Title: Do the sealer solvents used affect apically extruded debris in retreatment?

Author: Can Canaki B et al

Journal: JOE, Vol.41, No(9):1507

Reviewer: Alshammari Abdulaziz DDS

Purpose: Evaluate the extruded debris apically during retreatment of root canals filled with different sealers (AH Plus and Tubli-seal) and gutta-percha using 3 solvents (Resosolv, Endosolv E, and Guttasolv)

Material and Methods:

- Ninety extracted mature, mandibular central and lateral incisors with single root canal and a root canal curvature of <10° on periapical radiograph in buccal and proximal to insure no internal resorption.
- All teeth shortened to 20 mm from incisal edge access by high speed bur. WL 1mm short by 15K file with the tip of the file sawed at the apex.
- Prepared by Reciproc #25 .08 NiTi to WL.
- Irrigation: during the instrumentation - 5% NaOCl, final irrigation - 5ml 17% EDTA, 5ml 5% NaOCl and 10ml distilled water.
- 6 groups: group 1, 2 and 3 Canal filled with AH plus sealer and GP. Group 4, 5 and 6 canal filled with Tubli-seal sealer and GP using lateral condensation technique.
- Stored for 100% humidity and 37° C for 2 months.
- Group 1: Gates Glidden used for 3mm coronal part. Total .04 ML Resosolv solvent used .01Ml each 4mm removed and wait 2 minutes, Protaper universal retreatment was used
- Group 2 and 5 same procedure (Guttasolv) solvent
- Group 3 and 6 same procedure but no solvent
- Group 4 same procedure (Endosolve E) Solvent
- Washed with 1ML distilled water and stored in incubator at 68° C for 5days
- Weights calculated three times and mean value was taken.

Results: Guttasolv showed higher extruded debris than solvents specific to sealer. Resosolv+AH Plus and Endosolv E + Tubli seal reduced the extruded debris amount apically during the retreatment. Explained by softening the solving effect of the solvent on GP and sealer. NiTi Rotary instrument can penetrate with minimal resistance. Use of solvent every 4mm reduced the time for the retreatment.

<table>
<thead>
<tr>
<th>Group no.</th>
<th>Group name</th>
<th>Median (25%–75%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AH Plus + Resosolv</td>
<td>39.0 (34.75–48.50)</td>
</tr>
<tr>
<td>2</td>
<td>AH Plus + Guttasolv</td>
<td>115.0 (84.50–138.0)</td>
</tr>
<tr>
<td>3</td>
<td>AH Plus control</td>
<td>181.0 (154.50–109.25)</td>
</tr>
<tr>
<td>4</td>
<td>Tubli-Seal + Endosolv E</td>
<td>28.00 (23.50–44.25)</td>
</tr>
<tr>
<td>5</td>
<td>Tubli-Seal + Guttasolv</td>
<td>140.0 (116.25–164.00)</td>
</tr>
<tr>
<td>6</td>
<td>Tubli-Seal control</td>
<td>185.0 (145.50–203.25)</td>
</tr>
</tbody>
</table>

Conclusion: The amount of extruded debris and duration of retreatment were reduced by the use of the solvent specific to sealer.

LOE: 5
Title: Assessment of root perforation within simulated internal resorption cavities using cone-beam computed tomography

Author: Khojastepour L et al

Journal: JOE 41(9): 1520

Reviewer: Christina Lee DDS

Purpose: To evaluate the accuracy of cone-beam computed tomographic (CBCT) imaging in the detection of small perforations within simulated internal resorption cavities. Introduction: Internal resorption is an inflammatory process initiated within the pulp space with loss of dentin and possible invasion of the cementum. Sensitivity is accuracy of positive test results to determine whether a disease exists, true positives/(true positives + false negatives). Specificity is accuracy of negative test results for measuring absence of disease, true negatives/(true negatives + false positives). Positive Predictive Value (PPV) and Negative Predictive Value (NPV) are the proportions of positive and negative results that are true positive and true negative results, respectively.

Materials and Methods:

- 32 single root premolars extracted for periodontal reasons
- Split teeth in half mesiodistally and internal resorption cavities were created in each half at the middle third of the roots on buccal and lingual surfaces
- Perforations with 0.5mm diameter were created in half of the specimens
- Teeth halves were glued back together and placed in sheep mandibles
- CBCT scans obtained using NewTomVGI scanner (NewTomQR srl)
- Two examiners evaluated the scans

Results: High degree of intraexaminer and interexaminer agreement in the detection of perforations was seen. The sensitivity (correct diagnosis of root perforation) was 81.3%. Specificity was 84.4%, PPV was 83.9%, NPV was 81.8%

Conclusions: CBCT imaging is useful for detecting perforations in internal resorption defects.

LOE: 5
Title: Odontoblastic differentiation, inflammatory response, and angiogenic potential of 4 calcium silicate–based cements: Micromega MTA, ProRoot MTA, RetroMTA, and experimental calcium silicate cement

Authors: Chang S et al

Journal: JOE, Vol 41; No: 9; 1524-29

Reviewer: Hari P Chebrolu DMD

Purpose: Calcium silicate–based cements (CSCs), such as ProRoot mineral trioxide aggregate and Portland cement, are mainly composed of hydrophilic particles of dicalcium and tricalcium silicate and tricalcium aluminate. MTA powder is essentially a mixture of Portland cement and bismuth oxide and has been used successfully in dental applications for root perforation repair, 1-visit apexification, and pulp capping. However, MTA has some disadvantages, such as prolonged setting time, high cost, potential of discoloration, and poor handling. To reduce the setting time and extend its clinical use, new CSCs have been designed by adding different compounds. The aim of this study was to analyze the effects of different calcium silicate–based cements for pulp capping materials including MicroMega MTA (MMTA), RetroMTA(RMTA), ProRoot MTA(PMTA) and experimental CSC (ECSC) on odontoblastic differentiation, in vitro angiogenesis, and the inflammatory response in human dental pulp cells.

