expressions of Sox9 and type II collagen.

367 ASSESSMENT OF CHEWING CYCLE MORPHOLOGY – A LONGITUDINAL STUDY IN CHILDREN FROM 5 TO 7 YEARS OF AGE

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AIM: To evaluate the relationship between chewing cycle morphology and the developmental stage of the dentition.
SUBJECTS AND METHOD: The chewing pattern was assessed in 31 children (x = 5.42 ± 0.50 years) with the use of the Sirognathograph electrognathographic device in the primary dentition period (T1), in the early mixed dentition (x = 6.02 ± 0.50 years) (T2) and after eruption of the first permanent molars (x = 6.92 ± 0.50 years) (T3). Chewing pattern morphology was analysed in terms of shape and duration of the chewing cycles. Statistical analysis of the data was performed.
RESULTS: Chewing pattern morphology was found to be statistically significantly different between T1 and T2 for seven, between T2 and T3 for two and between T1 and T3 for 10 chewing parameters. In the frontal plane, the lateral deviation of chewing cycles from the midline was enlarged from 2.51 mm (T1) to 3.28 mm (T2) to 4.52 mm (T3). The axial inclination angle and the mouth closing angle were reduced. The cycles surface was enlarged from 15.86 mm^2 (T1) to 33.67 mm^2 (T3). In the sagittal plane, an enlarged inclination angle of chewing cycles (from 88.88° to 121.70°) was measured at T1 and T2 and a decline at T3 (114.66°). The mouth closing angle (from 84.79° to 114.71°) was enlarged at T2 and reduced at T3 (106.33°). The cycles surface was enlarged (from 2.77 mm^2 to 8.49 mm^2 to 9.40 mm^2). The average opening time was extended (from 0.21 to 0.24 to 0.28 seconds), resulting in a prolonged duration of the whole chewing cycle (from 0.57 to 0.65 to 0.69 seconds).
CONCLUSION: Eruption of the permanent teeth has a significant influence on the shape and duration of the chewing cycle. An objective assessment of chewing cycle morphology may be an important part of functional diagnostics in orthodontics.

368 FACIAL MORPHOLOGY CHANGES IN THE MIXED DENTITION PERIOD FROM 8 TO 9 YEARS OF AGE – A THREE-DIMENSIONAL EVALUATION

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AIM: To quantify facial morphology differences in a population of Slovenian children in the mixed dentition period, aged from 8 to 9 years, using three-dimensional (3D) laser scanning technology.
SUBJECTS AND METHOD: Forty-two children (19 girls, 23 boys) participated aged 8 years. One year later 30 children attended the follow-up (17 girls, 13 boys). Facial images were taken using a 3D imaging system, consisting of two high resolution laser cameras (Minolta Vivid VI910 3D). Average 3D facial shells were derived from the female and male attendees. The 9-year-old facial shell was superimposed on the 8-year-old shell. A colour map was used to highlight the differences between the two average male/female shells for the 8 and 9-year-old children.
RESULTS: The difference between the average facial shells after one year of growth and development was for girls (mean = 0.32 ± 0.25 mm) and for boys (mean = 0.32 ± 0.30 mm). The greatest soft tissue changes from 8 to 9 years of age were in the nasal and temporal area as well as in the ramus ascendens area of the lower jaw for girls, while in the boys it was in the lower jaw and premaxillary regions.
CONCLUSION: 3D laser soft tissue technology is suitable for monitoring growth and developmental changes in a population. Furthermore, facial morphology changes can be determined non-invasively, reliably and more objectively.

369 HOW WELL DO ORTHODONTISTS DIAGNOSE AND RECORD TEMPOROMANDIBULAR DISORDERS?

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AIM: To compare the recording of signs and symptoms temporomandibular disorders (TMD) in a sample of patients examined by consultant orthodontists (uncalibrated and calibrated) and a calibrated TMD examiner. The sample was taken from consecutive patients attending new patient clinics at Manchester Dental Hospital. A sample size of 22 patients was required in the uncalibrated and calibrated phase.
SUBJECTS AND METHOD: The study was carried out in two phases. In phase 1 the orthodontic consultants were not calibrated in TMD diagnosis. Twenty-two patients were examined by the orthodontists and the calibrated TMD examiner. Assessment was recorded on data collection sheets. In phase 2, the orthodontic consultants were calibrated in TMD diagnosis and the patients were assessed by the calibrated consultants and calibrated TMD examiner. The level of agreement between the orthodontist and the TMD examiner was assessed.

RESULTS: Recording of TMD examination in patients' notes was low in the uncalibrated phase (45.8%) and increased in the calibrated phase (88.5%). For all outcome measures, the level of agreement in diagnosing signs and symptoms of TMD was greater in the calibrated phase compared with the uncalibrated phase. The sensitivity of the TMD examination was higher in the calibrated phase.
CONCLUSION: Without calibration, clinicians show low reliability compared with a calibrated TMD examiner for the recording and diagnosis of TMD. The findings highlight the importance of reliable clinical standards for examination and diagnosis of TMD.

