Title: In vitro evaluation of the antibacterial activities of MTAD in combination with nisin against Enterococcus faecalis

Author: Zhongchun Tong et al, JOE, Vol. 37, No. 8, 1116. (August 2011)

Reviewer: Arnav R. Mistry, DMD

Purpose: To evaluate the synergistic action between MTAD and nisin against E. faecalis.

Materials and Methods:

- MTAD is a mixture of 3% doxycycline, 4.25% citric acid, and 0.5% polysorbate 80 detergent, which is often used to remove endodontic smear layers and causes minimal erosive changes on the dentin surface.
- Nisin is an antimicrobial peptide which inhibits the proliferation of most gram-positive bacteria.
- Three different antibacterial combinations were used MTAD, MTAN (substitution of doxycycline with nisin), and MTADN (doxycycline in conjunction with nisin)
- Minimal inhibitory concentration (MIC) and minimal bactericidal combination (MBC) were used to measure the antibacterial activities of MTAD, MTAN, and MTADN.
- The synergetic effect between nisin and doxycycline was evaluated by fractional inhibitory concentration (FIC) and time-killing curves.
- Morphologic changes in E. faecalis were observed by SEM after E. faecalis was treated with MTAD, MTAN, or MTADN for 24 hours.

Results: The MBC of MTADN against E. faecalis was lower than that of MTAD and MTAN. The combination of nisin and doxycycline had a significantly synergetic antibacterial effect on E. faecalis. Among the 3 antimicrobial treatments, MTADN caused the most severe damage to E. faecalis.

<table>
<thead>
<tr>
<th>Medicaments</th>
<th>3% doxycycline</th>
<th>MTAD</th>
<th>3% Commercial nisin</th>
<th>MTAN</th>
<th>MTADN</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIC (fold dilution)</td>
<td>1:8192</td>
<td>1:8192</td>
<td>1:32</td>
<td>1:32</td>
<td>1:8192</td>
</tr>
<tr>
<td>MBC (fold dilution)</td>
<td>1:4</td>
<td>1:8</td>
<td>1:16</td>
<td>1:16</td>
<td>1:256</td>
</tr>
<tr>
<td>MBC/MIC</td>
<td>2048</td>
<td>1024</td>
<td>2</td>
<td>2</td>
<td>32</td>
</tr>
</tbody>
</table>

Table – MIC and MBC assays for different antimicrobial treatments.

Conclusions: The combination of nisin and doxycycline has a synergetic antibacterial effect on E. faecalis, and MTADN in conjunction with nisin inhibits E. faecalis better than MTAD alone.

LOE: 5
Title: Cyclic fatigue resistance of three different nickel-titanium instruments after immersion in sodium hypochlorite

Author: Pedulla et al

Journal: JOE Vol. 37, No. 8:1139, 2011

Reviewer: Marisa Zarchy, DMD

Purpose: To assess the resistance to cyclic fatigue of three NiTi files after immersion in NaOCl solutions in conditions similar to those used in clinical practice.

Background: There is clear evidence that NiTi rotary files are better than K-files at shaping root canals to their original path with fewer errors. However, in vitro studies suggest NiTi rotary files fracture more often. Fracture takes place in two ways: torsion and flexural cyclic fatigue. With torsion, the instrument is locked in the canal while the shank still rotates. With flexural cyclic fatigue, a tension-compression cycle within curved canals causes metal fatigue and fracture. An additional factor is corrosion which may occur in the presence of NaOCl. Studies of NiTi rotary files in static mode indicate NiTi files have corrosion patterns. However, it has not been shown to be true clinically.

Methods and Materials:

- Three types of files were used: Twisted files, Revo S® SU files, and Mtwo® files
- 50 files of each brand were assigned to 5 groups:
  1. No immersion in solution
  2. Static immersion for 5 minutes
  3. Static immersion for 1 minute
  4. Dynamic immersion for 5 minutes (300 rpm)
  5. Dynamic immersion for 1 minute (300 rpm)
- After immersion, all files were rinsed by bi-distilled water to neutralize the NaOCl, dried, registered with an ID number, and stored in glass vials
- All groups were subjected to a cyclic fatigue test by using a mechanical device (used for this purpose in past studies) within an artificial stainless steel canal
- For each instrument, the time was recorded from when the test began until the moment of breakage using a chronometer and the number of cycles of failure (NCF)
- A two-way statistical analysis was used to evaluate the effect of NaOCl on fatigue

Results:

- Resistance to the cyclic fatigue of the same NiTi file was not significantly affected by NaOCl (p>0.05)
- The Twisted file showed a higher resistance in all groups than the Revo S® SU (p<0.001)
- The comparison between the same groups of Twisted Files and Mtwo® files or between Mtwo® and Revo S® files did not show significant differences (P > .05) except for two cases: group 2 of the Twisted Files and Mtwo® files and group 5 of the Mtwo® and Revo S® SU files (P < .05)

Conclusion: Static or dynamic immersion in NaOCl for 1 minute or 5 minutes did not reduce significantly the cyclic fatigue resistance of NiTi files. However, the type of instrument influenced cyclic fatigue resistance. Specifically, Twisted Files were more resistant than Mtwo® and Revo S® SU

LOE: 5
Title: Residual effectiveness of final irrigation regimens on Enterococcus faecalis-infected root canals

Author: Baca, et al

Journal: JOE, Vol. 37, No 8:1121

Reviewer: Quan Nghiem, DMD

Purpose: Evaluate the residual antimicrobial activity of four final irrigation [Chlorhexidine (CHX), Sodium hypochlorite (NaOCl), EDTA, Maleic Acid (MA), Centrimide (CTR)] regimens in root canals contaminated with Enterococcus faecalis.