Materials & Methods:

- Under aseptic conditions, PMTA, RMTA, MMTA, and IRM were mixed with distilled water following the manufacturer’s instructions.
- Immortalized HDPCs transfected with human telomerase catalytic component were cultured in alpha-minimum essential medium supplemented with 10% fetal bovine serum, 100 U/mL penicillin, and 100 U/mL streptomycin in a humidified atmosphere of 5% CO² at 37°C.
- Differentiation was evaluated by alkaline phosphatase activity, alizarin red staining, and reverse-transcriptase polymerase chain reaction.
- The levels of inflammatory mediators and cytokines were measured by RT-PCR and an enzyme-linked immunosorbent assay. In vitro angiogenesis was assessed by RT-PCR for angiogenic genes and an endothelial tube formation assay.

Results: The most intense ALP activity and bio-mineralization were exhibited by the PMTA, MMTA, and ECSC groups at 7 and 14 days. All CSC materials were shown to up-regulate the messenger RNA (mRNA) expression of odontogenic markers at 14 days. PMTA, MMTA, and ECSC induced a significant increase in the expression of angiogenic genes and capillary tube formation compared with RMTA. Messenger RNA expression levels of pro-inflammatory cytokines tumor necrosis factor alpha, interleukin (IL)-1β, IL-6, and IL-8 were similar among the CSCs.

Conclusion: Results suggest that PMTA, MMTA, and ECSC can be useful for dental pulp capping. The differentiation and angiogenesis of progenitor cells into odontoblast like cells are critical in the pulp healing process and inducing differentiation and angiogenesis is required characteristics of pulp capping materials.

LOE: 5
Title: The effect of isthmus on vertical root fracture in endodontically treated teeth

Authors: Chai H et al

Journal: JOE Vol. 41 (9); 1515-1519

Reviewer: Jeffrey Yui DDS

Purpose: To explore vertical root fracture (VRF) in 2-canal roots and to study the distribution of interior damage in mandibular molar teeth extracted because of VRF.

Materials and Methods:

- 25 mandibular molar teeth having 2 roots (1 distal canal and mesial with 2 canals) were extracted
- 18 of these teeth exhibited a visible fracture extending over a part or the entire root axis
- Roots were cut in horizontal cross sections and analyzed with a 2-dimensional fracture mechanics model
- Theoretical fracture mechanics model:
  - A small, theoretical initial crack was placed along the long axis of the canal section and the surface of 1 or both the canals was subjected to a uniform pressure
  - VRF was taken to occur when the crack reached the external root wall; the apical load needed to cause VRF was then evaluated

Results: Damage is conclusively limited to the 2-canal roots, attesting to the prime role of the isthmus is causing root failure. The isthmus is a loosely connected material that can be considered a planar crack. According to the fracture mechanics model, the presence of an isthmus dramatically reduces the VRF force. Force needed to cause VRF is 50 N with no isthmus to 10 N with isthmus present

Conclusion: Two-canal mesial roots are much more prone to VRF than 1-canal distal roots. VRF may occur during clinical condensation of gutta-percha in mesial roots of mandibular molars as well as other roots with canals connected by isthmus

LOE: 5
Purpose: External inflammatory root resorption (EIRR) is usually the result of trauma with sufficient magnitude to involve the pulp and periodontal issue, causing pulp necrosis and subsequent bacterial contamination. Bacterial metabolites cause inflammatory osteoclastic differentiation, bone resorption and progressive external root resorption. The current treatment protocol comprises multiple and long-term Ca(OH)₂ applications. This study evaluated the revascularization therapy protocol for EIRR treatment.

Clinical procedures:

- First visit: The tooth was isolated and accessed. WL was determined. The tooth was irrigated with 20 ml 5.25% NaOCl, accompanied by 10 ml sterile saline. The canal was filled with triantibiotic paste (metronidazole, ciprofloxacin and minocycline). Access then sealed with Fuji IX.
- Second visit (30 days): The tooth was isolated and reaccessed. Blood clot was induced by using a K-file 2mm beyond the apex. After the formation of a blood clot 3mm apical of the CEJ, MTA (mineral trioxide aggregate) was placed and final restored with composite resin.
- The cases were followed up every 3 months with dental history and clinical and radiographic examination.

Initial clinical presentations and results of patients:

Case I: 9 y/o boy, maxillary incisors presented uncomplicated crown fracture. Time lapse between trauma and treatment: 12 months.

<table>
<thead>
<tr>
<th>Vitality</th>
<th>Percussion/Palpation</th>
<th>Mobility</th>
<th>Radiographic</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>#8</td>
<td>NR</td>
<td>N</td>
<td>II</td>
<td>EIRR (advanced stage) Pulp necrosis w/ chronic apical abscess</td>
</tr>
<tr>
<td>#9</td>
<td>NR</td>
<td>N</td>
<td>EIRR</td>
<td>pulp necrosis w/ asymptomatic apical periodontitis</td>
</tr>
</tbody>
</table>

Follow up time: 30 months

Case II: 9 y/o boy, #9 avulsion with replantation 4 hrs after trauma (dry storage), splint for 21 days. time lapse: 3 months

<table>
<thead>
<tr>
<th>Vitality</th>
<th>Percussion/Palpation</th>
<th>Mobility</th>
<th>Radiographic</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>#9</td>
<td>percussion: A</td>
<td>EIRR</td>
<td>EIRR (advanced); apical radiolucency</td>
<td>Pulp necrosis w/ symptomatic apical periodontitis</td>
</tr>
</tbody>
</table>

Follow up time: 18 months

Case III: 8 y/o boy, #8, 9 avulsion with replantation 2hrs after trauma (milk storage), splint for 30 days. time lapse: 1 month

<table>
<thead>
<tr>
<th>Vitality</th>
<th>Percussion/Palpation</th>
<th>Mobility</th>
<th>Radiographic</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>#8,9</td>
<td>NR</td>
<td>N</td>
<td>EIRR</td>
<td>Pulp necrosis w/ asymptomatic apical periodontitis</td>
</tr>
</tbody>
</table>

Follow up time: 15 months

Result: All teeth remained asymptomatic, and normal dental function with physiologic mobility. Radiographic arrest of the EIRR and resolution of the radiolucency areas and the root resorptive defect showed hard tissue ingrowth after 3 months. All teeth also presented different stages of crown discoloration.