370 STRUCTURAL ADAPTATION OF RABBIT JAW MUSCLES TO ALTERED MASTICATORY FUNCTIONAL LOAD

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AIM: Skeletal muscle fibres can change their myosin heavy chain (MyHC) isoform and cross-sectional area (CSA) to adapt to altered environmental conditions. In general, reduced muscle activity induces transition towards faster fibres (MyHC IIX > IIA > cardiac alpha > I) with smaller CSA. The aim of this study was to investigate the effect of a reduction in masticatory functional load on MyHC composition and fibre CSA of three functionally different jaw muscles in a rabbit model.
MATERIALS AND METHOD: MyHC composition and the corresponding CSA of fibres were determined in the masseter, temporalis and digastric muscles of male rabbits aged 20 weeks. Between 8 and 20 weeks of age the experimental animals (n = 8) had been fed pellets requiring a significantly lower force to break the pellet (10 N) in comparison with the standard pellets (120 N) fed to the control animals (n = 8).
RESULTS: The proportion and CSA of the slow-type fibres co-expressing MyHC-I and MyHC-cardiac alpha were significantly lower in the masseter muscles of the experimental animals than in those of the control animals ($P < 0.05$). In contrast, the proportions and CSAs of the various fibre types in the temporalis and digastric muscles did not differ significantly between the groups of animals ($P > 0.05$).
CONCLUSION: Long-term reduction in masticatory functional load contributes to selective disuse of jaw muscles. The muscles affected adapt structurally to the reduced functional load with decreases in the proportion and CSA of their slow fibres.

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371 CLEFT LIP/PALATE IN MAYO, IRELAND 1999–2007

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AIM: A cleft lip and palate (CL/P) is the most common congenital abnormality in the craniofacial region. The incidence varies according to race/ethnicity, gender, family history and cleft type. The population of County Mayo, Ireland was 123,839 in 2006. The aims of this study were to identify and classify all cleft-affected children born in Mayo, Ireland between January 1999 and December 2007, and to assess their dental status.
MATERIALS AND METHOD: Dental records centralised at Mayo General Hospital were reviewed. Two clinicians carried out a clinical examination, along with completing a standardised questionnaire regarding the subject's medical history.
RESULTS: Thirteen CL/P subjects were identified, all Caucasian, nine males (69%), four females (31%) with a M:F of 2.25:1. The mean age was 5 years 10 months (range of 2 years 1 month, to 9 years 4 months). Four (31%) had CL/P, seven (54%) an isolated CP, and two (15%) an isolated cleft lip. Males predominated the CLP group and females the CP group. Twenty-three per cent were syndromic. A family history existed in 31 per cent. Fifty-four per cent required ear, nose and throat assessments. Sixty-two per cent had received speech therapy. The mean age at lip repair was 4.16 months and 11 months at palatal repair. The age at the first dental visit ranged from 3 months to 7 years 1 month (mean of 21 months). The mean number of decayed missing and filled teeth was 0.037. Fifty-four per cent had received fissure sealants. Fifteen per cent presented with hypodontia. Eight-five per cent had an orthodontic malocclusion.
CONCLUSION: From 1999 to 2007, the most common cleft anomaly in Mayo, Ireland was an isolated CP. The findings, including gender, cleft type, side and associated dental findings, followed international trends. Despite dental access being available from infancy, further investigation is necessary to determine the wide age range for the first dental visit found in this study.

372 THIN-PLATE SPLINE ANALYSIS OF THE DIFFERENT FACIAL TYPES IN FRONTAL NORM TELERADIOGRAPHS

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AIM: To evaluate facial morphology in teleradiographs with respect to normal values derived from frontal radiographs using thin plate spline (TPS) analysis.
SUBJECTS AND METHOD: Thirty subjects (15 females, 15 males), all in the mixed dentition phase with ages ranging from 8.4 to 10 years with satisfactory occlusion and harmonic profile with no history of orthodontic or orthopaedic facial treatment. The sample was divided into three groups according to the facial types proposed by Ricketts (1982). The coordinates of the anatomical points of the traces scanned from the teleradiographs were obtained using appropriate software (tpsDig2). The average craniofacial configurations of each group were obtained by superimposing orthogonal Procrustes, eliminating the differences in size, and analysing only the shape differences between groups by the visualization of the grid of deformations of the TPS method.
RESULTS: Statistically significant differences were observed between the three facial types but they were more marked between mesofacial types than between the mesofacial and brachyfacial subjects.
CONCLUSION: TPS morphometric analysis is efficient for accurate visualization of transverse and vertical differences among facial types even before the peak of pubertal growth.

