ABSTRACTS

Wladimir Adlivankine European Society of Endodontology Research Prize

RP1

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SEM-analysis of the integrity of resected root apices of cadaver and extracted teeth after ultrasonic root-end preparation at different intensities

Aim To compare the integrity of root apices of cadaver and extracted teeth after resection, ultrasonic root-end cavity preparation at medium and low ultrasonic power settings and following extraction.
Methodology Root canal treatment, perpendicular root-end resection and root-end cavity preparation were performed on single-rooted anterior and premolar teeth [49 teeth *in situ* in maxillary and mandibular jaws from cadavers (CT) and 45 extracted teeth (ET)]. Apical root-end cavities were prepared with the S12/90°D tip and the Suni-Max ultrasonic unit (Satelec, France) at the intensity prescribed by the manufacturer (*P*ower 7 at power mode S) (34 CT, 30 ET) and at a lower intensity (*P*ower 4 at power mode S) (15 CT, 15 ET). After ultrasonic preparation the cadaver teeth were retrieved from the jaws. Exaflex impressions (GC Corporation, Japan) were made of the root apices after resection, root-end preparation and retrieval. These impressions were processed for SEM-analysis, and the recordings evaluated for cracks and marginal chipping.
Results In general, extracted teeth showed significantly more cracks and chipping than cadaver teeth. Lowering the ultrasonic power from medium to low intensity resulted in equal scores for cracks on extracted teeth and for chipping on cadaver teeth, in higher scores for cracks on cadavers and in lower scores for chipping on extracted teeth. Complete cracks and cracks originating from the root surface occurred only in extracted teeth.
Conclusions The number of cracks and chipping caused by ultrasonic root-end preparation was higher on extracted teeth than on cadaver teeth. Lowering the ultrasonic power from medium to low intensity cannot be recommended as it resulted in more cracks and equal chipping on cadaver teeth. Investigation of techniques and materials should be conducted *in situ* and not on extracted teeth.

RP2

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Effectiveness of three different nickel-titanium rotary instruments for removing gutta-percha in curved root canals *in vitro*

Aim To compare *in vitro* the effectiveness of FlexMaster (Vereinigte Dentalwerke, Germany), ProTaper (Dentsply Maillefer, Switzerland), RaCe (FKG Dentaire, Switzerland) rotary instruments and Hedström hand files for removing gutta-percha in curved root canals during retreatment.
Methodology Sixty mandibular premolars with one single canal with a curvature between 20 and 36 degrees, determined by Schneider's method, were selected. The canals were enlarged to size 30 with FlexMaster instruments and filled using the cold lateral condensation technique. The teeth were randomly divided into four groups of 15 specimens each. After repreparation with Gates Glidden burs and the test instruments the specimens were cleared. The area of remaining filling material on the root canal wall was measured from buccolingual and mesiodistal directions using a microscope and a computer image analysis program. Statistical analysis was performed using the Kruskal-Wallis test and a closed test procedure.
Results RaCe instruments revealed the least residual filling material. They removed significantly more gutta-percha and sealer than FlexMaster files ($P < 0.05$). No significant difference was found among the Hedström, the ProTaper and the FlexMaster groups ($P > 0.05$). The shortest time for removal of gutta-percha was observed with Hedström files ($P < 0.05$). There were five fractured instruments in the ProTaper group, three in the FlexMaster group and none in the other groups.
Conclusions The RaCe rotary system was efficient and safe but time-consuming for gutta-percha removal in curved root canals. During retreatment the risk of instrument fractures of ProTaper and FlexMaster instruments was higher than that of RaCe and Hedström files.
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RP3

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In vitro characterisation of the dentinogenic potential of Mineral Trioxide Aggregate

Aim To provide an explanation for the biological effects of Mineral Trioxide Aggregate in vital pulp therapy.
Methodology Mouse odontoblast-like cells (MDPC-23) were grown on 24 hr set Mineral Trioxide Aggregate (MTA) for 24 hours and examined by scanning electron microscopy (SEM) for biocompatibility. Samples of normal human dentine were extracted with EDTA (10%), calcium hydroxide (0.02 M) and the soluble products of MTA (1.72 g in 1000 ml of water). The resulting extracellular dentine matrix protein preparations (E-DMP's) were analysed using 1D-Polyacrylamide Gel Electrophoresis. A sandwich ELISA technique was employed to determine the concentration of TGF-b1 in each matrix preparation. MDPC-23 cells were exposed to concentrations of 1, 100, 1000 mg/mL of these matrix preparations for 24 h and analysed by reverse transcription – polymerase chain reaction (RT-PCR) to determine expression of TGF-b1.
Results MDPC-23 cells were observed to grow well on MTA over the 24 h culture period. MTA solubilised E-DMP's throughout the experimental period of 14 days whereas the action of calcium hydroxide was minimal after day 7. The protein profile identified by 1D PAGE analysis demonstrated a more diverse profile for E-DMP's solubilised with MTA. ELISA showed a higher concentration of TGF-b1 in E-DMP'S extracted with soluble products of MTA than calcium hydroxide. MTA solubilised E-DMPs caused significant up-regulation in gene expression for TGF-b1.
Conclusions MTA is capable of solubilising a heterogeneous profile of matrix components from human dentine over extended periods of time. The matrix components solubilised included the growth factor TGF-b1 and demonstrated bio-active properties on regulation of gene expression in odontoblast-like cells. The interactions of MTA

with the cells and matrix in the dentine-pulp complex may complement its biocompatible properties and contribute to its biological effects on dentine bridge formation and regeneration in these tissues.
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RP4