Conclusion: Revascularization procedure was efficient in the treatment of external inflammatory root resorption, reducing the number of appointments and increasing patient compliance.

LOE: 5
Title: Histologic analysis of the influence of a gelatin-based scaffold in the repair of immature dog teeth subjected to regenerative endodontic treatment

Author: Londero et al

Journal: JOE 41(10): 1619

Reviewer: Christina Lee DDS

Purpose: To assess tissue repair in immature dog teeth with necrotic pulps and apical periodontitis subjected to regenerative endodontic treatment with the use of a gelatin-based scaffold (Gelfoam). Gelfoam is a gelatin-based sponge used for hemostasis by forming a blood clot and it is absorbable.

Materials and Methods:

- Premolars with open apices of 3 beagle dogs = 20 teeth + 10 teeth left untouched as negative control group
- Accessed, removed pulp tissue, teeth left open to create apical periodontitis
- Canals reentered, irrigated with 2.5% sodium hypochlorite, dried with paper points and filled with triple antibiotic paste (ciprofloxacin, metronidazole, and minocycline) and temporized with cotton pellet and IRM
- After 2 weeks temps were removed, canals irrigated with 2.5% NaOCl, sterile saline, then 17% EDTA, dried with paper points then filled
- 2 groups: blood clot alone and blood clot with Gelfoam
- MTA placed and teeth restored with amalgam
- After 7 months, dogs killed, roots sectioned and stained for analysis with light microscopy for apical extension of the root, presence of vital tissue, newly formed mineralized tissue, and inflammatory reaction

Results: Control group specimens all showed normal physiological root development. Four experimental teeth were lost – 3 of blood clot alone group, 1 of blood clot + Gelfoam. No difference was seen between the two groups regarding apical extension of roots or inflammatory reaction was seen. One hundred percent of blood clot + Gelfoam specimens had vital tissue in the root canal space compared to 71.4% of blood clot alone. None of the specimens from either group showed pulp or dentin tissues but both groups had newly formed mineralized tissue on the dentinal walls which was cementum-like and in the root canal space which was bone-like

Conclusions: The use of Gelfoam and a blood clot as a scaffold had statistically significant effects on the formation of cementum-like mineralized tissue and new vital tissue when compared with blood clot alone.

LOE: 5
Title: Infection control in retreatment cases: *in vivo* antibacterial effects of 2 instrumentation systems

Author: Rodrigues, R. et al.

Journal: JOE, Volume 41, Number 10, pages 1600-1605

Reviewer: Salome Masrani DDS

Purpose: The success of endodontic treatment is dependent on the elimination of bacteria. With persistence of bacteria at the time of obturation, the treatment outcome is compromised. The decrease in success between retreatment cases and initial treatment may be due to difficulty in disinfecting previously treated canals. New instruments have been developed for more efficient chemomechanical disinfection. The Self-Adjusting File (SAF) (ReDent-Nova, Ra’anana, Israel) is a hollow, cylindrical file that has the flexibility to adapt to the shape of the canal to enlarge the canal without changing it. The hollow core allows for constant irrigation. The Twisted File Adaptive System (TFA) (SybronEndo, Orange, CA) is a NiTi Rotary system with rotating and reciprocating motions. For improved disinfection, passive ultrasonic irrigation has been developed through which irrigants are ultrasonically activated after root canal preparation.

Through the use of qPCR, this study evaluated the effectiveness of SAF system and TFA system prior to and after the use of PUI on total bacteria count, *Streptococcus* species, and *Enterococcus faecalis*.

Materials and Methods:

- 48 patients, ages 12-72 years with post-treatment apical periodontitis in single rooted, single canal teeth, being seen at the Endodontic Clinic of Estácio de Sá University, Rio de Janeiro, RJ, Brazil. Radiographically, periapical lesion present, treatment performed at least 2 years prior, acceptable coronal restorations
- Samples from root canals were acquired using aseptic techniques after access using paper points and after removal of gutta percha with DR1 (size 30/0.10, at 1000rpm) and DR2 (size 25/0.04, at 600 rpm) instruments (D-Race System)
  - Patients rinsed with 0.12% CHX, isolated tooth with rubber dam and cleaned with 3% Hydrogen Peroxide and 2.5% NaOCl; sterile instruments and saline used during procedure
  - Using qPCR with 16S ribosomal RNA bacterial primers, compared sterility control samples, negative for bacteria, with initial sample (S1), positive for bacteria, resulting in exclusion of 5 teeth
- SAF Group: 21 teeth; root canal preparations completed with use of SAF 2mm instrument for 4 minutes under continuous irrigation with 2.5% NaOCl at a rate of 5L/min; apex hand instrumented with 50/0.02 NiTi file. Total irrigation with NaOCl was 31ml and 1ml 17% EDTA. Post instrument sample taken (S2)
- TFA Group: 22 teeth; ML kit used to WL (25/0.08, 35/0.06, and 50/0.04); irrigated with 23ml 2.5% NaOCl and 1ml 17% EDTA and sample taken (S2)
  - PUI used with 3ml of 2.5% NaOCl for 1 minute with ultrasonic device by GVDentus to WL
  - Canal rinsed with additional 2.5% NaOCl prior to sampling (S2b) totaling 31ml of irrigation with 2.5% NaOCl
- DNA extracted from samples using QIAamp DNA Mini Kit, and 16S ribosomal RNA gene-targeted qPCR used to quantify *E. faecalis* and *Streptococcus* species
- Statistical analysis performed

