Title: Weight of apically extruded debris following use of two canal instrumentation techniques and two designs of irrigation needles.

Author: Yeter, KY et al.

Journal: IEJ 2013; 46, 795-799

Reviewer: Ricky Gonzalez-Lopez, DMD

Introduction: The main purpose of root canal treatment is to enlarge the root canal system in order to remove pulp, bacteria, necrotic tissue and dental debris. During canal preparation these materials and the irrigant may be extruded onto the periapical tissues despite control of working length. This can cause inflammatory reaction and postoperative pain, the so-called flare up (Seltzer & Naidorf 1985). Different instrumentation techniques indicate that all result in some degree of extrusion through the apex (Fairbourn et al 1987). It has been recommended that root canals should be flushed with a small-diameter irrigation needle with a safety tip (side port).

Purpose: To compare the amount of apically extruded debris with K-files and the Revo-S system (Micro-Mega France) using two different needle tips.

Materials & Methods: Forty teeth were divided into 5 groups:

- Group 1 – Sterile saline followed by 5 ml of 2% Chlorohexidine (CHX)
- Group 2 – Citric acid followed by 5 ml of 2% CHX
- Group 3 – EDTA followed by 5 ml of 2% CHX
- Positive control – only with CHX
- Negative control – only with 6% NaOCl.

Mass Spectrometry used to determine the identity and presence of principal component analysis (PCA).

Results: PCA was present in the canals of all experimental groups except the negative group. Citric acid had the least amount of PCA formation.

Conclusions: The combination of NaOCl and CHX in endodontic therapy should be avoided. Further research is needed to determine the mechanism of diffusion of PCA into periapical tissues and the amount needed to cause damage.

LOE: 5
Purpose: Analysis of scientific basis for the methods that we apply in endodontics has demonstrated extensive shortcomings.

- There is a lack of diagnostic methods that can disclose whether a vital but injured pulp can be maintained or whether it should be removed and replaced with a root filling.
- Insufficient investigation of the effects of different methods we use for instrumentation disinfection and root filling of teeth.
- Extensive variation in treatment strategies and choice of materials and methods.
- Prospective research studies of root canal therapy are needed to determine how teeth can be preserved in the long term without risk of recurrent symptoms, periradicular inflammation or tooth fracture.
- National registries with quality are needed to be applied for follow up evaluations of pulpal and root canal treatments.
- Interpretation of prevalent clinical signs and symptoms can be better investigated.
- CBCT diagnostic accuracy has not been adequately investigated and studies should be done to compare CBCT with conventional intra-oral radiography.
- More clinical research should be conducted in general practice settings to test effectiveness of different root canal treatments because that’s where the majority of endodontic procedures are performed.
- Scientific evidence describing the natural course of events and prognosis for root filled teeth is inadequate and needs further documentation.
- Endodontic retreatment methods (orthograde or retrograde or both) should be investigated to determine if they are effective and result in long-term tooth survival.
- Alternatives to retreatment such as extraction and replacement by a tooth supporting bridge or an implant should be evaluated from the perspective of quality of life and cost effectiveness.

LOE: 5
Title: Predictive models of pain following root canal treatment: a prospective clinical study

Author: Arias A et al.


Reviewer: Ashley Gonsky, DMD

Purpose: The purpose of this paper is to determine the probability of the incidence, intensity, duration and triggering of post-endodontic pain, considering factors related to the patient (age, gender, medical evaluation) and to the affected tooth (group, location, number of canals, pulp vitality, preoperative pain, periapical radiolucencies, previous emergency access, presence of occlusal contacts with antagonist).

Materials and Methods: Five hundred one visit root canal treatments were performed with Gates Glidden drills and K-Flexofiles®. Five percent NaOCl solution was used for irrigation and canals were filled with lateral compaction and AH-Plus® sealer. Independent factors were recorded during the treatment and characteristics of post-endodontic pain (incidence, intensity, duration) were later surveyed through questionnaires. Three hundred seventy-four questionnaires were returned and split into two groups for statistical purposes. Three hundred sixteen cases were used to adjust the logistic regression models to predict each characteristic of post-endodontic pain using predictive factors. Fifty-eight cases were used to test the validity of each model.

Results: The predictive model showed that the incidence of post-endodontic pain was significantly lower when the tooth was not a molar, demonstrated periapical radiolucencies, had no history of previous pain or emergency endodontic treatment, and had no occlusal contact. The probability of experiencing moderate or severe pain was higher with increasing age and in mandibular teeth. The probability of pain lasting more than 2 days was increased with age and decreased in males and when a radiolucent lesion was present on radiographs.

Conclusion: Predictive formula for the incidence, intensity, and duration of post-endodontic pain were generated and validated taking into account the interrelation of multiple concomitant clinical factors.