373 EFFECT OF QUERCETIN ON EXPRESSION OF BMP2 AND PTHrP IN MICE SPHENO-OCCIPITAL SYNCHONDROSES

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AIM: The spheno-occipital synchondrosis is an important growth centre that affects the position of the maxilla and mandible. Due to its inaccessible position, modification of its growth by mechanical means using appliances is not possible. To explore the biological possibility of its growth modification with chemicals could be an important breakthrough. Quercetin, one of the flavonoids found in onions, apples and grapes, has been reported to affect new bone formation locally. It may be used for growth modification. The objective of this study was to evaluate the expressions of BMP2 and PTHrP during growth in spheno-occipital synchondroses in response to quercetin, using a mouse model *in vitro*.
MATERIALS AND METHOD: Spheno-occipital synchondroses together with adjacent structures were aseptically excised from 50 one-day-old male BALB/c mice that were randomly assigned to five control and five experimental groups in five experimental periods. In the control groups, the specimens were immersed in BGJb medium. In the experimental groups, 1 μM quercetin was added into BGJb medium. Both groups were then cultured for 6, 24, 48, 72 hours and 7 days. Alcian blue-periodic acid Schiff staining was used to study growth of the synchondroses; immunohistochemical staining to identify BMP2 and PTHrP expressions. The areas of BMP2 and PTHrP expressions were measured.
RESULTS: Quantitative analysis showed that both BMP2 and PTHrP expressions increased significantly 48 hours after quercetin application in the experimental group ($P < 0.001$). Compared with the control groups, both BMP2 and PTHrP were expressed consistently higher in the experimental groups at all time points.
CONCLUSION: Quercetin enhances an increase in BMP2 and PTHrP expressions in spheno-occipital synchondroses. It is a new discovery that the growth of spheno-occipital synchondrosis can be modified by chemical mean.

374 THREE-DIMENSIONAL MAXILLO-MANDIBULAR DENTAL CHANGES AFTER ORTHODONTIC TREATMENT WITH PREMOLAR EXTRACTIONS

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AIMS: Traditionally, measurements on lateral cephalographs only determine dental changes occurring in two planes, and whilst dental models provide three-dimensional (3D) information, relating the changes is difficult due to the lack of adequate reference structures for quantifying these changes. The aims of this study were: 1) To visualize and quantify dental changes to the maxillary and mandibular teeth in patients with a Class II division 1 incisor relationship after fixed appliance orthodontic treatment, involving extraction of four first premolars, versus extraction of two upper first premolars and two lower second premolars; 2) To investigate the effect that the two different extraction patterns have on the magnitude of dental change.

MATERIALS AND METHOD: Pre- and post-treatment records of 60 patients who had finished fixed appliance orthodontic treatment were randomly selected from completed premolar extraction cases. Thirty had extraction of four first premolars, whilst 30 had extraction of two upper first premolars and two lower second premolars. Pre- and post-treatment study models were digitally occluded and digitally superimposed on the pre-and post-treatment lateral cephalographs, which were then superimposed on each other using stable reference structures.
RESULTS: Statistically greater mean retraction of the lower canines (3.91 ± 2.83 mm versus 1.88 ± 3.11 mm) and lower incisors (3.31 ± 3.39 mm versus 1.52 ± 2.95 mm) was noted in the group with four first premolar extractions, whilst greater mean mesialization of the lower molars (4.66 ± 2.67 mm versus 2.50 ± 2.76 mm) was noted in the group with lower second premolar extractions.
CONCLUSION: The type of premolar extraction may influence the amount of lower incisor and lower canine retraction, and the amount of lower molar mesialization that occurs during treatment. However, a great degree of individual variability exists, and other factors, such as pre-treatment parameters, may affect the type of dental change observed.

375 COMPARATIVE STUDY OF BOND STRENGTH OF NEW AND RECONDITIONED BRACKETS AND ASSESSMENT OF RESIDUAL ADHESIVE

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AIM: An average rate of bracket loss of approximately 6 per cent is to be expected in daily clinical orthodontic practice. For reasons of economy, detached brackets are commonly reattached after sandblasting to remove adhesive, or replaced with used brackets reconditioned by specialist companies.
MATERIALS AND METHOD: Sandblasting and specialist bracket reconditioning procedures were systematically compared by comparative shear testing of re-bonded, reconditioned and new brackets using light and chemically cured adhesives.
RESULTS: The mean bond strength of reconditioned brackets was in each case less than that of new brackets, with the lowest value obtained with sandblasted brackets. This nevertheless exceeded the minimum value of 5–8 MPa required for orthodontic use. Bond strength was generally higher with a chemically curing adhesive than with a light curing adhesive; the chemically curing adhesive provided bond strength on previously bonded enamel higher than the light curing adhesive on intact teeth. Consistent with this, the results of an Adhesive Residue Index study demonstrated better bonding of the chemically curing adhesive than the light curing adhesive to the bracket base.
CONCLUSION: Despite the weaker bond strength than new brackets, sandblasting brackets accidentally detached during orthodontic treatment will generally allow effective reattachment to be achieved. Bond strength can moreover be improved with the use of a chemically curing adhesive. Used brackets reconditioned by specialist companies provide a second alternative to new brackets and higher bond strengths than sandblasted brackets.