Results: Total bacterial counts in S1 samples compared to S2 samples showed reduction of 83.7% in SAF Group and 94.8% in TAF and additionally to 96.9% with PUI. The differences between groups were not statistically significant. *Streptococci* in SAF group were present in 17/21 of S1 samples (mean of 8.50 X 10⁴ cell equivalents) and in S2 samples reduced 9/21 (mean of 1.06 X10³). In TFA group present in 19/22 S1 samples (mean 9.08 X 10⁴) and reduced to 6/22 S2 samples (mean 6.83 X10³). After PUI, remained in 6/22 cases (mean 6.57 X10¹). *E. faecalis* in SAF group present in 5/21 S1 samples (mean 4.47 X10³) and after instrumentation 100% reduction, therefore, not detected after PUI.

Conclusion: Use of both, SFA and TFA systems, resulted in significant reduction of bacterial load in root canal. No significant difference found between the two systems. This may, in part be due to difference in length of time of NaOCl exposure with single vs. multiple instrument systems. Benefits of SAF system would be more evident in cases with curved and irregular canals. Additionally, use of PUI did reduce bacterial count, but was not statistically significant on disinfection of a single canal. Bacteria still persisted in 48% of SAF group and 32% TFA groups, therefore, disinfection methods need to be further improved.

LOE: 4
Title: Influence of endodontics treatment and coronal restoration on status of periapical tissue: A cone-beam computed tomographic study

Author: Gomes A et al.

Journal: JOE, Vol 41, Number 10; 1614-1618

Reviewer: Salar Sanjari DDS

Purpose: Previous cross sectional studies using 2D radiographs have reported presence of periapical radiolucency (PRL) in about 40% of endodontically treated teeth (in contrast with the 90-95% success rate of root canal treatment). These studies report a significant correlation between the quality of RCT and presence of coronal restoration; and the outcome of RCT. Moreover no study has previously reported on use of CBCT to correlate the success of RCT with the quality of RCT, presence of a post and coronal restoration.

Materials and Methods:

- Cross-sectional prospective study
- Involving 434 patients who have had CBCT taken as part of their treatment
- Total of 1290 teeth include
- A dental radiologist and an endodontist were calibrated and reviewed 100 CBCT slides at random at a time.
- PRL =>.5mm included
- Reviewers evaluated each slide simultaneously
  - Adequate RCT: Filled 0-2mm from apex, No voids
  - Inadequate: Overfilled, >2mm short of the apex, presence of voids, inadequate density, unfilled canal
- Coronal restoration and presence of post also noted

Results: The quality of Endo was found adequate in only 55.1 % of the cases. Only 48.83% of treated teeth were classified as healthy. Presence or absence of coronal restoration was significantly associated with presence or absence of apical radiolucency. Presence or absence of post revealed no statistical difference. Adequate endo and presence of corona restoration showed significant apical status. Canals filled 0-2mm short of the apex showed significantly higher rate of health compared to overfilled or under-filled canals.

Conclusion: Study proposed higher rate of PRL compared to previous studies. Quality of Endo treatment, presence of coronal restoration and apical extent of apical fill are significant determinants of presence or absence of pathology.

LOE: 4
Title: Diagnostic accuracy of quantitative sensory testing to discriminate inflammatory toothache and intraoral neuropathic pain

Author: Porporatti A et al

Journal: JOE- Vol. 41, Number 10; 1606-1613

Reviewer: Aaron Salimnia DDS

Purpose: Evaluation of the somatosensory function of subjects with IT (Inflammatory Toothache), AO (Atypical Odontalgia) and healthy volunteers. To see how accurately QST (quantitative sensory testing) differentiates tooth pain as IT or AO and to assess whether QST (quantitative sensory testing) can assist Endodontist in differentiating the conditions.

Materials and Methods:

- Used Pubmed, MDlinx and ResearchGate
- IT consisted of 20 subjects with acute pulpitis
- AO consisted of 20 subjects that were diagnosed with persistent pain localized in the dentoalveolar area which was present for 8 hours a day for more than 15 days per month for at least 3 months
- CBCT was used when in doubt regarding the diagnosis
- Quantitative sensory testing consisted of 4 methods
  - Mechanical detection threshold
  - Pain Detection Threshold
  - Dynamical Mechanical Allodynia
  - Temporal Summation
- Pain intensity was recorded using VAS (Visual Analogue Scale)
- Analysis was performed using Statistica for Windows computer
- One-way analysis was performed for QST statistical analysis
- Tukey post hoc analyses was used to determine significant differences between groups

Results: AO had a lower threshold to touch and pain compared to IT. A specific feature of AO is mechanical allodynia. Touch threshold more than 1 g/mm² and pain threshold forces more than 10 g/mm² was a characteristic of AO. Mechanical detection threshold, pain detection threshold and dynamical mechanical allodynia are accurate QST methods for differentiating IT and AO.

Conclusion: Somatosensory abnormalities are common in AO subjects. There were no somatosensory abnormalities in IT subjects. QST is a successful method in the differential diagnosis between AO and IT.

LOE: 4
Title: Ultrasonically activated irrigation to remove calcium hydroxide from apical third of human root canal system: A systematic review of in vitro studies

Author: Yaylali, I et al.

Reviewer: Xiomara Y. Rivera DMD

Journal: Journal of Endodontics, Volume 41, Number 10; 1589-1599

Purpose: To review the effectiveness of ultrasonically activated irrigation and other irrigation techniques for the removal of Ca(OH)$_2$ from the apical third of the root canal system.

