Research Posters – Clinical Science

R76

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Apical status of root filled teeth in a German population

Aim To evaluate radiologically the apical status of root filled teeth in a population in Berlin, Germany using a cross-sectional study design.

Methodology A total of 747 panoramic images taken between 1999 and 2001 were evaluated by one observer in a darkened room on an illuminated screen. Prior to evaluation the observer was calibrated and the intraobserver reliability was tested. Numbers of root filled teeth, apical lucencies, quality and length of root fillings were registered. Sound teeth without root fillings served as control for the judgement of apical lucencies. Relations between the apical status and the quality of root fillings as well as the quality and presence of the coronal seal were statistically evaluated using the chi-square test. Results In 747 panoramic images, 17648 teeth could be evaluated. Regardless of their filling status (root canal filling and/or coronal restoration) 6.3% of all teeth had apical lucencies. Overall, 5.6% of all examined teeth were root filled and 48.5% of these were associated with apical rarefactions. For teeth with unacceptable root fillings, chi-square test showed significantly more apical lucencies compared to teeth with acceptable root fillings (P < 0.001). When crowns or fillings were present as opposed to no coronal seal, significantly less apical lucencies were associated with root filled teeth (P < 0.001).

Conclusions The presence of coronal restorations and an acceptable quality of root filling had a positive impact on the apical status of root filled teeth.

R77

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Comparison of periapical health in a Belgian population between the periods 1992/93 and 2002/03

Aim To collect and compare data on the prevalence and the technical standard of root canal treatment as well as the prevalence of apical periodontitis (AP) over a 10-year time period in a Belgian population. **Methodology** The patient records of Belgian adults attending the Dental School of the Ghent University Hospital from November 1992 to October 1993 (1) & from November 2002 to October 2003 (2) were selected. A total of 249 (1) and 681 (2) panoramic radiographs were selected and examined for endodontic treatment, periapical condition and coronal restorations.

Results Of the 5721 (1) and 16229 (2) teeth examined, 6% were root filled. There were statistically significantly less teeth missing in the later cohort (2): 15% (2) versus 18% (1) (P < 0.0005). Periapical radiolucencies were found in 6% (1) and 5% (2) of all teeth (P = 0.002), in 44% (1) and 35% (2) of the endodontically treated teeth (P = 0.005), and in 4% (1) and 3% (2) of non-root filled teeth (P = 0.003). The apical level of the root fillings was inadequate in 57% (1) and 39% (2) of the root filled teeth (P < 0.0005). There was no statistically significant difference in prevalence of AP in relation to

the length of the root fillings between (1) and (2). However, when no AP was present in root filled teeth, a statistically significant increase in quality of root fillings was noted (P = 0.004). No statistically significant differences were found between the number of teeth restored with plastic coronal fillings or crowns, and the number of teeth with caries.

Conclusions Although there was a statistically significant (i) increase in quality of root fillings scored on a radiographic basis and (ii) decrease of the percentage of AP on root filled teeth over this 10-year time period, the technical standard of root canal treatment remained disappointing.

R78

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Frequency and distribution of root filled teeth and apical periodontitis in an adult urban Croatian population

Aim To investigate the prevalence and quality of root fillings in teeth and the presence of apical periodontitis in an adult Croatian urban population.

Methodology Radiographs of 675 patients presenting for the first time at four different dental offices in Zagreb were examined. The occurrence and technical quality of root fillings were assessed for each root according to the position and the density. The periapical status was evaluated using the Periapical Index Scoring System. The data were analyzed statistically and differences were tested by ANOVA and Scheffe Post Hoc test.

Results A total of 17983 teeth were examined: of these 1017 (5.6%) were root filled and 1449 (8.0%) had apical periodontitis (PAI \geq 3). Molars were the most commonly root filled teeth (424–41.7%), then premolars (355-34.9%) and anterior teeth (237-23.5%). Root fillings ending more than five mm from the radiographic apex were observed in 530 (21.6%) roots. Root fillings ending 2-5 mm short were present in 726 (29.5%) roots. Root fillings ending <2 mm from the apex were found in $838\ (34.0\%)$ roots. Root filling material beyond the apex was noticed in 96 (3.9%) roots, and 269 (10.9%) roots had radiopaque material in the pulp chamber and/or orifice of the root canal. Adequate filling with a homogenous radiopaque material in the root canal without voids between material and walls of canal was observed in 882 (35.8%) roots. There was no difference in the frequency of endodontically treated teeth by gender or age. Conclusions There was a high prevalence of periapical periodontis and with only 34.0% root fillings ending <2 mm from apex. Overall, 35.8% well obturated root fillings were observed.