376 *IN VITRO* PEAK INSERTION TORQUE VALUES OF SIX COMMERCIALLY AVAILABLE MINI-IMPLANTS

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AIM: Mini-implants are a popular adjunct of orthodontic treatment. There are a number of unwanted potential side-effects associated with the use of mini-implants, such as fracture during insertion. The aim of this study was to compare peak insertion torque values.
MATERIALS AND METHOD: Six commercially available self-drilling mini-implants [Mini Spider Screw®, Health Development Company (1.5 × 8 mm), Infinitas®, DB Orthodontics (1.5 × 9 mm), Vector TAS®, Ormco (1.4 × 8 mm), Dual Top®, Jeil (1.6 × 8 mm), Tomas Pin®, Dentaurum (1.6 × 8 mm) and Ortho-Easy®, Forestadent (1.7 × 8 mm)]. Twenty implants each were drilled into acrylic rods at eight rotations per minute using a motorized torque measurement stand. An additional 20 Ortho-Easy® implants per group were tested at a slower speed of four rotations per minute and with 6 and 10 mm lengths, to assess the impact of speed and length.
RESULTS: There were significant differences for some of the maximum torque values for the different mini-implants with the same length. The Mini Spider Screw and Infinitas showed the lowest average torque values (in Ncm) 6.5 and 12.4, compared with Vector TAS, Dual Top, Tomas Pin and Ortho-Easy implants (30.9, 29.4, 25.4 and 24.8 respectively). The Tomas Pin showed the largest standard deviation (7.7); the Dual Top was the most consistent (0.6). Different insertion speeds did not result in significant differences in peak torque values for Ortho-Easy® implants but the 6 mm implant was significantly stronger than those measuring 8 and 10 mm.

CONCLUSION: The different torque values could be due to the variation of core diameter, implant shape and/or composition of the Titanium alloy. Differences in production technique and alloy could account for variability of standard deviations. Although clinical torque values rarely exceed 12 Ncm, pre-drilling cortical bone to reduce insertion torque values appears justified for some implants to reduce the risk of fracture during insertion.

377 INFLUENCE OF ORTHODONTIC TREATMENT ON CANDIDA COLONISATION IN THE ORAL CAVITY

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AIM: Fixed appliances make oral hygiene care difficult by creating new retention sites where dental plaque and tartar accumulate. As microbiologic studies have shown, the sites especially permitting adhesion of bacteria and yeast are orthodontic brackets, bands and adhesive. The aim of this research was to examine how orthodontic treatment with fixed appliances affects the frequency of candida occurrence in the oral cavity of adults.
SUBJECTS AND METHOD: One hundred and fourteen adult patients (85 females, 29 males) divided into two groups. In group I (62 subjects) the material for microbiological examination was collected three times: before treatment and one and six months after the start of treatment and in group II (52 patients) after 18 months of treatment. The material was collected from four sites in the oral cavity: the buccal surface of tooth 16, the labial surface of tooth 21, the buccal surface of tooth 36 and the dorsal surface of the tongue. The material was obtained with the use of a disposable sterile matrix. A sterile swab moistened in 0.9 per cent salt solution was used and delivered to a microbiology laboratory within 1 hour.
RESULTS: In group I, 55 candida strains were cultured in 24 (38.7%) patients before treatment, 57 strains in 23 subjects (37.1%) at one month, while 87 candida strains were cultured in 32 patients (51.6%) at six months. In group II, 120 candida strains were found in 39 (75%) of patients. The most frequently observed species were *Candida albicans* (52.97%).
CONCLUSION: The number of candida species in the oral cavity of patients treated with fixed appliances increases over treatment time. The most frequently found candida species was *C. albicans*.

378 ROOT RESORPTION AFTER LIGHT AND HEAVY ROTATIONAL FORCES FOR 4 WEEKS – A MICRO-COMPUTER TOMOGRAPHIC STUDY

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AIM: To quantitatively measure and compare the location(s), dimensions and volume of root resorption craters in human premolars following the application of controlled light and heavy rotational orthodontic forces over a 28 day (4 week) period.
SUBJECTS AND METHOD: Fifteen patients requiring bilateral extraction of the maxillary first premolars as part of their orthodontic treatment. Each patient received a heavy rotational force (225 g) on one premolar and a light rotational force (25 g) on the contralateral premolar. Orthodontic rotational forces were applied over 28 days with buccal and palatal cantilever springs; 0.016 inch beta-titanium molybdenum alloys were used to apply the light force and 0.018 inch stainless steel was used for the heavy force. Following the 28 day experimental period, the upper first premolars were extracted under stringent protocols to prevent root surface damage. The samples were then scanned using a microcomputer tomographic X-ray system and analysed using specific software to obtain direct volumetric measurements.
RESULTS: The mean volume of resorption craters in the light force group was 0.42 compared with the heavy force group of 0.51 ($P = 0.013$). When separated at the root level, the difference in volume of root resorption craters between the two groups was significantly different only at the mid level ($P = 0.001$). Root resorption craters were consistently detected at the boundaries between the buccal and distal surfaces, and the mesial and lingual surfaces. Positive areas developed significantly more root resorption craters at all three levels, as compared with minimal areas ($P < 0.001$).
CONCLUSION: Heavy rotational forces cause more root resorption than light rotational forces. Compression areas (buccal-distal and lingual-mesial surfaces) showed significantly greater root resorption than other areas at all levels of the root.