Materials and Methods:

- Literature search using PubMed, Embase, TRIP databases
- Inclusion Criteria: in vitro studies on fully formed human teeth, studies evaluating the cleaning efficacy of an irrigation device/method, studies comparing ultrasonically activated irrigation with another irrigation technique, and studies assessing the removal of Ca(OH)$_2$ placed as an intracanal medicament at the apical third.
- Exclusion Criteria: studies that involved the use of scanning electron microscope
- Variable evaluated included: type of teeth, type of intervention, type, placement and verification of Ca(OH)$_2$, irrigation method, evaluation methods, and main findings
- Descriptive analysis was done

Results: Of 212 abstracts evaluated, 9 articles fulfilled the inclusion criteria. Ultrasonically activated irrigation was found to be superior to syringe irrigation (7 Studies) and Apical Negative Pressure (ANP) Irrigation (2 Studies). No evidence found for the superiority between any of these irrigations:

- Ultrasonically Activated Vs. Sonically Activated Irrigation- 4 Studies
- Ultrasonically Activated Irrigation Vs. Self-Adjusting File (SAF)- 2 Studies
- Ultrasonically Activated Irrigation Vs. RinseEndo- 2 Studies
- Ultrasonically Activated Irrigation Vs. Other Irrigations (Ex. Endodontic Brush, Rotary files, and hand files)

Conclusion: This study was able to confirm the superiority of ultrasonically activated irrigation over syringe and ANP irrigation. However, high methodological quality studies on the outcome of ultrasonically activated irrigation and other irrigation devices for the removal of Ca(OH)$_2$ are needed. Further research is required to produce definitive results.

LOE: 2
Title: Osteonecrosis of the jaws in patients with a history of receiving bisphosphonate therapy

Author: Melo M


Reviewer: Aaron Salimnia DDS

Purpose: Bisphosphonates are inhibitors of osteoclasts and have been used in the treatment of resorptive bone diseases. Bisphosphonates are beneficial for treatment of metastatic bone disease but play a possible role in the development of osteonecrosis of the jaws. This study describes how osteonecrosis of the jaw develops in patients who had taken bisphosphonates and have not received radiation therapy.

Materials and Methods:

- Study included 11 patients with osteonecrosis of the jaw and history of bisphosphonate therapy
- Duration of bisphosphonate therapy was 34 months
- 4 of the 11 patients received pamidronate
- 4 of the 11 patients received zoledronic acid
- 3 of the 11 initially taken pamidronate and switched to zoledronic acid
- Primary oncologic diagnoses were multiple myeloma in 7 of the patients, breast cancer in 3 patients and lung cancer in 1 patient
- 8 patients had mandibular lesions
- 2 patients had maxillary lesions
- 1 patient had bilateral lesions in both the maxilla and mandible
- Lesions demonstrated bony exposures and inflammation of the soft tissues

Results: Panoramic radiograph showed loss of bone extending beyond the IANB in the mandible which was very common. Patients experienced paresthesia along the distribution of the trigeminal nerve. The entire specimen on microscopic examination had necrotic bone with debris and granulation tissue without evidence of metastatic disease.

Conclusion: Osteonecrosis observed in patients with bisphosphonate therapy.

LOE: 4
Title: Histologic outcomes of uninfected human immature teeth treated with regenerative endodontics: 2 case reports

Author: Nosrat et al


Reviewer: Michelle Jordán DMD

Purpose: Apexification using MTA apical plug has been shown to produce successful outcomes, the main shortcoming of this procedure is that it doesn’t promote continuation of root development and these remain susceptible to coronal root fracture. An ideal treatment for these teeth is pulp regeneration. The benefit of regeneration is not only revitalization but also continued root development. To examine clinically and histologically the outcome of 2 non-infected human teeth treated with regenerative endodontics.

Materials and Methods:

- Two bicuspid fully erupted immature maxillary first premolar teeth from 2 patients aged 9 and 10 years old were studied.
- Local anesthesia 3% carbocaine without epinephrine was used. RD isolation, access cavity and WL were established 1mm short of the open apex. Canals were instrumented, in the 9 year old pt were taken to size 90 master file. In 10 year old to a size 60 master file.
- Irrigation with 1.25% NaOCl and 17% EDTA done 1 mm short WL. Bleeding was induced by overextension of file #30 2 to 3 mm beyond WL. Blood clot was allow to form for 10 min
- MTA was placed over blood clot and access was filled with composite.
- Followed by teeth were schedule for extraction 4 months after treatment and they were embedded in paraffin and stained with hematoxylin-eosin.

Results:

<table>
<thead>
<tr>
<th>9 year old</th>
<th>10 year old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roots showed well developed dentin layer surrounded by PDL</td>
<td>Well-developed dentin surrounded by PDL</td>
</tr>
<tr>
<td>A thick layer of hard tissue was observed beneath MTA</td>
<td>Dentin layer in this tooth was much ticker</td>
</tr>
<tr>
<td>No inflammatory cells were found</td>
<td>MTA was also observed but the hard tissue close to MTA was not as thick as in the other specimen</td>
</tr>
<tr>
<td>Tissues within the roots displayed features mimicking odontogenic fibroma-PDL-type histology</td>
<td>Tissues within the roots displayed features of periodontum structure</td>
</tr>
<tr>
<td></td>
<td>No inflammatory cells were observed</td>
</tr>
</tbody>
</table>

Conclusion: Based on histological features the tissue that regenerates in the canal is not a true pulp tissue instead it resembles periodontal tissue. Stem cells in blood clot might not differentiate into odontoblasts.

LOE: 5
Title: Accuracy of cone-beam computed tomography in the detection of a second mesiobuccal root canal in endodontically treated teeth: An ex vivo study.