R79

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An assessment of periapical status in a group of Turkish patients

Aim To assess the prevalence and severity of apical periodontitis (AP) using the Periapical Index (PAI) and the quality of root fillings. **Methodology** A total of 171 randomly selected male and female patients older than 13 years with mature apices having a total of

25

4107 teeth were evaluated clinically and radiographically, in Hacettepe University, Faculty of Dentistry, Departments of Endodontics, Ankara-Turkey, PAI scores, missing and decayed teeth, presence and standard of root fillings of the patients were recorded. The criteria to evaluate the root canal fillings were: uniformity, well condensed, apical level and were evaluated by two observers. The reliability between the observers was tested with Cohen's Kappa.

Results In all 130 (76.02%) of 171 patients had a total of 327 carious lesions, 106 (61.98%) of 171 patients had periapical lesions. Four (2.33%) of the 171 patients had a DMFT index score of zero. Only 6 (8.95%) of 67 root fillings were acceptable; 42 (62.68%) root filled teeth had chronic periapical lesions. Overall 106 of 4107 teeth (2.58%) had apical periodontitis.

Conclusions The majority of root fillings were unacceptable in terms of technical quality. The percentage of teeth with AP was high.

R80

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Short-term calcium hydroxide medication of teeth with large periapical lesions

Aim To evaluate the outcome of root canal treatment in teeth with large periapical lesions following short-term application of calcium hydroxide dressings.

Methodology Thirty seven teeth with a chronic or aggravated chronic periapical pathosis were selected in 34 patients (17 females and 17 males) whose age ranged from 19 to 58 years (mean 36.4 \pm 11.6 SD). Root canal treatment of large periapical lesions with a radiographic diameter of at least 8 mm was carried out. In each case an approximate area of the lesion was determined. The lesions whose approximate area did not exceed 100 mm², and those with an area of 100 mm² or more were identified. After chemomechanical preparation of the root canals an antiseptic calcium hydroxide dressing was applied for 1-2 weeks. Finally, the canals were filled with guttapercha using the lateral condensation technique. The results of treatment were monitored clinically and radiographically after periods of 6-8 months, 12-14 months, 2 years and beyond. While evaluating the results of the treatment the following criteria were considered: complete healing, significant improvement, lack of improvement or exacerbation. Statistical analysis was performed using Fisher's exact test (P = 0.05).

Results Thirty-four teeth out of 37 were included (91%). Complete healing was achieved in 22 cases (64%), and marked improvement in 9 cases (26%). In 3 teeth (9%) exacerbation was observed. No statistically significant difference (P = 0.999) in successful root canal treatment between the lesions with the size <100 mm² (17 cases), and the lesions with >100 mm² (14 cases) was found.

Conclusions Regardless of the size of periapical pathosis conventional treatment should be undertaken. Large periapical pathosis can be treated with a short-term application of calcium hydroxide.

R81

26

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Management of apical periodontitis by Flemish general practitioners

Aim To gather information on general practitioners' (GPs) attitude towards treatment of apical periodontitis (AP).

Methodology In all 282 dentists attending peer review sessions organised by the Flemish universities were asked to complete an anonymous questionnaire in a multiple choice format. Data were entered in a database and subjected to descriptive and analytical statistics.

Results Five questionnaires were discarded because respondents were not general practitioners. Considering their outlook on a number of issues regarding AP, 32% of the respondents believed that the size of the radiolucency influenced the choice between conventional or surgical endodontic treatment. According to 29% of respondents, the distinction between a granuloma and a cyst can be made radiographically. Overall, 57% believed that healing of cysts is possible after root canal treatment. In relation to the endpoint of canal preparation, 38% made a distinction between vital and periapically involved teeth. Sixty percent of GPs, choose 'open drainage' as a treatment mode under certain circumstances. Regarding treatment of periapically involved teeth, the choice between single or multi-visit treatment seemed to be influenced mainly by the presence of symptoms and, in absence of symptoms, by tooth type. In case of root filled teeth presenting with AP, retreatment + follow-up was the most popular option if primary root canal treatment had been completed on a periapically sound tooth. If the tooth originally had AP, a surgical approach was more frequently chosen. When rating the type of teeth scheduled for periapical surgery 38% of respondents never apicectomized teeth, and 65% of respondents surgically treated 1–5% of root filled anterior and premolar teeth.