379 A COMPARISON OF FACEMASK TREATMENT EFFECTS ACCORDING TO CERVICAL VERTEBRAE MATURATION

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AIM: Use of a maxillary protraction appliance, and the decision concerning appropriate treatment timing are important. The aim of this research was to compare the effects of facemask treatment according to the cervical vertebrae maturation (CVM) method.
SUBJECTS AND METHOD: Thirty subjects treated with a facemask were divided into two groups according to CVM.
RESULTS: In CVM 1~2 group, vertical and angular measurements showed statistically significant differences, except for the palatal plane. For horizontal measurements, the CVM 3~5 group showed statistically significant differences and all angular measurements were statistically significantly different except for SNB, mandibular plane before and after treatment. The skeletal change in the CVM 1~2 group was larger than in the CVM 4~5 group, but the dental effects in the CVM 3~5 group were larger than in the CVM 1~2 group. These results show that the effect of maxillary protraction was mostly skeletal in the pre-pubertal and pubertal growth peak periods, and the dental effects were larger after the growth peak period.
CONCLUSION: The skeletal change in the CVM 1~2 group and the dental effects in the CVM 3~5 group contributed to overjet correction. Treatment with a facemask is more effective when it is commenced before the growth spurt. CVM is useful for evaluating treatment timing with the advantage of reducing radiation exposure.

380 THE EFFECT OF BMP7 ON OSTEOGENIC DIFFERENTIATION OF DENTAL PULP STEM CELLS***

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AIM: The repair of large bony defects continues to present a challenge to clinicians. The use of stem cells opens up new hopes for replacing lost bone. Human dental pulp stem cells (DPSCs) offer an excellent source of cells that could potentially be committed to the osteogenic route. DPSCs differentiation ability with human bone morphogenic protein 7 (BMP7) transfection as an inducer was evaluated. The objective was to assess the possibility of *in vitr*o osteogenic differentiation of DPSCs under inducer stimulation.
MATERIALS AND METHOD: A strain of stem cell was isolated from dental pulp of two extracted permanent premolars, expanded and further characterized. Human BMP7 was used to trigger it to differentiate into osteoblasts. The gene was sub-cloned as a recombinant pcDNA3.1/V5-His-TOPO-BMP7 vector. pcDNA3.1/V5-His-TOPO-BMP7 vectors were transfected into stem cells as well as three different negative controls: blank cell, empty vector and non-related green florescent protein (GFP) vector. After 24 and 48 hours, the mRNA level of alkaline phosphatase (ALP) and osteocalcin (OC) was measured by real-time polymerase chain reaction to confirm osteogenic differentiation.
RESULTS: The relative transcription level of ALP mRNA in the BMP7 group was significantly higher than all three negative controls after 48 hours transfection. The relative mRNA levels of ALP were 11.24 for blank cell, 78.05 for empty vector, 73.10 for non-related GFP vector and 706.9 for pcDNA3.1/V5-His-TOPO-BMP7 vector. The relative transcription level of OC was significantly higher than all three negative controls after 24 hours transfection. The decreased level of expression at 48 hours indicated the possibility of a negative feedback of the increased production of OC.
CONCLUSION: Osteoblastic lineage was indicated by expression of ALP and OC. BMP7 can induce differentiation of DPSCs into osteoblasts.

381 PREDICTION OF THE MESIODISTAL WIDTH OF PERMANENT TEETH

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AIM: During the period of the mixed dentition several methods are used to predict tooth width. They show high values of correlation and determination coefficients. The purpose of present study was to determine a formula for prediction of the width of unerupted canines and premolars based on the sum of the width of the first permanent molar and incisors.
MATERIALS AND METHOD: Two hundred dental casts (100 maxillary, 100 mandibular) of 26 male and 64 female Caucasian patients with an average age of 16.6 years. Mesiodistal tooth width was measured with an electronic digital calliper. Statistical and correlation analysis were used.
RESULTS: The results showed high correlation (r) values, varying from $r = 0.677$ to $r = 0.831$. These values are among the highest described in the literature for non-radiographic prediction methods. There was no significant difference between the predicted and actual widths of the maxillary and mandibular permanent canines and premolars. The standard errors of estimation were 1.18 for males and 1.2 for females for the maxillary arch, and 1.01 for males and 1.02 for females for the mandibular arch. No statistical difference was found in tooth width between the right and left sides.
CONCLUSION: This method is accurate, practical, and easy to use and requires no specific equipment.