Authors: Mirmohammadi H et al

Journal: JOE, Volume 41, Number 10: 1678-81

Reviewer: Hari P Chebrolu DMD

Purpose: Cone-beam computed tomographic (CBCT) imaging has been introduced in clinical dentistry as a diagnostic imaging method and has been widely applied in several dental fields. The applications of CBCT imaging in endodontics have been previously reported in the literature. These include detection and follow-up of periapical lesions, diagnosis of vertical root fractures, assessment of the proximity of the root canal to adjacent anatomic structures including the maxillary sinus and the inferior dental canal, detection of traumatic injuries, and pre-surgical assessments. Moreover, the added advantage of the third dimension in assessing the complex anatomy of the root canal has been emphasized. The aim of this study was to assess the accuracy of CBCT imaging in detecting an MB2 canal in endodontically treated maxillary molars using mCT measurements as the reference gold standard.

Materials Methods:

- Sixty extracted maxillary molars were included in this study.
- The inclusion criteria were complete intactness of all roots and crowns, normal root numbers (3 roots) with no severe curve, no visible signs of external root resorption, no root filling, no root caries, and/or restorations.
- The teeth were endodontically opened and examined under a dental operating microscope for the presence of an MB2.
- The teeth were then further examined using micro–computed tomographic imaging as the gold standard.
- Root canals were filled (except the MB2) and were then subdivided into an experimental and a control group.
- Teeth were then fixed in a dry human skull and scanned using CBCT.

Results: Two observers (maxillofacial radiologists) with more than 5 years of experience in interpreting CBCT data sets assessed the visibility of the MB2 canal independently. Twenty percent of MB2 canals were missed under DOM evaluation (6/30 teeth).

Discussion Conclusion: Endodontic treatment of maxillary molars remains challenging because of complex root canal anatomy, which requires an integrated and holistic diagnostic approach to achieve correct and adequate treatment. CBCT imaging has the unique ability to provide high-resolution images in multiple planes of space while eliminating superimposition of surrounding structures. However, the presence of root canal filling materials and metallic posts has been suggested as a limiting factor for CBCT image quality, resulting in several streak and beam hardening artifacts, which could negatively influence the detectability of an MB2 canal. A variety of factors including contrast-to-noise ratio, detector specification, FOV, and scan setting selections and image artifacts play an equally important role in determining the visibility and contrast appearance of small anatomic structures such as the pulp chamber and root canal. These findings show the need to develop standardized scanning and image reconstruction protocols for endodontic applications.

LOE: 5
Title: Qualitative time-of-flight secondary ion mass spectrometry analysis of root dentin irrigated with sodium hypochlorite, EDTA, or Chlorhexidine

Author: Kolosowski et al


Reviewer: Michelle Jordán DMD

Purpose: Time-of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS) combines the advantages of scanning electron microscopy in providing high-resolution images of the test surface, and mass spectroscopy in providing highly sensitive profiles of chemical constituents. Analysis can be used to identify inorganic, organic proteins and other compounds. To use TOF-SIMS to qualitatively evaluate the surface of untreated root dentin and compare it with root dentin treated with NaOCl, EDTA or CHX.

Materials and Methods:

- A noncarious human upper molar was sectioned at the midroot level to obtain a 2mm thick horizontal slice
- The slice was further sectioned to create four dentin blocks, which were then embedded in epoxy resin.
- Followed by blocks were placed in a microtome and sectioned to expose root canal aspect of the dentin
- Irrigation of Samples: Sample A -No irrigation treatment was used (NT), Sample B -Dentin was immersed in 5mL 2.5% NaOCl (Lavo Inc, Montreal, Quebec, Canada) for 3 min, Sample C -Dentin was immersed in 5mL 17% EDTA (Vista Dental Products, Racine, WI) for 1 min, Sample D -Dentin was immersed in 5mL 2% CHX (Chlorhexidine Digluconate BP; Medisca, Montreal, Quebec, Canada) for 1 min
- Dentin surface analysis with different irrigants was performed by TOF-SIMS

Results:

- Sample A: Revealed intense peaks characteristics of hydroxyapatite in addition to Na⁺, K⁺, CH₃N⁺, Mg⁺, CN⁻, F⁻, CNO⁻, HCO₃⁻. DTs (dental tubules) that were rather obstructed were observed on the dentin surface.
- Sample B: Showed severely decreased CH₃N⁺, and increased intensity of Cl⁻. DTs were clearly visualized.
- Sample C: Lacked Ca⁺ and Mg⁺ and showed a decreased in PO₄²⁻, PO₃⁻. Surfaces with some patent DT.
- Sample D: An intense signal originating from CHX was evenly distributed on the dentin surface. Exhibited multiple patent DTs.

Conclusion: This study shows a difference in the chemical characteristics of surface dentin after treatment with different root canal irrigants. After treatment with NaOCl signal from CH₃N⁺ almost disappeared indicating that degradation of proteins occurred. EDTA removes Ca⁺ and Mg⁺ from dentin. CHX treatment leaves behind a layer of CHX on dentin surface.

LOE: 5
Histologic assessment of quick-set and mineral trioxide aggregate pulpotomies in a canine model

Authors: Woodmansey K et. al

Journal: JOE Vol. 41 (10); 1626-1629

Reviewer: Jeffrey Yui DDS

Purpose: Mineral trioxide aggregate is a popular material for vital pulp therapy including procedures like pulpotomies. Despite its usefulness, some drawbacks include long setting time, difficulty of handling, wash out, and staining. Quick-Set is a calcium aluminosilicate cement designed to maintain the positive qualities of MTA while improving on its shortcomings. This study compared the histologic response of pulpal tissues in dogs when exposed to Quick-Set (QS) or Proroot White MTA (WMTA) after pulpotomy.

Materials and Methods:

- 42 maxillary premolar teeth were treated in 7 beagle dogs
- Teeth were isolated with a dental dam and pulpotomies were performed
- Pulp chambers were irrigated with 6% NaOCl; experimental material (QS or WMTA) placed over pulp tissues
- Access cavities restored with Ketac glass ionomer
- Animals sacrificed 70 days postprocedure and histologic sections of teeth and surrounding tissues were evaluated using light microscopy
- Sections of the pulpotomy areas were scored for inflammation, pulp tissue organization, reactionary dentin formation, and quality of dentinogenesis

Results: No periapical alterations observed radiographically at 70 days after pulpotomy with either QS or WMTA. The Quick-Set group exhibited significantly more pulpal inflammation and significantly less pulp tissue organization. No significant difference found for reactionary dentin formation and quality of dentinogenesis.