Methods and Materials: Fifty-eight single-rooted anterior human teeth stores in 0.1% thymol solution at 4°C were decoronated to obtain roots 12 mm in length. Each root was autoclaved at 121°C and immersed in a sterile brain-heart infusion broth (BHI), and sealed and incubated for 1 week at 37°C. An initial bacterial suspension of 1X10^7 colony-forming units per milliliter from a subculture of E. faecalis, was obtained. The sterilized tooth and 1.2 mL of this suspension were added to an Eppendorf Tube and were incubated for 4 weeks under aerobic conditions at 37°C, with re-inoculation performed every 7 days. The cultures were checked for purity by gram stain and colony morphology.

After 4 weeks, the working length was established for each tooth using a #10 K file and the apexes of the teeth were sealed with cyanoacrylate. The root canals were instrumented using the ProTaper system to the working length to a F3 master apical file. During the preparation, 1mL of 5.25% NaOCl was used after each file.

Once instrumented, the roots were randomly divided into 4 groups according to the final irrigation regimen:

- EDTA-NaOCl - Irrigation with 5 mL of 17% EDTA followed by 5 mL of 5.25% NaOCl
- MA-NaOCl - Irrigation with 5mL of 7% maleic acid followed by 5 mL of 5.25% NaOCl
- EDTA-CHX + CTR – Irrigation with 5 mL of 17% EDTA followed by 5 mL of 2% CHX + 0.2% CTR
- MA-CHX + CTR - Irrigation with 5mL of 7% maleic acid followed by 5 mL of 2% CHX + 0.2% CTR

In each group, two other specimens not contaminated with E. Faecalis received the same treatment and served as negative controls. After treatment, root canals were dried with sterile paper points and filled with BHI broth. #15 K file was placed in the canal to within 1 mm of the working length, and the canal was circumferentially filed for 10 seconds. Three consecutive paper points were introduced into the canal to absorb the BHI broth. After collection of the first bacterial sample the canal was refilled with the same broth. Samples were collected daily for 60 days and incubated 24 hours at 37°C. A sample of the broth was then streaked onto blood agar plates and bacteria were identified to ensure that there was no contamination other than E. Faecalis.

Results: All root canals of groups:

- EDTA-NaOCl and MA-NaOCl whose final irrigants was 5.25% NaOCl yielded positive cultures on 5th day
- EDTA-CHX + CTR and MA-CHX + CTR with final irrigations of 2% CHX + 0.2% CTR showed respective percentages of sample without regrowth of 72.1% and 66.8% at 60 days

Conclusion: The results obtained indicate that the final irrigation with the mixture of CHX and CTR inhibited the regrowth of bacteria in the root canals more effectively that the final irrigation of NaOCl. NaOCl is the irrigant of choice for root canal treatment, but it does not provide residual action. Regardless of the chelating agent used, the findings reported in this study show that an effective final irrigation would be the combination of 2% CHX + 0.2% CTR given its antimicrobial action over time.

LOE: 5
Title: Biofilm dissolution and cleaning ability of different irrigant solutions on intraorally infected dentin

Author: del Carpio-Perochena, A et al.

Journal: JOE Vol 37, no.8:1134

Reviewer: Anil Reddy Manda, DMD

Purpose: The aim of this study was to evaluate the biofilm dissolution and cleaning ability of different irrigant solutions on intraorally infected dentin. The hypothesis of the study was that biofilm dissolution depends on the irrigant solution and the contact time. Biofilms can be defined as cells attached to a surface embedded in an exo-polysaccharide matrix that fills the space between cells.

Materials and Methods: One hundred twenty bovine dentin specimens were infected intraorally by using a removable orthodontic device to allow the biofilm development. Thirty samples were used for each irrigant solution: 2% chlorhexidine and 1%, 2.5% and 5.25% NaOCl. The solutions were used for 5, 15 and 30 minutes and at two experimental volumes, 500 µL and 1mL. One additional dentin sample in each group was treated with 1mL distilled water for 30 min. to serve as a control. The samples were stained using acridine orange dye before and after the experiments and evaluated by using a confocal microscope. The percentage of biofilm, isolated cells and non-colonized dentin was measured by using a grid system. Differences in the reduction or increase of the studied parameters were assessed by using non parametric methods.

Results: The higher values of biofilm dissolution and non-colonized dentin were found in the 30-minute NaOCl group and in 5-minute and 15-minute groups of 5.25% NaOCl. The use of 2% chlorhexidine solution did not improve the biofilm dissolution or increase the cleaning of the dentin in comparison with the NaOCl solutions. Absence of differences between the 500-µL and 1-mL groups which means the results were not dependent on the irrigant volume.

Conclusions: Two percent chlorhexidine does not dissolve the biofilms. Thirty minutes of NaOCl are necessary to have higher values of biofilm dissolution and to increase the cleaning of the dentin independently of the concentration in comparison with the 5-minute and 15-minute contact times. The results suggest that a short time period does not allow adequate biofilm dissolution especially in 1% and 2.5% NaOCl groups. Under clinical conditions, a lower contact time in the apical third might be insufficient to allow a total degradation of intraradicular biofilm.

LOE:4
Title: Cutting efficiency of Twisted versus machined nickel-titanium endo files

Authors: Mukhtar, D et al.


Reviewer: Daniel Cassis, DDS

Purpose: To compare the efficacy of the cutting ability of two different instruments (Twisted files and Protaper files), concerning changes in the dentin thickness removed and root canal volume, by using computed tomography scanning.

Materials & Methods:

- 30 freshly extracted single-rooted mandibular premolars with less than 15°deviation from the long axis.
- Teeth were decoronated to a standard size of 14mm. WLs were determined with a size 15 file.
- Teeth were divided into 2 groups.
- 15 teeth were instrumented with Twisted files and 15 teeth were instrumented with ProTaper files.
- The teeth were prepared according to manufacturer’s instructions in a crown down method with NaOCl and EDTA used as irrigants.
- The final apical size was set to size 30 for both groups.
- The roots were scanned before and after instrumentation.
- Dentin Thickness and root canal volume were calculated.

Results: There was no significant difference between the two groups in the apical third. In the coronal and middle thirds, the ProTaper system removed significantly more of the dentin thickness than the Twisted file system. No significant difference was found between the two groups in regards to canal volume.