382 STRUCTURAL CHANGE OF THE HYOID BONE AND UPPER AIRWAY AFTER ORTHOGNATHIC SURGERY USING THREE-DIMENSIONAL COMPUTED TOMOGRAPHY

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AIM: To find structural changes of the hyoid bone and upper airway after mandibular setback osteotomy for skeletal Class III patients with anterior open bites.
SUBJECTS AND METHOD: Twelve patients diagnosed with a skeletal Class III malocclusion with an open bite who underwent a mandibular setback osteotomy. Skeletal measurements were analysed using three-dimensional imaging of the hyoid bone and upper airway. Ten subjects with a 'normal' occlusion comprised the control group.
RESULTS: 1. In the open bite group, the hyoid bone was positioned anteriorly, compared with the controls ($P < 0.05$). 2. Post-surgery the hyoid bone was positioned upward, posterior, left displacement, but this was not statistically significant. 3. The angle between the hyoid plane and mandibular plane in Class III group pre-surgery was greater than in the controls ($P < 0.05$), and the difference increased significantly post-surgery ($P < 0.01$). 4. In the Class III subjects, the volume of the upper airway decreased significantly post-surgery ($P < 0.001$). The volume of the upper airway was significantly smaller than in the control group both pre- and post-surgery ($P < 0.001$).
CONCLUSION: In Class III open bite subjects, the angle between the hyoid plane and mandibular plane was greater than in the normal group. Upper airway volume in the Class III patients was smaller than in the controls and volume was decreased after orthognathic surgery.

383 LONG-TERM OBSERVATION OF MASSETER MUSCLE CHANGES IN FACIAL ASYMMETRY

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AIM: To examine how the soft tissues are changed and adjusted by comparing and analyzing changes in the masseter muscle of patients with a skeletal Class III malocclusion with facial asymmetry 1 and approximately 4 years after bimaxillary orthognathic surgery.
SUBJECTS AND METHOD: Eight patients who were diagnosed with skeletal facial asymmetry and who had undergone surgery comprised the asymmetry group, and 10 subjects with a 'normal' jaw and normal occlusion were selected as the controls.
RESULTS: 1. Volume, maximum cross-sectional area (CSA) and thickness of the maximum CSA all increased in the asymmetry group post-surgery. The width of the masseter muscle increased, and the length of the muscle decreased, on average. 2. The most related variable to the volume of the masseter muscle 4 years after mandibular setback osteotomy was the maximum CSA of the masseter muscle and the thickness of the maximum CSA ($P < 0.01$). 3. Pre-surgery there were significant differences between the asymmetry and control group in volume, masseter muscle angle, maximum cross-sectional area, thickness of the maximum CSA, width and length of the masseter muscle. However, 4 years post-surgery there were no significant differences in the masseter muscles between the groups.
CONCLUSION: The skeleton of patients with facial asymmetry was stable 1 year post-surgery. The shape of the masseter muscle in the asymmetry group continuously changed to be similar to that in the normal group one year after surgery.

384 *IN VITRO* DIFFERENTIATION OF DENTAL PULP STEM CELLS INTO THE CHONDROGENIC ROUTE

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AIM: Cartilage cells have a limited ability to regenerate and self-repair. A large number of people are affected by cartilage deformity due to trauma, degenerative disease, congenital craniofacial defect, idiopathic condylar resorption, ageing, etc. The limited availability of donor sites for cartilage reconstruction makes it an ideal candidate for tissue engineering. Currently bone marrow aspirate is the most popular source of mesenchymal stem cells. Human dental pulp tissue has been found to be an alternative rich source of stem cells. The aim of this study was to examine the *in vitro* potential of dental pulp stem cells (DPSC) to differentiate into chondrogenic lineage when added to human transforming growth factor beta 3 (TGF-ß3).
MATERIALS AND METHOD: A strain of stem cells were isolated from human dental pulp, expanded and further characterized. TGF-ß3 was chosen to trigger its differentiation to cartilage. The TGF-ß3 gene was subcloned as a recombinant pcDNA3.1/V5-His-TOPO-TGF-ß3 vector. The vector was transfected into the DPSC. Three different negative controls were used; blank cells, empty vector and non-related green fluorescent protein (GFP) vector. After 48 hours, the mRNA level of collagen type II and aggrecan was measured by real-time polymerase chain reaction.

RESULTS: The relative transcription level of collagen type II mRNA in the TGF-ß3 group was significantly higher than all three negative controls. The relative levels of collagen type II mRNA were 2.746 for blank cell, 154.3 for empty vector, 49.41 for non-related GFP vector and 233.4 for TGF-ß3 vector.
CONCLUSION: TGF-ß3 was successful in triggering DPSC differentiation into chondrogenic progenitor cells. It is concluded that DPSC have the capability to form cartilage cells.