LOE: 4
Title: Antibiofilm activity, pH and solubility of endodontic sealers

Author: Faria-Junior N et al.

Journal: International Endodontic Journal, Vol. 46 (8); 755-762

Reviewer: Kevin Baweja, DDS

Purpose: To evaluate the antibiofilm activity against *E. faecalis*, pH and solubility of AH Plus®, Sealer 26, Epiphany® SE, Sealapex™, Activ GP™, MTA Fillapex® (MTA-F) and an experimental MTA-based sealer (MTA-S)

Introduction: Use of root filling materials with antimicrobial properties may contribute to eliminate remaining microorganisms or to prevent recontamination. Different types of sealers have been developed each with their own set of unique properties – resin based, Resilon™, calcium hydroxide, MTA.

Materials and Methods:

- Sealer samples were made and stored for 2 or 7 days
- Prepared sealers were evaluated using a modified direct contact test (DCT) for 5h, 10h, 15h with an *E. faecalis* biofilm previously induced on bovine dentine
- Control group – biofilm not exposed to sealers
- Number of colony forming units in the remaining biofilm was determined
- Sealer solubility was assessed by the percentage of mass loss after 15h of immersion in distilled water
- Sealer pH was evaluated at 5h, 10h, 15h
- Sealers tested were – AH Plus®, Sealer 26, Epiphany® SE, Sealapex™, Activ GP™, MTA Fillapex® and MTA based sealer

Results:

- At 2 days post-manipulation, the DCT showed that Sealapex™ and MTA-F were associated with a reduction in the number of bacteria in all 3 contact periods compared to control
- At 7 days, Sealapex™ had the greatest antibiofilm action at 10h and 15h.
- Sealapex™ had the highest pH values 2 and 7 days after manipulation
- At 2 days, MTA-F, MTA-S, Sealapex™ and Activ GP™ had the highest solubility values
- At 7 days, MTA-F and MTA-S had greater solubility than the other materials
- AH Plus® had the lowest solubility for both manipulation groups

Conclusion: Sealapex™ and MTA-F were associated with the greatest reduction of bacteria in biofilms and had the greatest solubility. The high solubility and pH may be related to the antimicrobial activity. None of the root filling materials tested were able to completely eliminate *E. faecalis* biofilm

LOE: 5
Title: Dental trauma in patients with maxillofacial fractures

Author: Hai-Hau Zhou et al.


Reviewer: Raj Shenoy, DDS

Purpose: The aim of this study was to analyze and evaluate the correlation between dental injuries and the pattern of maxillofacial fractures. Additionally, the occurrence of dental injury in relation to age, gender, trauma mechanism, and type of maxillofacial fracture was also investigated.

Materials and Methods: The study was conducted on 1131 patients with facial fractures between January 2000 and December 2009 (retrospective study). Of these patients, 473 presented with associated dental trauma. The data collected included: age, gender, mechanism of injury (assaults, road accidents, sports or work related or other), type of facial fracture, and type of dental injury. A statistical analysis was performed to assess the relationship between the variables.

Results: It was found that of the 473 patients that sustained dental injury, a total of 2215 teeth were injured. Of the 2215 injured teeth, (53.8%) were in the maxilla and (46.2%) was in the mandible. Fall from a height had the highest risk of dental injuries. The central incisor was the most injured tooth for both the maxilla and mandible. The most common type of dental injury was avulsion (out of socket). More anterior teeth were injured in the maxilla by crown fracture, avulsion, and intrusion compared to in the mandible. In the mandible, anterior teeth were injured more by subluxation and concussion. Dental injuries were more prone to occur in patients who sustained only symphysis fractures.

Conclusions: The overall prevalence of dental trauma associated with maxillofacial fractures was 41.8%. On average, 4.7 teeth were injured per patient. This shows that we should do more careful examinations on dental status with patients presenting with maxillofacial fractures. The most frequent cause of dental injury was road traffic accidents (52.9% of the injuries.) More teeth overall were injured in the maxilla than in the mandible. It is speculated that it could be due to the fact that the mandible has better bony anchorage. Overall, they observed a significant dental injury rate in patients who sustained maxillofacial fractures. The occurrence of dental trauma is also significantly related to the pattern and position of the maxillofacial fractures. Fall from a height possessed the highest risk of dental trauma. Preventive measures such as wearing mouth guards when working or playing at height should be emphasized. A thorough dental examination in all patients with facial injury should be emphasized.

LOE: 5
Title: The setting characteristics of MTA Plus in different environmental conditions

Author: Camilleri, J et al.