Discussion: The ProTaper had less dentin remaining in the M-D and B-L directions of the coronal and middle thirds of the canal. This is due to their large taper. There was no significant difference in the overall canal volume due to the twisted files ability to uniformly enlarge the canals.

LOE: 5
Title: Effect of irrigants on the survival of human stem cells of the apical papilla in a platelet-rich plasma scaffold in human root tips

Authors: Trevino et al.

Journal: JOE 2011; Vol.37, No. 8: 1109-1115

Reviewer: Hector M. Garcia, DMD

Purpose: To test the hypothesis that different root canal irrigation protocols alter survival of stem cells from the apical papilla (SCAP) in a regenerative endodontic model.

Materials and Methods:

- SCAP was isolated from immature human third molars
- A subpopulation of STRO-1 expressing cells was selected and expanded in vitro using an immunomagnetic separation method
- Standardized human 5mm root segments were created. These segments were then instrumented to an apical opening of 1.3mm in diameter (to simulate an open/immature apex).
- Standardized human root segments (5 per group) were irrigated (20mL) for 1 minute with 1 of 4 protocols: (1) 17% EDTA, (2) 6% NaOCl/17% EDTA/6% NaOCl, (3) 17% EDTA/2% CHX or (4) 6% NaOCl/17% EDTA/6% NaOCl/isopropyl alcohol/2% CHX
- SCAP was mixed with platelet rich plasma, injected into the root canal system, and cultured for 21 days
- Roots were then decalcified, sectioned, processed for immunohistochemistry, and stained for vimentin (viable stain) and TO-PRO-3 (cellular nucleus stain). Root segments were visualized with a laser confocal imaging system and a microscope.

Results:

- Cells identified in the root canal system after 3 weeks were located adjacent to the dentinal walls
- Effect of irrigant solutions on the survival of SCAP was:
  - Group 1 (EDTA only) showed a 88.66% stem cell viability
  - Group 2 (EDTA + NaOCl) showed a 74.35% stem cell viability
  - Groups 3 and 4 (both contain CHX) showed a 0% stem cell viability and had extensive cell death and debris

Discussion: Irrigants for regenerative endodontic procedure should be selected considering both their bactericidal property and their ability to promote survival and proliferative capacity of the patient’s stem cells. This study showed that irrigation with 17% EDTA promoted survival of SCAP, whereas irrigating with 2% CHX was detrimental to stem cell survival. The addition of 6% NaOCl to EDTA decreased cell viability when compared to EDTA alone. More studies need to be done in order to identify the optimal irrigant for endodontic regenerative procedures.

LOE: 5
Title: Apical morphology of the palatal roots of maxillary molars by using micro-computed tomography

Author: Meder-Cowherd et al

Journal: JOE, Volume 37, Number 8, August 2011

Reviewed by: Nicole Vu, DMD

Purpose: To study the characteristics, the incidence of occurrence and morphology, of apical constriction of palatal roots of maxillary molars using noninvasive micro-CT

Materials and Methods: Forty extracted first and second maxillary molars were used. These were stored in water and thymol, soaked in 6% sodium hypochlorite. Palatal roots were sectioned 10mm from apex. Roots were scanned using micro-CT and images were reconstructed so that both the root surface and canal were visible. Five endodontists evaluated 40 teeth in buccal/lingual and mesial/distal views. Five different shapes of; single constriction, tapering, flaring, parallel, or delta, were being evaluated. Data were subdivided into, presence (single and tapering) or absence (flaring, parallel, and delta)

Results:

- 65% didn’t have constriction in apical 1-3mm.
- 35% demonstrated constriction.
- Morphology frequency of parallel (35%), single (19%), flaring (18%), tapered (15%), and delta (12%).

Discussion: The study demonstrated a frequent absence of apical constriction and also the variation in its anatomy when present possibly because the use of cone beam tomography rendered the transparent and 360 degree view of the canal. Therefore, if this is true with other tooth groups, the apical constriction should not be used as an anatomical marker for canal preparation and obturation

LOE: 5
Title: Endodontic pathogens causing deep neck space infections: Clinical impact of different sampling techniques and antibiotic susceptibility.

Author: Poeschl et al

Journal: JOE Vol 37 (9) 2011

Reviewer: Ferras Mashtoub, DDS

Purpose: To compare different sampling techniques (swabbing vs. needle aspiration) and antibiotic susceptibility of microbes detected in deep neck space infections resulting from endodontic infections.

Materials and Methods:

- 89 patients with abscess formation in neck stemming from an endodontic infection that resulted in hospitalization and extraoral incision/drainage were used in this experiment. Only primary endodontic infections were used in this study.
- After disinfection of the skin around the planned area of drainage, patients either had pus drained with a 16-G needle or if that did not work they had the abscess sampled by swabbing after incision and expression of pus.
- After sample collection, they were immediately transported to the lab and tested for bacteria present and their antibiotic susceptibility.
- Antibiotics tested were Penicillin G, amoxicillin, amoxicillin clavunate, clindamycin, and erythromycin.

Results:

- Aspiration was successful in 25 patients, swabbing was used in 64 patients.
- Most frequently involved space was submandibular (35%), then buccal (31%), pterygomandibular (19%), other spaces (15%).
- Mandibular molars were the causative tooth in 92% of the cases.
- Predominant bacteria were streptococci, staphylococci, and obligate anaerobes (Prevotella, Peptostreptococcus, and Bacteroides)
- A statistically significant greater number of obligate anaerobes was observed in the aspiration group.
- Majority of patients presented with a mixed aerobic-anaerobic bacterial flora.
- Resistance rates of the overall bacteria to antibiotics tested were:
  - 10% for Penicillin G
  - 9% for Amoxicillin
  - 24% for Clindamycin
  - 24% for Erythromycin
  **No pathogen showed resistance to amoxicillin clavulanate**

Discussion:

- In comparing the sampling techniques, aspiration recovered more anaerobes.
- Swabbing was more prone to contamination by natural skin flora (detected more *staphylococcus epidermidis*).
- In severe cases, you want to use a broad spectrum antibiotic that has very few/no resistant strains. Amoxicillin clavulanate fit this criterion.
- For penicillin allergic patients, clindamycin is normally used for less severe cases. Due to the high rate of resistance to it, the authors are currently investigating the effectiveness of moxifloxacin (a quinolone with antimicrobial activity comparable to Amoxicillin Clavulanate).
- Erythromycin is not a good drug to prescribe for endodontic infections due to high resistance rates.