385 DIAGNOSTIC INVESTIGATIONS OF PATIENTS WITH OLIGODONTIA AND ECTODERMAL DYSPLASIA

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AIM: Oligodontia is defined as congenital absence of six or more permanent teeth while ectodermal dysplasia (ED) is a group of diseases characterized by the abnormal development of two or more structures derived from the embryonic ectodermal layer the skin, hair, nails, sebaceous and sweat glands and teeth. Classification of ED is based on the assessment of the occurrence of the four basic clinical symptoms proposed by Freire-Maia and Pinheiro: 1. trichodysplasia, 2. dental abnormalities, 3. onychodysplasia and 4. hypohydrosis. The aim of this investigation was to evaluate patients with oligodontia and suspected ED allowing differentiation of oligodontia and particular ED types.
SUBJECTS AND METHOD: A retrospective study of 25 patients (7 females, 18 males) with oligodontia and symptoms of ED, aged from 5 to 24 years. To assess trichodysplasia, a trichogram and trichoscopy were performed. Dental abnormalities were determined through clinical examination and on panoramic radiographs. To assess dyshydrosis, the pilocarpine test was performed.
RESULTS: Trichodysplasia was observed in 19 patients (variable shaft thickness, hair shafts without pigmentation, dominance of pilosebaceous units with a single hair, pili torti, trichoschisis and trichotiodystrophy). All 25 patients had dental abnormalities: oligodontia (from 6 to 26 missing teeth), microdontia, conical shaped crowns, taurodontism, abnormal tooth positions, and unerupted teeth. Dyshydrosis was observed in one patient. Pure oligodontia was present in six patients and ED in 19 patients.
CONCLUSION: Trichoscopy, trichogram and pilocarpine tests are non-invasive and inexpensive methods for differentiation of pure oligodontia and ED, and types of hydrotic and hypohydrotic ED. Although they will not replace genetic tests, they could be useful in diagnosis, differentiation and planning of comprehensive treatment.

386 EPIDEMIOLOGICAL ASPECTS OF MISSING TEETH IN A ROMANIAN POPULATION

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AIM: There are different opinions regard opening or closing the spaces in subjects with anodontia. The aim of this research was to study the prevalence of missing teeth and their relationship with the occlusion.
SUBJECTS AND METHOD: Two thousand six hundred subjects from 5 to 28 years of age (46.62% males, 53.38% females) attending for orthodontic treatment. Dental records, consisting of extra- and intraoral photographs, diagnostic casts and panoramic radiographs, were analyzed.
RESULTS: From the sample, 9.84 per cent presented missing teeth (49.59% males, 50.41% females), 37.82 per cent in the maxilla, 42.62 per cent in the mandible; the remaining cases were bimaxillary. The most frequently missing tooth was the lower second premolar (71.%) on one side of the arch, and then the upper lateral incisor, asymmetrical side (48.86%).
CONCLUSION: The prevalence of missing teeth in this population was 9.84 per cent corresponding with the literature data (3.5-10%). The sequence in this sample was lower second premolar, upper lateral incisor, upper second premolar and lower central incisor, most frequently asymmetrical. Females were more affected than males, and the maxilla more than the mandible.

387 A COMPARATIVE STUDY ON THE ALIGNMENT EFFICIENCY OF A LINGUAL SYSTEM

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AIM: The Incognito lingual system is characterized by customized brackets and wires, and thus can improve patient comfort and save chair-side time for orthodontists. However, treatment efficiency has not been studied, especially for Asian patients, whose teeth are commonly of a smaller size and lingual surface area. The objective of this study was to evaluate the alignment efficiency of the Incognito lingual system in Asian patients.

SUBJECTS AND METHOD: Twenty-one Asian patients treated with the Incognito lingual system were compared with a randomly selected group of 21 adult Asian patients treated with labial fixed appliances. Each arch was considered as independent, thus the sample number was 42 in both the study and control group. Two indices were used to evaluate the alignment efficiency: the treatment period (TP) was the total treatment time (months) from the date of full mouth bonding to the date when the rectangular stainless steel wire was fully engaged, and crowding release efficiency (CRE) = crowding (mm) in individual arch/corresponding TP. Statistical differences were analyzed using a *t*-test.
RESULTS: The Incognito system showed higher CRE during the alignment stage compared with the labial straightwire appliance (2.5 ± 0.2 mm versus 1.8 ± 0.35 mm per month), and shorter TP of the alignment stage (4 6 ± 0.5 versus 6.2 ± 0.75 months). The difference was statistically significant ($P < 0.05$).
CONCLUSION: The Incognito lingual system is more efficient in the alignment stage compared with commonly used labial straightwire system.