Conclusions The views and strategies of this group of GPs concerning periapically involved teeth were not always consistent with present-day recommendations.

R82

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The relation between apical periodontitis and root filled teeth in patients with periodontal treatment need

Aim To investigate factors associated with apical periodontitis in root filled teeth in a population of periodontally compromised patients.

Methodology The present investigation was a retrospective crosssectional study on data collected from periodontal examination and the associated conventional intra-oral radiographic evaluation from patients attending the Department of Periodontology of the Dental School of the Ghent University Hospital. Periodontal parameters (mean probing depth, deepest pocket in relation to the cementoenamel junction (CEJ), distance between the CEJ and the lowest marginal bone level), root canal treatment (length, homogeneity and overall quality of the root filling), the quality of coronal restorations and the history of periodontal treatment were related to the prevalence of apical periodontiits. A total of 272 root filled teeth in 94 patients were evaluated.

Results The periapical condition was significantly influenced by the quality of the root filling and the coronal filling (P < 0.05). More apical periodontitis was seen when the coronal level of the root filling exceeded the marginal bone level (P < 0.005). The marginal periodontal condition seemed to influence the periapical status. Teeth with apical periodontitis were associated with a significant increase of average probing depth (P < 0.001), more marginal bone loss (P < 0.001) and a higher measure of deepest pocket depth (P < 0.001). Statistically significantly less apical periodontitis was seen in patients that had received marginal periodontal treatment (P < 0.001).

Conclusions Periodontal disease may influence the periapical condition of root filled teeth. Efforts should be taken in preventing spread of infection through the periodontal-endodontic pathway by periodontal treatment and a high quality of root filling and coronal restoration. Care should also be taken to seal the coronal cavity up to the level of the root filling, where it should be advocated to reduce the coronal level of the root filling below or at least at the level of the surrounding marginal bone.

R83

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Evaluation of a system for grading the complexity of root canal treatment

Aim To evaluate a system of grading the complexity of root canal treatment and apply it to endodontic referrals.

Methodology A system of grading the complexity of root canal treatment that had been previously developed was applied to all endodontic referrals to a Department of Restorative Dentistry in a District General Hospital within a period of one year. Grading was repeated in 60 randomly selected teeth to test for intra-observer and inter-observer agreement. The appropriateness of referrals and treatment undertaken was assessed in terms of the complexity.

Results In all 152 patients were referred for root canal treatment of 186 teeth within this period. Of these, 60 teeth were treated in the Department. There was moderate intra-observer agreement and moderate to poor inter-observer agreement with regards to the complexity grades allocated. Among the referrals, 47% (87) of teeth were of complexity grade 3 (high), 48% (89) of grade 2 (medium) and 5% (10) of grade 1 (low). Overall, 48% (29) of treatment was undertaken in teeth of complexity grade 3 and 52% (31) in teeth of complexity grade 2.

Conclusions This system of grading the complexity of root canal treatment was found to be simple to use, but was ambiguous and incomplete. There was moderate intra-observer agreement and moderate to poor inter-observer agreement. The referrals to the Department were of appropriate complexity.

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R84

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Endodontic surgery using endoscope visualization: 1-year follow-up

Aim To monitor the outcome of ultrasonic apical root-end preparation using endoscope visualization during endodontic surgery in relation to tooth type and location, and the presence of post retained restorations.

Methodology Teeth treated surgically had a periradicular lesion of strict endodontic origin. In all 28 anterior and premolar teeth were included in the study using specific selection criteria. A full mucoperiosteal tissue flap was reflected and carefully retracted. Surgical access to the root was then made through the cortical bone using a round bur. The periradicular lesion was removed with sharp bone curettes and angled periodontal curettes. After exposure of the apical root-end, a straight fissure bur in a hand-piece was positioned perpendicular to the long axis of the root and then beginning from the apex, 2.5–3 mm of the root-end was removed. Prior to root-end preparation, local haemostasis was achieved through the use of bone wax. Root-end cavities were prepared using a zirconium nitrate retro-tip (Dentsply Maillefer Instruments, Switzerland) driven by an

ultrasonic device unit (EMS, Switzerland). Root-end cavities were then dried using paper cones and a zinc oxide EBA-reinforced cement was used as the root-end filling material. All root-end procedures were performed using endoscope visualization. Cases were followed for a period of one year and then classified into three groups (healing, uncertain healing and disease) according to radiographic and clinical criteria.