Conclusion: Quick-set exhibited more pulpal inflammation and decreased pulp tissue organization. Differences in pulpal inflammation may be related to differences between pulpotomy materials. The pH of QS is lower (pH 10) than WMTA (pH 12). Fewer available hydroxyl and calcium ions could slow precipitation of hydroxyapatite and overall healing. QS has a puttylike consistency whereas MTA has consistency similar to wet sand. Aluminum oxide in hydraulic phase of QS could also be related to inflammation.

LOE: 4
Title: Micro-computed tomographic evaluation of hard tissue debris removal after different irrigation methods and its influence on the filling of curved canals

Author: Freire L et al

Journal: JOE, Vol.41, No10; 1660

Reviewer: Alshammari Abdulaziz DDS

Purpose: The aim of the study to use the micro-CT scanner to evaluate and quantify the presence of dentinal debris in the mesial canals of Mandibular molars after cleaning and shaping and compare the effectiveness of Passive ultrasonic irrigation (PUI) and Endovac (EV) system in the removal of the debris.

Material and Methods:

- Total of 24 first and second Mandibular molar with intact pulp chamber and mesial root fully formed apex. Size of teeth standardized 17 mm.
- Micro-CT scanner for teeth before and after instrumentation, after final irrigation and after obturation. Teeth embedded in high precision impression material access face down. Root covered with 2 layers of nail varnish embedded in PVS to act as PDL. A glide path made using #15 K file using Reciproc R25 instrument. Total of 8ml 1% (NaOCl) used for the irrigation of the shaping. Final irrigation 5ml 1% NaOCl followed 5ml 17% EDTA then 5ml 1% NaOCl. Divided into two groups:
  - PUI (N=12) each canal irrigated 2ml 1% NaOCl followed with activation for 30 sec #20 ultrasonic tip. Repeated twice with 2ml 17% EDTA then 2ml 1% NaOCl
  - EV (N=12) 3 cycle were implemented with microcanaula. 1 cycle microcanaula 1mm from WL for 6 Sec with 2ml 1% NaOCl. Two cycles then withdraw 2mm from WL for 6 Sec with 2ml 17% EDTA .3cycle 2mm from WL 6 Sec with 2ml 1% NaOCl.
- Canals aspirated with capillary Tip suction and dried with Reciproc R25 paper point. Condensation silicone was removed.
- Obturation with Reciproc R25 GP and AH plus sealer clean pulp chamber with cotton pellet soaked 70% alcohol, Temp filling and stored 37° C under 100% humidity for 72 H.

Results: No difference between groups in the initial volume of the root canal system. Instrumentation produced 3.40% of debris. The use of PUI irrigant showed a 55.55% decrease in debris volume while EV system showed a 53.65% decrease in the debris volume. No difference was observed in the percentage of volume of filling material and voids after the final rinse when comparing with PUI and EV groups.

Conclusion: Micro–CT enable the identification and quantification of debris in mesial canal. PUI and EV showed same effectiveness in the removal of debris. The irrigation technique did not affect the filling quality in both groups.

LOE: 5
Title: Comparison of the resistance of teeth instrumented with different nickel-titanium systems to vertical root fracture: An in vitro study

Authors: Çiçek, E et al.

Journal: JOE Volume 41, Number 10; 1682-1685.

Reviewer: Salome Masrani DDS

Purpose: As a result of mechanical instrumentation, microcracks can develop in the apical area leading to eventual vertical root fractures in root canal treated teeth. Approximately 10.9-31% of root canal treated teeth are extracted because of vertical root fracture associated with treatment (Fuss, et al, 1999). Increased risk of VRF can be attributed to loss of dentin, dehydration of dentin, and negative effects of irrigation. There are several Nickel-Titanium file systems that differ in production phases, alloys, cutting edges, and working motion. This study compares the resistance of teeth instrumented with 6 different NiTi Systems to VRF

Materials and Methods:

- 72 mandibular first premolar teeth extracted for orthodontic reasons from patients between 17-24 years. Teeth had straight canals, mature apices, and of similar size. Analyzed with stereomicroscope for presence of craze lines, and if present, were replaced
- Crowns were sectioned from teeth and pulp tissue was extirpated
- Roots were fixed in acrylic in Eppendorf tubes surrounded by a thin layer of silicone impression material to simulate periodontal ligament space
- Groups
  - Group 1: ProTaper Universal (PTU; Dentsply): SX file to ½ WL; S1 and S2 files to ⅔ WL with brushing motion, F1 (20/.07), F2 (25/.08), F3 (30/.06), F4 (40/.06) to WL with in and out motion, irrigation with distilled water after every other file
  - Group 2: ProTaper Next (PTN; Dentsply): SX file to ½ WL, X1 (17/.04), X2 (25/.06), X3 (30/.06), X4 (40/.06) to WL with in and out motion
  - Group 3: Wave One (WO; Dentsply): Reciprocating file (40/.08) with in and out pecking motion, irrigation after every 3 pecks
  - Group 5: Mtwo (MT; VDW): 10/.04, 15/.04, 20/.06, 25/.06, 30/.06, 35/.06, 40/.06, irrigation between every file
  - Control: 12 roots that were not shaped or obturated
- Experimental teeth were obturated with respective gutta percha cones for single cone technique with AS-26 sealer (Dentsply)
- Temporary restorations placed and teeth were maintained in moist environment for 2 weeks
- Used Universal Testing Machine to apply force (crosshead speed: 1mm/min) until roots fractured
- Statistical Analysis performed

Results: Group 2 was the most resistant to fracture at 334.0308 N. Group 5 was the least resistant to fracture at 242.8883 N. VRFs occurred in the buccolingual direction. PTU, WO, TF, RS were not statistically different from each other. Control teeth were measured at 217.1681 N.