Conclusions:

- Aspiration technique is a superior to swabbing when sampling deep neck infections.
- Penicillin G and Amoxicillin are not adequate when used alone in treatment of deep neck infections.
- Amoxicillin Clavulanate is a more reliable antibiotic to use in treatment of these cases.

LOE: 3
Title: Analysis of symptomatic and asymptomatic primary root canal infections in adult Norwegian patients.

Author: Rocas et al.

Journal: JOE, 2011; 37: 1206-1212

Reviewer: Arwa Siyam, DDS

Purpose: To analyze the microbiota of primary root canal infections in samples from adult Norwegian patients by using the reverse capture checkerboard DNA-DNA hybridization approach.

Materials and Methods:

- Root canal samples were taken from 43 adult Norwegian patients.
- All the teeth had necrotic pulps with radiographic evidence of apical periodontitis.
- 21 cases were asymptomatic, 9 had an active draining sinus and no pain (chronic apical abscess) and 13 were diagnosed as symptomatic apical periodontitis.
- DNA was extracted from the clinical samples by using the QIAamp DNA mini kit.
- Reverse-capture checkerboard assay: 16sRNA was amplified using PCR from the extracted DNA genome. The PCR products were used in the checkerboard assay to determine the presence and levels of 50 bacterial taxa.
- Data was analyzed and the Mann-Whitney test was used to compare the levels of each taxon in cases with or without pain.

Results:

- Bacterial DNA was detected in all cases.
- In teeth with asymptomatic apical periodontitis, the most frequent taxa were *Dialister invisus* (71%), *Fusobacterium nucleatum* (62%), and *Porphyromonas endodontalis* (62%).
- In chronic apical abscesses, the most prevalent taxa were *P. endodontalis* (100%), *D. invisus* (89%), *Parvimonas micra* (78%), and *Solobacterium moorei* (78%).
- In teeth with symptomatic apical periodontitis, the most prevalent taxa were *D. invisus*, *P. endodontalis*, *S. moorei*, *Propionibacterium acnes*, and *Streptococcus* species (all in 69%).
- None of the targeted taxa were significantly associated with either sinus tract or pain except for *Selenomonas sputigena*, which was more frequently found in painful cases.

Conclusion:

Although basically the same species were highly prevalent in the different conditions examined and none of the most prevalent taxa were positively associated with symptoms, results revealed that species formed different partnerships and associations in samples from teeth with or without pain. Therefore, it is possible that more virulent multispecies communities can form as a result of overall bacterial combinations and give rise to acute inflammation.

LOE: 4
Title: Accuracy of Root ZX II in locating foramen in teeth with apical periodontitis: An in vivo study

Author: Piasecki et al

Journal: Journal of Endodontics, Vol. 37, Number 9:1213-1216

Reviewer: Andrew Chang, DMD

Purpose: To investigate the accuracy of Root ZX II in locating the apical foramen in teeth with Apical Periodontitis (AP) in vivo.

Materials and Methods:

- 12 single rooted teeth with mature apexes with clinical pulp necrosis and radiographic presence of apical lesion were selected.
- 15 single rooted teeth with mature apexes that were vital (VT) were selected as control.
- Teeth were isolated, accessed, and working length determined with Root ZX II using a 15 file.
- Files were the fixed in place with GI cement, and teeth were extracted and fixed with formalin.
- A dissecting microscope was used to visualize position of Apical Foramen compared to anatomic apex.
- The apical-most 4 mm were longitudinally shaved until the end of the file was visible
- Digital photos were taken and analyzed with Image Tool 3.0 software.

Results:

- The mean distance from the file tip to the foramen in the AP and VT group was +0.117 mm and -0.105 mm respectively.
- Percentage of acceptable distances (+/- 0.05 mm) was 83% in AP group and 100% in VT group.

Discussion: Both results for the distance of file tip to the foramen and percentage of acceptable distances showed no statistical difference with controls. Under in vivo clinical conditions, the Root ZX II was accurate in locating the apical foramen regardless of the presence of apical periodontitis.

LOE: 4
Title: Top cited articles in endodontic journals

Author: Anastasia Fardi et al

Journal: JOE Vol 37 (9), September 2011

Reviewer: Chaiwing Hsiao, DMD

Purpose: To identify the top 100 cited articles published in journals dedicated to Endodontontology and to analyze their main characteristics to gain insight into the types of publications influential in this field of dentistry.

Materials and Methods:

- Top 100 cited endodontic articles published in endodontic journals were identified using web of knowledge.
- The top 100 articles were selected and analyzed with regards to authors, institution, publication name, year of publication, and number of citations.
- Oxford center for evidence based medicine was used to categorize the type of study design as well as the level of evidence.

Results: The 100 articles are listed in table 1 in descending order of the number of citations. The most cited article received 554 citations and the least cited article received 87 citations.

- Journals: 54 articles from JOE, 23 From OS, OM, OP, OR and Endodontology.
- Authors: M Torabinejad authored 12 articles in the top 100 article list.
- Country: United states had 52 articles in the top 100 list, followed by Sweden (13)
- Institutions: Loma Linda University produced the highest number of endodontic publications.
- Research Design: 55 articles concerned basic science (evaluating coronal or apical leakage), 28 articles reported clinical experience (Endodontic Microbiology), and 17 were reviews (instrumentations).