388 ADVANCED MORPHOMETRICS: REGISTRATION OF THREE-DIMENSIONAL FACIAL IMAGES

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AIM: Appropriate registration (superimposition) of three-dimensional (3D) facial images is the most important prerequisite for evaluating and comparing facial variations. Traditional registration techniques, based on a small number of landmarks, are not accurate enough for the assessment of facial growth in children, facial asymmetries, and other aspects. The aim of thi research was to develop an advanced registration techniques that take into account all data points available.
SUBJECTS AND METHOD: Two Konica Minolta VIVID 900/910 cameras were used for data acquisition. Rapidform® software and in-house developed subroutines were employed for data processing. A sample of 350 scanned faces of 15-year-old British Caucasians was examined and 21 facial landmarks were placed on each image. Generalised Procrustes analysis was used to register the sets of landmarks.
RESULTS: Mid-endocanthion was found to be the least variable point in the eye region, which is known to undergo the least variations as the face grows. A method for identifying a common reference frame for each face was developed as a set of subroutines for Rapidform®. The reference frame has mid-endocanthion as its origin and involves three reference planes: (i) mid-sagittal as the symmetry plane of the symmetrised structure consisting of maxilla and its mirror counterpart, (ii) transverse as the plane normal to the axis of the cylinder fitting the symmetrised structure and (iii) coronal as the plane normal to the first two.
CONCLUSIONS: The proposed common reference frame is automatically identified for each landmarked face and can be used to superimpose 3D facial images. This approach is based on all facial data available, is more accurate than the traditional approach based on landmarks only, and is especially suitable for studying facial growth, evaluating facial asymmetries and constructing average faces.

389 ECTOPIC ERUPTION OF THE MAXILLARY FIRST PERMANENT MOLAR

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AIM: Ectopic eruption reflects the eruption of a tooth in an abnormal position. The most frequently found ectopic teeth are the maxillary first permanent molars and canines followed by the mandibular canine, mandibular second premolar, and maxillary lateral incisors. Ectopic eruption of the maxillary first molars shows a variable frequency between 2 and 6 per cent. The aim of this retrospective study was to describe the characteristics and occurrence of ectopic eruption of the maxillary first permanent molar and its correlation with pathological resorption of the maxillary second primary molar in a group of untreated normal growing Macedonian children.
SUBJECTS AND METHOD: Five hundred and twenty one consecutive patients in the first phase of the mixed dentition. They were reviewed from January 2005 to May 2009 as a routine procedure. All were evaluated with a dental pantomograms and intraoral radiographs, taken every six months. The position of the maxillary first permanent molar and the amount of pathological resorption of the second maxillary primary molar was evaluated and the radiographs of each patient were compared.
RESULTS: The frequency of occurrence was 5.3 per cent with no differences in gender. Of these, 46.7 per cent were unilateral and 53.6 per cent bilateral with a right-left relationship of 2:1. Almost half (52%) of ectopic molars spontaneously self-corrected.

CONCLUSION: Early diagnosis and treatment of the maxillary first permanent molar results in the prevention of premature loss of the second maxillary primary molar and resulting malocclusion.

390 CRANIOFACIAL MORPHOLOGY OF CHINESE ADULTS WITH NORMAL OCCLUSION AND SKELETAL DIVERGENCE

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AIM: To examine the craniofacial morphologic characteristics of different vertical dysplasias in a population of Chinese adults with normal occlusion.
SUBJECTS AND METHOD: Sixty-nine subjects with normal occlusion were selected from 800 healthy students between 18-24 years of age. Lateral cephalograms were obtained and 27 hard and 10 soft tissue measurements were analyzed. The subjects were then divided into three groups of high angle, low angle or control according to the value of FH-MP. Intraclass correlation coefficient was determined for the repeated measurements. One-way ANOVA was used to determine the differences between the groups.
RESULTS: The low angle group had a larger cranial basis angle (N-S-Ar) and the high angle group a shorter maxilla (Ans-Ptm) ($P < 0.01$). The high angle group displayed vertical hyperdivergency with increased PP-OP, OP-MP, gonial and lower gonial angles, whereas the low angle group showed significant hypodivergence with decreased values for all variables ($P < 0.01$). The low angle group had a more protrusive chin and the high angle group a more retrusive chin ($P < 0.01$). Differences in dentoalveolar measurements in the divergent groups were mainly in the anterior region. Moreover, the low angle group had a thicker, and the high angle group, a thinner lower dentoalveolus ($P < 0.01$). For face height measurements, the main differences in the divergent groups were at the anterior lower third ($P < 0.01$). Soft tissue deviations were less obvious in the high angle group and in general less significant than those of the hard tissues in both divergent groups.
CONCLUSION: Significantly different morphological characteristics exist in Chinese adults with vertical dysplasia but normal occlusion. Major skeletal cephalometric changes existed at the lower third of the face. The soft tissues showed a well adapting mechanism of soft tissue coverage for the skeletal dysplasia.