Conclusion: Previous studies have correlated increased dentinal damage with factors such as taper of the files, and the occurrence of taper lock. Others have found the instrumentation motion to be significant and use of reciprocating motions to reduce strain. MT files have two cutting edges that result in more aggressive cutting, while the PTN system utilizes M wire technology to alter the taper of the files at different points and has rectangular cross section with two points of contact.

LOE: 5
Title: Shear bond strength of a self-adhering flowable composite and a flowable base composite to mineral trioxide aggregate, calcium-enriched mixture cement, and biodentine.

Author: Altunsoy M et al.

Journal: JOE, Vol. 41, Number 10; 1691-695

Reviewer: Salar Sanjari DDS

Purpose: The shear bond strength (SBS) between the restoration and pulp capping material is important to the quality of the filling and success of a restoration. Proper bonding of the restorative material to the pulp capping material will also provide an adhesive join that will separate the stress evenly.

Materials and Methods:

- 3mm x 1.5mm holes were created in 60 acrylic cylinders.
- Holes were filled with MTA (Angelus), Biodentine (Septodent) and CEM (Yektazist Dandan) and covered with a wet cotton pellet and stored for 72 hrs @37°C and 100% humidity.
- A 2mm x 2mm plastic cylinder used to add either flowable composites (self-adhering: Vertise™ Flow - Kerr or conventional: X-tra base) on the top of each pulp capping material.
- A knife-edge blade in a universal testing machine was used to measure the load and calculate the bond strength at which failure occurs.
- Failures categorized to 100% adhesive, 100% cohesive or mix using microscopy.

Results: No adhesive failure observed. No statistically significant difference observed between the SBS of the 2 flowable composites. Vertise Flow with CEM and X-tra Base with MTA showed the higher SBS when compared to Biodentine and significantly higher when compared to Biodentine with Vertise.

Conclusion: MTA and CEM exhibit higher SBS than Biodentine.

LOE: 4
Title: Evaluation of root canal debridement of human molars using the GentleWave System

Author: Molina B et al.

Journal: JOE 41(10): 1701

Reviewer: Christina Lee DDS

Purpose: GentleWave® System is by Sonendo and consists of a console with a handpiece. The tip of the handpiece is held within the pulp chamber and a strong hydrodynamic cavitation cloud generates a broad spectrum of sound waves within the degassed fluid inside the tooth. Instructional recommended use with 3% NaOCl. This study histologically compared the efficacy of tissue debris removal from root canals of human molars using minimal instrumentation with the GentleWave® System and conventional rotary instrumentation with needle irrigation.

Materials and Methods:

- 45 extracted human molars accessed and set within simulated periapical tissue
- 3 groups were created: Control: no treatment, Conventional rotary instrumentation with needle irrigation – Vortex Blue .04 taper rotary instruments, 3% NaOCl between each instrument and final rinse with 3% NaOCl then 17% EDTA and then saline
- Minimal instrumentation followed by GentleWave System – instrumentation to 15/.04 using EndoSequence rotary file with saline irrigation between each instrument and final wash treatment with GentleWave per manufacturer’s
- Recommendations (3% NaOCl -> distilled water -> 8% EDTA -> distilled water)
- Teeth underwent histologic processing and evaluated with light microscopy

Results: Both experimental groups has significantly less debris than the control group in the apical and middle regions. For the conventional group, more debris remained in the apical region of MB and ML canals of mandibular molars and MB canals of maxillary molars than in the middle region while the GentleWave group had no significant difference in the percent of debris found in those same areas. Conventional group cleaned 67.8% of the apical and middle region of mandibular molar mesial canals and 87.3% of maxillary molar MB canals. GentleWave group cleaned tissue debris in 97.2% and 98.1% of the apical and middle region of the mandibular molar mesial canals and the maxillary molar MB canals, respectively.

Conclusion: The GentleWave System left less tissue debris than conventional treatment.

LOE: 5
Micro-computed tomography evaluation of ProTaper Next and BioRace shaping outcomes in maxillary first molar curved canals

Pasqualini D et al.

JOE Vol. 41 (10); 1706

Jeffrey Yui DDS

Purpose: Micro-computed tomography (micro-CT) is a powerful tool for ex-vivo evaluation of root canal morphology because it is accurate as anatomic sectioning. This study described shaping outcomes of ProTaper Next (PTN) and BioRace system (BR) in terms of volume and surface changes, canal centering ability, and canal geometry modification by micro-CT analysis.

Materials and Methods:

- 34 maxillary first permanent molars were extracted and randomly allocated to experimental groups, ProGlider and ProTaperNext (PG/PTN), and ScoutRace and BioRace (SR/BR)
- After access cavity preparation, each canal was instrumented to working length with a #10 K-file
- Glide paths were performed with either ProGlider in the PG/PTN or ScoutRace in the SR/BR group
- Irrigation was performed with alternated 5% NaOCl with 10% EDTA for a total of 10 mL
- The following parameters were measured in both preoperative and postoperative scans:
  - Root canal volume and surface area
  - Root canal centering ability
  - Symmetrical enlargement of the canal geometry
  - Thickness of dentinal wall at inner curvature
- Results were analyzed with 4 one way analyses of variance

Results: Canal centering ability was superior in PG/PTN and demonstrated a more conservative increase of canal areas. Inner dentinal wall thickness was less reduced with PG/PTN compared with SR/BR. Both systems demonstrated a homogeneous increase in root canal diameters

Discussion: Both SR/BR and PG/PTN shaping systems provided root canal preparation without significant shaping errors in maxillary first molar canals. The PG/PTN system resulted in a more centered and less invasive preparation

LOE: 5