Discussion: The top 100 cited articles were cited between 87-554 times. This is similar to the number of citations of periodontology. However lower than other medical fields such as orthopedic surgery (353-1748), general surgery (278-1013). A publication cited more than 400 times should be considered a classic.
Title: Survey of general dentists to identify characteristics associated with increased referrals to endodontists

Author: Abbot, et al.


Reviewer: Christian Kecht, DDS

Purpose: To examine the effects of an endodontist’s characteristics and professional behavior and the role of GP demographics and perceptions on GP referral behavior.

Materials and Methods:

- Cross-sectional study that included quantitative online survey of GP’s in the United States from November 4-18, 2009.
- Survey link distributed via e-mail to GP’s nationwide who opted to receive e-mails from dental and medical information sources.
- 983 GP’s completed the survey
- GP practice locations represented a mix of small cities, large cities, and large metro areas in all regions of the US.

Results:

- 94% rated endodontists positively
- 93% agreed they were likely to refer patients to endodontists in the future
- GP’s reported, on average, that they referred 46% of their patients needing RCT to endodontists
- 93% agreed that “Endodontists are my partners in delivering quality dental care”
- Percentage of GP’s rating the following ways to build relationships/partnerships as effective:
  - Timely follow up of reports and images - 96%
  - Referring patients back for restorative treatment - 94%
  - Patient scheduling accommodation - 92%
  - Showing signs of appreciation such as holiday gifts, fruit baskets, outings - 38%
- Female GP’s referred a higher percentage of patients to endodontists compared with male GP’s
- Male GP’s more likely to say they perform moderately and very complicated endodontic procedures compared to female GP’s
- Supported recommendations of what endodontists should do:
  - Answer technical and procedural questions
  - Accommodating patients into their schedules
  - Referring RCT cases back to GP’s for restorative work
  - Sharing informational updates
  - Submitting reports and images in a timely manner
  - Collaborating on patient care
  - Sharing the treatment philosophy of GP’s
  - Extending invitations for professional learning events
  - Requesting feedback from GP’s

Conclusion: GP’s who perceive endodontists as their partners in providing quality dental care and who value an endodontist’s work are more likely to refer to endodontists in the future.
Title: Proliferation of mature *Ex Vivo* human dental pulp using tissue engineering scaffolds

Author: Chandrahasa S et al, JOE, Vol. 37, No. 9, 1236

Reviewer: Arnav R. Mistry, DMD

Purpose: To measure and compare the proliferation of mature human dental pulp tissue using three types of tissue engineering scaffolds.

Materials and Methods:

- Collected mature human teeth immediately after extraction devoid of caries, fracture of pulp infection. Teeth were washed, disinfected and cut into 1-mm thick transverse slices using diamond saw.
- Three types of tissue engineering scaffolds were investigated:
  1) Open-polylactic acid (polymer) scaffolds
  2) Bovine collagen (collagen) scaffolds
  3) Calcium phosphate bioceramic (calcium phosphate) scaffolds
- Scaffolds were placed in direct contact with the dental pulp of tooth slices from 7 to 30 days.
- Neutral dye was added to stain metabolically active cells.
- Specimens were processed for histology.
- The numbers of proliferating cells were counted per unit area of scaffold according to ISO criteria.

Results:

- Proliferating dental pulp cells had a fibroblast phenotype, no other cells were observed, and none of the cells appeared to be mineralizing.
- The average rate of mature vital dental cell proliferation in:
  1) Calcium phosphate scaffolds – 1.305 cells per day
  2) Collagen scaffolds – 7.195 cells per day
  3) Polymer scaffolds – 13.885 cells per day

Conclusions: Tissue engineering scaffolds can enhance the proliferation of mature dental pulp tissue. Rate of pulp proliferation is dependent on the chemical composition of the scaffold. The polymer scaffolds were more optimal than collagen or calcium phosphate scaffolds for mature dental pulp proliferation.

LOE: 5
Title: Efficacy of different final irrigation activation techniques on smear layer removal

Author: Vera J et. Al

Journal: JOE, vol. 37, no.9:1272-1275, Sep 2011

Reviewer: Marisa Zarchy, DMD

Purpose: To compare smear layer removal after final irrigant activation with ANP, MDA, and PUI. The null hypothesis tested was that there is no difference in smear layer removal by using different final irrigant activation protocols.

Background: Irrigation is an essential part of root canal debridement. The smear layer prevents the penetration of intracanal medicaments into dentinal tubules and influences the adaptation of filling materials. Different techniques for irrigant delivery devices have been proposed to increase the flow and distribution of irrigating solution since during conventional needle irrigation, replenishment and fluid exchange do not extend much beyond the tip of the irrigating needle.

Materials and Methods:

- Forty single-rooted human mandibular premolars were decoronated to a standardized length of 16mm.
- They were cleaned and shaped by using ProTaper system to size F4 and NaOCl 2.5%.
- The specimens were divided into 4 equal groups (n=10) according to the final irrigation activation technique:
  - Group 1, passive irrigation (PI);
  - Group 2, apical negative pressure (ANP) (EndoVac);
  - Group 3, manual dynamic activation (MDA);
  - Group 4, passive ultrasonic irrigation (PUI).
- Samples were split longitudinally and examined under scanning electron microscope for smear layer presence.

Results: PI and PUI had the highest smear scores with no significant differences between them. This was followed by MDA and finally ANP, which showed the statistically significant lowest mean scores at P ≤ 0.05.

Conclusion: Final irrigant activation with ANP and MDA resulted in better removal of the smear layer than with PUI or PI.

LOE: 5
Purpose: The purpose of this in vitro investigation was to use a novel methodology to evaluate the efficacy of Ultrasonic (US) tips by using a clinically relevant axial force and linear movement.