Journal: IEJ 2013; 46, 831-840

Reviewer: Saehee Kim, DMD

Introduction: The two main types of MTA for use as root-end fillers and perforation repair materials are ProRoot MTA and MTA Angelus. Recently, another MTA has been introduced, MTA Plus. MTA Plus is similar in composition but is finer.

Purpose: To study the characteristic and the hydration reaction of the MTA Plus exposed to the different environmental conditions.

Material and Methods: MTA Plus was mixed with water in a ratio of 0.35 tested under three environmental conditions, dry, immersed in water or Hank’s balanced salt solution (HBSS).

Results:

Un-hydrated MTA Plus characteristics:

- MTA Plus has 1.5 times the specific surface area compared to ProRoot MTA. So MTA Plus is finer than ProRoot MTA.
- MTA Plus is based on Portland cement because energy dispersive x-ray analysis (EDX) showed large peaks of calcium and silicon. Bismuth was also found.
- Setting time: setting time longer when wet than dry and longest with HBSS mixture.
  - MTA Plus cured dry: 128 ± 8 min
  - MTA Plus cured in water: 283 ± 7.5 min
  - MTA Plus cured in HBSS: 1052 ± 13.5 min

Hydrated MTA Plus characteristic:

- When cured dry, a dense microstructure in the core and outer region.
- When it was cured in water it gets porous in the outer region while the core is dense. There was microcracking, loss of calcium hydroxide and partial decalcification due to leaching of calcium in outer region.
- When MTA Plus was cured in HBSS, core and outer region was dense but as you approach the interface with the oasis (around 100 micrometer), it became porous.

Conclusion: The MTA Plus had a similar chemical composition but was finer than ProRoot MTA. The extended setting time, decalcification of calcium silicate hydrate, microcracking and leaching of calcium hydroxide occur when cured wet. This is clinically significant, because this can affect the long-term stability of the root-end restoration. Microcraking allow reinfection of the apex and when it doesn’t set, it can be eroded away in the long term.

LOE: 3
Title: The permanent deformation of the self-adjusting files when used in canals of extracted teeth.


Publication: International Endodontic Journal, 46, 863–869

Reviewer: Nadia Liss, DMD

Purpose: The aim of the present ex vivo study was to study the deformation patterns of the self-adjusting files (ReDent-Nova, Ra’anana, Israel) when used repeatedly by endodontists with no previous experience with this system, until a mechanical failure occurred.

Methods and Materials: Extracted human molars were mounted in a vise that held them rigidly throughout the procedure. The self-adjusting file (SAF) is a hollow file designed as a compressible, thin-walled, pointed cylinder of Ni-Ti lattice. The 1.5 mm in diameter per 25 mm length SAF was used in this study. The tip of all SAF instruments is asymmetrical and creates a single-sided, two-arched abrasive tip on the even side of instrument. The file is operated by a special handpiece head that turns the micromotor rotation (5000 vibrations/min) into an in-and-out vibrating motion (RDT3, ReDent-Nova, Ra’anana, Israel). The hollow SAF file allowed for continuous irrigation throughout the procedure. Three percent NaClO solution was pumped through the lumen of the file, into the canal, which escaped through the access cavity.

Study Design- The operators in this study were endodontists who were first instructed on the use of the SAF in simulated canals in plastic blocks. This was followed by using the SAF System for preparation of the root canals of extracted human molar(s) with straight root canals (less than 20° degrees curvature). Access cavity and glide path were initially prepared in the root canals of all teeth by a single experienced endodontist. Manual instrumentation up to size 20 K-files was used. Only canals with initial apical sizes of 15 or 20 were included. During SAF instrumentation, every 4 min, each file was withdrawn from the canal and inspected for integrity. If intact, it was used in another canal for an additional 4 min and checked again. This was repeated until all 19 SAF files were deformed. The files were collected for inspection at X50 magnification. All teeth were then examined radiographically for the presence of any metal fragments in the root canals. Permanent deformation was categorized according to the type and location occurred:

- Detachment of one component of the file at one end while the component is retained
- Detachment of a component at both ends and the component missing and
- Permanent twisting of the component. Recordings were made and statistically analyzed using McNemar’s test.

Results: Of 52 canals prepared, 19 deformed files were collected. The files were used in 3 canals/each before deformation occurred. In no case was there a full fracture of the SAF file, neither were any metal parts detected in the postoperative radiographs of the root canals. Deformations:

- the odd side (5-arch side) of the SAF↑ > the even side (6-arch side) (P-value = 0.039)
- the odd arches↑ > the even arches (P-value = 0.012)
- the odd arches at coronal positions↑ (standard errors P < 0.001)
- arches↑ > struts, but the difference was marginally non-significant (P-value = 0.063).
- odd struts in the apical positions ↓ (standard errors P = 0.081).
- beams ↓ < arches or struts (P-value < 0.001).