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Antibacterial effects of different root-end filling materials

Aim To evaluate the antibacterial activity of leachable components of amalgam, ProRoot MTA (Dentsply Maillefer, Switzerland), IRM (Caulk Dentsply, USA), Super Bond C&B (Sun Medical, Japan), Geristore (Den-Mat, USA), Dyract (Dentsply DeTrey, Germany) SE Bond (Kuraray, Japan) and Protect Bond (Kuraray) with Clearfil APX® (Kuraray) composite.

Methodology The direct contact test, with *E. faecalis*, *S. aureus*, and *P. aeruginosa*, was used. The walls of microtitre wells were coated with freshly mixed materials. The materials were tested immediately after application to the well (fresh samples) and after setting for 3 days (set samples). Ten μL bacterial suspensions were added to the wells for direct contact with the materials for 1 hour at 37°C. Growth of surviving bacteria was then measured in a microplate spectrophotometer hourly for 15 h at 620 nm. Automixing before each reading ensured homogenous bacterial cell suspensions. Twelve uncoated wells using identical size of inoculum for the three bacteria served as positive control. Inhibition of bacterial growth was recorded either as a delay in outgrowth in the second plate and/or a lower final number of bacteria.

Results Fresh samples of all materials showed a 3-h delay in exponential growth of both *E. faecalis* and *S. aureus*, and a 5-hr delay in growth of *P. aeruginosa*. Set samples of IRM and ProRoot cements showed generally greater antibacterial activity than the other materials: both completely inhibited *P. aeruginosa*, and both delayed and limited growth of *E. faecalis*. IRM was active also against *S. aureus*, whereas ProRoot had little if any activity towards this organism.

Conclusions The direct contact test, by being quantitative and virtually independent of solubility and diffusion, was found more suitable to assay solid root-end filling materials. IRM and ProRoot MTA were generally more potent inhibitors of bacterial growth than the other materials.

Research Posters – Microbiology

R1

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Detection of bacteraemia associated with intra-canal and extra-canal file manipulation

Aim To determine the prevalence and intensity of bacteraemia associated with intra- and extra-canal manipulation of instruments in asymptomatic teeth associated with periapical disease. The study was designed to account for confounding factors that may also potentially result in bacteraemia.

Methodology Blood and root canal samples were taken from 9 patients meeting strict selection criteria. The consented patients had a single asymptomatic tooth with apical periodontitis but were otherwise orally and generally healthy. Microbiological samples were taken from the root canals under aseptic conditions prior to root canal preparation using validated protocols. The first blood sample (baseline) was taken prior to any intra-canal filing. The root canals were then prepared to an apical size 20, maintaining the files within the terminus of the root canal system, determined by electronic and radiographic means. The second blood sample was taken 30 s following completion of this apical preparation. A size 15 instrument was then used as a patency file, 1 mm beyond the terminus of the root canal system. The third blood sample was taken 30 s after this. A period of 15 min was allowed to elapse between taking each blood sample. Blood samples were processed by lysis filtration and both blood and root canal samples were cultured under appropriate conditions. The prevalence and intensity of bacteraemia were determined.

Results Bacteria were isolated from all root canals sampled. Bacteraemias were not detected in the first (baseline) and second blood samples. Bacteraemias were detected in 5/9 (56%) of the third blood samples. The intensity of bacteraemia ranged from 1.0–5.0 CFU/6 ml.

Conclusions Only extra-canal manipulation of instruments caused bacteraemia, in just over half the cases, the intensity of which was low.

R2

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Culture-dependent and culture-independent detection of persistent bacteria retrieved by a novel apical sampling method

Aim To compare culture-dependent and culture-independent techniques to detect persistent root canal bacteria following chemo-mechanical debridement, retrieved by a novel apical sampling protocol.

Methodology Nineteen single-rooted, previously untreated teeth with radiographic evidence of a periapical lesion were subjected to root canal treatment and sampling procedures over 2 visits. Samples were obtained before and after separate preparation of the coronal (2/3) and apical (3 mm) parts of the canal using a protocol developed *in vitro*, which allowed independent sampling of the two parts of the canal. The coronal preparation was completed using ProTaper® and the apical using hand, stainless-steel instruments; NaOCl (2.5% w/w) irrigation and $Ca(OH)_2$ dressing were used in all cases. A further apical sample was taken just prior to root filling. Appropriate sterility-control measures were incorporated. Culture-dependent and culture-independent techniques were used to detect the presence of bacteria in the samples. The frequency of detection of bacteria in the apical samples using these techniques was compared using the McNemar test.

Results Apical preparation using 2.5% sodium hypochlorite and subsequent dressing with calcium hydroxide both resulted in a