Introduction: The types of US units are magnetostrictive (MS) and piezoelectric (PE). MS units produce a frequency of 25 kHz by converting electromagnetic energy into mechanical oscillation when an alternating magnetic field is applied to a stack of metal strips. MS units create a figure eight (elliptical) pattern at the tip and produce heat requiring adequate cooling. PE units can generate a frequency of up to 40 kHz by converting electrical energy into mechanical energy oscillation when an electric charge is applied to a crystal. PE tips create a linear movement and produce less heat than MS units. The linear movement and less heat production make PE unit ideal for endodontic instrumentation.

Materials and Methods: Ultrasonic tips have been evaluated on their cutting efficacy in dentin or dental stone by evaluating the change in weight between instrumentation cycles. A diamond bur was used to remove the diamond coating 3-4 mm from the cutting tip end of each BUC 1 US tip. A reference mark was placed where the diamond coating was removed with a carbide bur. The reference mark aided in a quantitative analysis of length and diameter by using photographs. The length from the reference mark made on the US tip shank to the end of the cutting tip was recorded. The diameter was also recorded and was measured at 0.25 mm from the US tip cutting end.

Dentin specimens from previously extracted third molars were mounted to a slow speed AC motor of the testing apparatus, which provided a 6-mm linear movement at an approximate rate of 1.5 mm/sec. A handpiece was mounted on an adjustable inclinable slide that was used to adjust and obtain a desired US tip axial force of 15g to dentin specimens.

The Saltec P5 Newton XS unit was used at power setting of 7. The US tips were attached to the handpiece and placed at a 90 degree angle to dentin specimen. The US tips were activated for 20 seconds. After each 20 second cycle, the tip was lifted off of the dentin specimen, and compressed-air was blown to remove cutting debris. This process was repeated until 2 minutes of instrumentation was completed. The dentin specimen was then removed and weighed to the nearest 0.01mg. The US tip was then photographed to record the length, width and diameter of the tip. This process continued for each specimen and trip specimen for 50, 100, 150, 190 minutes of instrumentation.

Results: A one factor analysis of variance and a Tukey post hoc (α=0.05) were used to determine whether there were statistically significant differences in change in dentin weight, change in length, and change in diameter as a function of time. There was no significant difference in dentin removal between measurement times for any tip specimen (n=10). There was a significant difference found for change in US tip length (P=.002). Tukey post hoc analysis revealed that tip length decreased statistically significantly at 2 minutes of instrumentation.

Discussion: It has been reported that incorporating a linear movement provides a more clinical representation of a brushing stroke used during clinical use. Although a significant change in length at 2 minutes revealed in this study had no effect on the efficacy of the dentin cutting of the US tips tested, it might be responsible for the short times of efficiency found in a past study that used a static model.

Within limits of the current investigation, the BUC 1 US tip did not significantly decrease in efficiency between 2 and 190 minutes of instrumentation. The decrease in tip length was found to be significant at 2 minutes of use. Adding a linear movement, in addition to an axial force, for testing US tips is an important for future in vitro investigations to make them more clinically relevant.

LOE: 5
**Title:** Qualitative analysis of the removal of the smear layer in the apical third of curved roots: conventional irrigation versus activation systems

**Author:** Blank-Goncalves, L et. al

**Journal:** JOE, vol. 37, No.9: 1268-1271

**Reviewer:** Anil Reddy Manda, DMD

**Purpose:** The aim of this study was to evaluate the effectiveness of different irrigant agitation techniques on smear layer removal in curved root canals. The smear layer contains dentin debris, organic remains such as pulp, odontoblastic process, and necrotic debris as well as microorganisms and their metabolic products. Currently syringe irrigation is a standard procedure using ethylenediaminetetraacetic acid (EDTA) and NaOCl.

**Materials and Methods:** Mesiobuccal canals of 62 extracted lower molars with a curvature of 33° were used and instrumented up to ProTaper F2. The samples were divided into 3 experimental groups according to the final irrigation: conventional irrigation, ultrasonic irrigation, and sonic irrigation by using the EndoActivator system. The control group was composed of 2 specimens without any final irrigation. In all of the experimental groups, 5mL of 17% EDTA was used for 1 minute, and 5 mL of 2.5% NaOCl was used for 30 seconds using a 30 gauge needle within 2mm of WL. The analysis of the apical region was performed via scanning electron microscopy by 3 examiners. The data were submitted to the Kruskal-Wallis and Dunn tests ($P<.05$).

**Results:** The activation systems removed significantly more smear layer than did conventional irrigation. In control group a thick smear layer covering the entire surface was observed and lack of open dentinal tubules.

**Conclusion:** Sonic and ultrasonic irrigation resulted in better removal of the smear layer in the apical third of curved root canals than did conventional irrigation.

**LOE:** 5
Title: *In vivo* host interactions with MTA and calcium hydroxide: inflammatory molecular signaling assessment

Author: Reyes-Carmona, et. al

Journal: JOE, vol. 37, No.9: 1225-1235

Reviewer: Hector Garcia, DMD

Purpose: Understand how MTA and Ca(OH)\(_2\) participate in the inflammatory, healing and biomineralization processes.

Materials and Methods:

- Human dentin tubes (n=165) were prepared from extracted human roots and were filled with proRoot MTA, Ca(OH)\(_2\) or kept empty (controls)
- Dentin tubes were then implanted in subcutaneous tissue in the back of rats (n=55)
- After 12 hours and 1, 3, 7, 15, 30 and 60 days of implantation in subcutaneous tissue in the back of mice, the tubes and surrounding tissue were retrieved
- Obtained samples were then prepared for cytokine level quantifications, histological and immunohistochemical analysis

Results:

- MTA and Ca(OH)\(_2\) induced proinflammatory cytokines (TNF alpha and IL-1β) upregulation for up to 3 days.
- IL-10 overexpression was noted on the tissues in contact with the biomaterials during the acute phase of the inflammatory reaction
- MTA and Ca(OH)\(_2\) elicited a similar response, but the greatest areas of coagulation necrosis occurred in tissues surrounding Ca(OH)\(_2\)
- Immunohistochemical analyses showed an increased expression of myeloperoxidase NF-KB, COX 2, nitric oxide synthase enzymes and VEGF on day one for all groups

Discussion: The study showed that both MTA and Ca(OH)\(_2\) induce a proinflammatory cytokine upregulation during the acute phase of the inflammatory response. Both materials are able to create a favorable environment for repair and healing, but MTA does it faster.