Conclusion: Deformation of SAF files occurred mainly as detachment of one of the arches or struts at connection points on the odd side of the file. SAF files proved safe for clinical use as there was no file separation detected within the root canal.

LOE: 5
Ex vivo evaluation of various instrumentation techniques and irrigants in reducing *E. faecalis* within root canals.

Basmaci F. et al.

International Endodontic Journal, Vol.46(9), 823-830

Sean Nguyen, DMD

To evaluate ex vivo the effectiveness of single-file instrumentation techniques compared with serial Ni-Ti rotary instrumentation with several irrigation regimens in reducing *E. faecalis* within root canals.

Methods and Materials: A total of 81 extracted human mandibular premolar teeth with a single root canal were infected with *E. faecalis* before and after canal preparation. Samples were divided randomly into 9 groups, as follows:

- group 1-A: sterile phosphate-buffered saline + Self-adjusting file
- group 1-B: 5% sodium hypochlorite + 15% EDTA + Self-adjusting file
- group 1-C: 5% sodium hypochlorite + 7% maleic acid + Self-adjusting file
- group 2-A: sterile phosphate-buffered saline + Reciproc (R25)
- group 2-B: 5% sodium hypochlorite + 15% EDTA + Reciproc (R25)
- group 2-C: 5% sodium hypochlorite + 7% maleic acid + Reciproc (R25)
- group 3-A: sterile phosphate-buffered saline + ProTaper
- group 3-B: 5% sodium hypochlorite + 15% EDTA + ProTaper
- group 3-C: 5% sodium hypochlorite + 7% maleic acid + ProTaper.

Anova was used to analyze statistically the differences in terms of reduction in colony counts between the groups, and Dunn's post hoc test was used for multiple comparisons.

Results: All techniques and irrigation regimens significantly reduced the number of bacterial cells in the root canal (P < 0.001). Comparisons amongst the groups revealed significant differences between group 1A (sterile phosphate-buffered saline + Self-adjusting file)/group 1B (5% sodium hypochlorite + 15% EDTA + Self-adjusting file) (P = 0.031), group 1A (sterile phosphate-buffered saline + Self-adjusting file)/group 2C (5% sodium hypochlorite + 7% maleic acid + Reciproc) (P = 0.003), group 2A (sterile phosphate-buffered saline + Reciproc)/group 3B (5% sodium hypochlorite + 15% EDTA + ProTaper) (P = 0.036), group 3B (5% sodium hypochlorite + 15% EDTA + ProTaper)/group 1A (sterile phosphate-buffered saline + Self-adjusting file) (P < 0.001), and group 3C (5% sodium hypochlorite + 7% maleic acid + ProTaper)/group 1A (sterile phosphate-buffered saline + Self-adjusting file) (P = 0.033).

Conclusions: No significant differences in terms of reduction in microbial counts were observed between single-file techniques (SAF and Reciproc) and serial Ni-Ti instrumentation technique (ProTaper) in combination with irrigants.

LOE: 5
Title: Healing responses following transverse root fracture: a historical review and case reports showing healing with (a) calcified tissue and (b) dense fibrous connective tissue

Author: Heithersay G. et al.

Journal: Dental Traumatology 29 (4):253-265

Reviewer: Christopher Maguire-Adams, DMD

Purpose: The aim of the review was to highlight early histological reports and studies that have contributed to the current understanding of the biological processes involved in the healing of transverse root fractures.

Case reports: Accompanying the historical review are two case reports with histology of root fracture healing by (a) calcified tissue and (b) dense fibrous connective tissue. The role of the pulp and the periodontal ligament in the repair process is described and the clinical significance discussed with particular emphasis to diagnosis and orthodontic management.

Case 1

![Image 1]

Case 2

Discussion: Case report 1 has some significant and possibly unique features of importance to the understanding of the role of the pulp and the periodontal ligament in healing of a transverse root fracture with calcified tissue. The clinical, radiological and postextraction evidence indicates that the apex of the tooth was immature and that the original transverse fracture extended from 2 mms above the cemento–enamel junction on the labial surface to 3 mms below the cemento–enamel junction on the palatal surface. Case report 2 has a significant feature of initial resorption of the fractured dentin surface of both the coronal and the apical segments, followed by repair by the deposition of a calcified tissue. In the present case, the extensive calcification evident within the root canals along with pulpal fibrosis is consistent with earlier reports.

Conclusions: These two case reports of healing of root fractures with either calcified or dense fibrous tissue provide further evidence regarding the cellular responses involved and the clinical implications relating to the diagnosis and conservation of teeth that have suffered this type of dental injury.

LOE: 4