Results Of the 28 teeth evaluated at 1-year follow-up, 26 teeth (93%) had healed, 1 tooth had uncertain healing and 1 had disease. There was no statistically significant differences in treatment outcome related to the type of tooth, tooth location, or presence of post restoration.

Conclusions In this study the adherence to a strict endodontic surgical protocol, the use of contemporary techniques and materials together with endoscope visualization lead to a predictable outcome with definite healing in 93% cases.

R85

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Operating times for mechanical Ni-Ti instrumentation with two filling techniques: a preliminary report

Aim To evaluate the amount of time allocated to each stage of root canal treatment (total working time TWT) and to compare the time taken to complete canal filling using 2 techniques.

Methodology In a private clinic, general dental practitioners with varying levels of experience were instructed to recruit, on a predetermined date, patients for all types of endodontic treatment. Three independent calibrated observers carried out a double-blinded evaluation by timing each step of the consecutive endodontic treatments. After hand exploration with size 08–10 K-Flexofiles, engine-driven rotary instrumentation (ProTaper[®], Dentsply-Maillefer, Switzerland) was employed for all the canal preparations. Subsequently, a similar evaluation was completed for 2 filling techniques employing thermoplasticized gutta-percha: Thermafil[®] system (Dentsply-Maillefer); and System B (SybronEndo, USA) with Obtura II (Obtura Corporation, USA) for vertical condensation and backfilling.

Results Thirteen teeth representing 35 canals were treated. Excluding radiographical examination, the mean TWT/canal was 20.7 \pm 7.7 mins. Seven different steps were measured: 1. Diagnosis, information and anaesthesia: t = 4.5 min (range 1-11 min) 2. Access cavity preparation: $t = 4 \min$ (range 1–7), exploration: $t = 1 \min$, 3. Electronic working length determination/canal: $t = 1 \min 4$. Cleaning, preparation and drying: 5 to 7 min/canal when using a five instrument sequence (Sx-S1-S2-F1-F2) including 10-15s for instrument changing (total = 1 min). Drying time: 1.5 min/canal 5. Thermafil[®] obturation/canal $t = 2.5 \min \pm 1.7$ 6. Temporary filling: $t = 1 \min 7$. Discussion $t = 3 \min$. TWT averaged 23 min, 34 min and 44 min for single rooted, 2-rooted and 3-rooted teeth, respectively. The operating time for canal obturation with Sytem B-Obtura II was $5.9 \min \pm 2.4$; the Thermafil[®] technique was faster and involved less preparation and instrumentation, without significantly influencing TWT.

Conclusions The major time consuming steps were canal cleaning and preparation, followed by diagnosis, anaesthesia and cavity preparation. New developments, mainly in the cleaning and preparation phase and a faster induction of anaesthesia could further shorten chair-side time.

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27

R86

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A new cone-beam computerized tomography system for use in endodontic surgery

Aim To present a newly developed ortho cubic super-high resolution computed tomography system (Ortho-CT) and its application in endodontic surgery.

Methodology A prototype was assembled on a Scanora (Soredex Findent Co, Finland) with the use of a 4-inch image intensifier instead of film. Data were collected from a single 360 degree scan and a cylinder 32 mm in height and 38 mm in diameter. Images were reconstructed with a software programme on a personal computer. Imaging data consisted of 240 (height) \times 280 (diameter) cubic

voxels, each with a dimension of 0.136 mm. With this small voxel size, the image resolution was high and was the same in any direction. Sections parallel to the dental arch (Parallel sections), perpendicular to the dental arch (cross sections) and horizontal sections were produced with a slice width of 1 mm at an interval of 1 mm. Patients with fractured instruments were evaluated with Ortho-CT, and the images were compared to routine radiographic films.

Results Ortho-CT produced images of high resolution, enabling identification of the lesions and the fractured instruments, and the relationship with the maxillary sinus and adjacent teeth.

Conclusions Because Ortho-CT can take high-resolution 3-dimensional images at any tomographic layer with only 1 exposure, it is a useful aid for the diagnosis and treatment of diseases in endodontic surgery.

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28

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