Conclusion: Sonic and ultrasonic irrigation resulted in better removal of the smear layer in the apical third of curved root canals than did conventional irrigation.

LOE: 5
Title: Critical diameter of apical foramen and of file size using the Root ZX apex locater: An in vitro study

Author: Herrera et al

Journal: JOE, vol. 37, No. 9:1306

Reviewer: Arwa Siyam, DDS

Purpose: To determine whether the accuracy of the Root ZX® apex locator is affected by widening of the apical foramen at 0.6mm, 0.7mm, 0.8mm, 0.9mm and 1.0mm and by using all possible file sizes ≥#10 with a view to determining which files and at what point the latter are no longer accurate.

Materials and Methods:

- 10 single rooted teeth with closed apices and straight canals were selected.
- The teeth were sectioned at the CEJ and actual length (AL) determined by inserting a #10 K file and visualizing its tip with a stereomicroscope at the apical foramen.
- The teeth were then inserted in an alginate mold and the canals instrumented at 1 mm beyond AL up to size 60.
- The working lengths were determined by using files from #10-#60.
- The canals were then enlarged to a size 70 and W.L determined by using files# 10-#70. This was then repeated for after enlarging the canals to sizes 80, 90 and 100.

Results:

- The values obtained with smaller file sizes were shorter than AL and gradually approached AL as the file size increased.
- These differences were not significant for an apical foramen diameter of 0.6mm, but were statistically significant for diameters 0.7-1.0mm.
- The Root ZX® is accurate in the ±0.5mm (87%) and ±1.0mm (99%) range error when the foramen size is 0.6mm regardless of the file size.
- In an apical foramen size of 0.7mm, the Root ZX® is accurate with a range error of ±0.5mm 84% of the time when a size 45 or larger file is used.
- With a tolerance of ±1.0mm the accuracy was 98% using files 45 or larger in 0.7mm diameter foramen, and 95% using files 70 or larger in an apical foramen size of 0.8mm.
- The measurements for diameters larger than 0.8mm were inaccurate.

Conclusion:

- The Root ZX® was accurate for an apical size of 0.6 mm independent of the file size.
- Between 0.7mm and 0.8 mm we should adjust the file size to the foramen.
- Above size 0.9mm the locator is not accurate.
- The accuracy of the locator is gradually lost as the foramen widens.

LOE: 5
Title: Shaping ability of reciprocating motion in curved root canals: A comparative study with micro-computed tomography

Author: Sung-Yeop You et al.

Reviewer: Hector Garcia, DMD

Purpose: Evaluate the shaping ability of reciprocating motion when compared with continuous rotation motion in curved root canals by using micro-computed tomography (micro-CT)

Materials and Methods:

- MB and DB canals of 20 extracted maxillary molars with curvatures of 20-45 degrees were instrumented with a series of ProTaper® rotary files.
- Canals in the continuous rotation motion (CM) group (n=20) were prepared by using continuous rotation with pecking motion.
- Canals in the reciprocating motion (RM) group (n=20) were prepared with reciprocating motion (clockwise 140 degrees and counterclockwise 45 degrees).
- Curvature, root canal volume, surface area, and structure model index (SMI) before and after canal shaping were evaluated by using micro CT.
- Degrees and directions of transportation were also measured.

Results:

- No significant differences between the two groups in canal curvature, volume, surface area, and SMI categories measured before preparation.
- Canal preparation resulted in a loss of canal curvature in both groups.
- Shapes of the canals became rounder in both groups after instrumentation.
- Changes in curvature, root canal volume, surface area, and SMI were not affected by the instrumentation technique used.
- There was no significant difference in the degrees and directions of apical transportation between CM and RM groups.

Conclusions: Application of reciprocating motion during instrumentation did not demonstrate any drastic differences when compared with continuous rotation. Reciprocating option might be an attractive alternative method to prevent procedural error during root canal shaping.

LOE: 5
Title: Comparison of the canal transportation and changes in canal curvature of two nickel-titanium rotary instruments

Author: El Batouty K and et al

Journal: Journal of Endodontics, 37(9):1290-1292, Sep 2011

Reviewer: Andrew Chang, DMD

Purpose: To compare the canal transportation and changes in canal curvature after canal preparation with two nickel-titanium rotary instruments: Twisted and K3 file systems.

Materials and Methods:

- 40 human mandibular molars extracted due to periodontal and prosthodontic reasons were chosen. Roots with angle curvature of 25-35 degrees were selected and separated into two groups for Twisted Files (TF) and K3 rotary file groups.
- #10 K-File was used for working length determination, after which a working length radiograph was taken.
- Canals were instrumented with crown down technique to working length at 350 rpm, torque control level of 3, using an 8:1 reduction handpiece.
- Final apical preparation was made to #30 in both groups.
- Post instrumentation radiographs were taken using the same platform as the working length radiograph.
- Difference in pre and post instrumentation angles was calculated using Schneider Method with Image J Software.

Results:

- TF mean pre-op canal curvature: 22.8 +/- 6.7
- TF mean post-op canal curvature: 22.1 +/- 5.5
- K3 mean pre-op canal curvature: 22.75 +/- 5.4
- K3 mean post-op canal curvature: 19.1 +/- 5.38
- The TF group had a 2.99 percent lower percentage of change in canal curvature than the K3 File.

Discussion: The TF system produced a significantly lower percentage of canal transportation than the K3 file system, and tends to preserve the original canal curvature better. (less straightening of the original canal)

LOE: 5
Title: Comparison of debris removal with three different irrigation techniques

Author: Howard R et al

Journal: JOE, Vol. 37, No. 9:1301

Reviewer: Arnav R. Mistry, DMD

Purpose: To compare the effectiveness of debris removal between EndoVac, PiezoFlow™, or needle irrigation (Max-i-Probe®) in the mesial roots of mandibular molars.

Materials and Methods:

- 30 extracted mandibular molars mesial roots were mounted in resin by using the K-Kube and then sectioned right angle at 2 and 4 mm from the apex.
- Specimens were re-instrumented to size #40/0.04 rotary files.
- For the teeth in the groups with needle irrigation only or PiezoFlow™, 1.0 mL of 6% NaOCl was used between each file to irrigate the canal to within 1 mm of the WL by using a Max-i-Probe®.
- For the EndoVac group, irrigation followed the manufacturer’s recommendations.
- Images of the canals and isthmuses were taken before final irrigation. The percentage of cleanliness for each canal and isthmus was calculated by using interactive software, Image J.
- The specimens were reassembled for final irrigation with EndoVac, PiezoFlow™, and Max-i-Probe® by using similar volumes of irrigants (8 mL of 6% NaOCl, 2 mL of 17% EDTA, followed by another 8 mL of 6% NaOCl)
- Images were again used to calculate cleanliness
- Comparisons of canal and isthmus cleanliness before and after final irrigation were made by using paired t tests, and the groups were compared with repeated-measures analysis of variance (P < .05).

Results: There were no statistically significant differences in canal and isthmus cleanliness among all 3 groups at 2 and 4 mm from working length before or after final irrigation. Canal and isthmus cleanliness significantly improved at all levels after the final irrigation regimen in each group.

Conclusions: Final irrigation by using EndoVac, the PiezoFlow™, or Max-i-Probe® with similar volumes of irrigants significantly improved canal and isthmus cleanliness. Also, depth and volume of irrigation are more important factors in removing debris and bacteria than the method used.

LOE: 5
Title: Comparative evaluation of propolis and triantibiotic mixture as an intracanal medicament against Enterococcus faecalis

Author: Madhubala, et al.

Journal: JOE 2011; 37: 1287-89

Reviewer: Christian Kecht, DDS

Purpose: To compare the antibacterial efficacy of ethanol extracts of propolis (a resinous product of honeybees), TAM (triantibiotic mixture), and calcium hydroxide against E. faecalis

Materials and Methods:

- 120 freshly extracted human max central incisors w/ mature apices
- Teeth decoronated 2 to 3 mm below the CEJ
- Canal prepared with Gates-Glidden drills and Hedstrom files
- Samples put 17% EDTA ultrasonic bath for 5 min, then 5.25% NaOCl for 5 min
- Apical foramen sealed with epoxy resin and samples mounted vertically in acrylic
- Samples inoculated with E. faecalis and incubated for 21 days at 37°C
- Microbial sampling done to establish level of contamination of each root
- Microbial samples plated and colonies counted
- Teeth randomly divided into the following medicament groups:
  1. Calcium hydroxide
  2. Ciprofloxacin, minocycline, and metronidazole
  3. Propolis
  4. Ethanol
  5. Saline
- Microbial sampling performed after 1, 2, and 7 days
- Microbial samples plated
- Antibacterial activity measured by % reduction in colony counts (%RCC)

Results:

<table>
<thead>
<tr>
<th></th>
<th>Calcium hydroxide</th>
<th>Triantibiotic mixture</th>
<th>Propolis</th>
<th>Ethanol</th>
<th>Saline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>24.94 ± 4.35</td>
<td>82.58 ± 3.77</td>
<td>92.54 ± 1.75</td>
<td>13.28 ± 2.07</td>
<td>1.1 ± 1.28</td>
</tr>
<tr>
<td>Day 2</td>
<td>39.06 ± 6.83</td>
<td>92.28 ± 4.16</td>
<td>100 ± 0.00</td>
<td>16.26 ± 1.71</td>
<td>1.33 ± 1.01</td>
</tr>
<tr>
<td>Day 7</td>
<td>59.42 ± 6.94</td>
<td>98.46 ± 1.46</td>
<td>100 ± 0.00</td>
<td>20.26 ± 1.50</td>
<td>1.9 ± 1.00</td>
</tr>
</tbody>
</table>

Conclusion: Propolis was more effective than TAM against E. faecalis at a 2-day time period, and both were equally effective at 7 days. Propolis and TAM were both more effective than calcium hydroxide.

LOE: 5
Title: Cleaning efficacy using two engine-driven systems versus manual instrumentation in curved root canals: A scanning electron microscopic study.

Authors: Zmener, O et al.


Reviewer: Daniel Cassis, DDS

Purpose: To evaluate the cleanliness of curved root canal walls instrumentation using two automated systems versus manual instrumentation.

Materials & Methods:

- 30 curved (20-30 degrees) mesial root canals of extracted mandibular 1st and 2nd molars were divided into 3 groups.
- 10 were instrumented with Endo-Eze® TiLOS™ hybrid engine-driven instrumentation. (#15 file to WL, then S1, S2, S3 to WL - 3mm, Then #20 to WL, then S1, S2, S3 to WL, then T1, T2, T3 to WL then NiTi files to desired apical sizes.)
- 10 were instrumented with ProTaper engine driven files series. (S1, SX, S2, F1, F2, F3)
- 10 were manually instrumented. (Gates, #30 hand file, Step back to #60 hand file)
- Irrigation with 5.25% NaOCl and 17% EDTA was kept constant across the groups.
- Teeth were split longitudinally and teeth were examined under SEM.
- Debris and smear layer scores were calculated at 1, 5 and 10 mm from the WL.

Results: There was no significant difference between the ProTaper and Endo-Eze® TiLOS™ system at any level, however there was significantly less debris between those two groups and the manual instrumentation group at all 3 levels. There were also significantly higher debris scores at 1mm compared to 5mm and 10mm from the WL for all the groups.

Discussion: The use of the ProTaper and Endo-Eze® TiLOS™ system achieved superior root canal cleanliness when compared to hand instruments.

LOE: 5