Title: Evaluation of the effect of *Enterococcus faecalis* biofilm on the 2% chlorhexidine substantivity: an *in vitro* study

Author: Bottcher D et al

Journal: JOE Vol 41(8): 1364

Reviewer: Christina Lee DDS

Purpose: To determine the correlation between the bacterial viability and the presence of 2% chlorhexidine on dentin after disinfection protocol.

Materials and Methods:

- 123 extracted human teeth: irrigated with 2.5% sodium hypochlorite and pulp remnants removed with a k-file, standardized dentin blocks were cut from the roots and smear layer removed with 2.5% NaOCl, 17% EDTA and final wash with distilled water
- 2 specimens were suspended with orthodontic wire in each tubes = 120 tubes * 2 specimens = 240 samples
  - Group 1a: 2% chlorhexidine + infected
  - Group 1b: 2% chlorhexidine + not infected
  - Group 2a: saline + infected
  - Group 2b: saline + not infected
  - Control: samples infected and not infected but no irrigant used
- Evaluation period of 48 hours, 7 days, 30 days by confocal laser scanning microscopy and high performance liquid chromatography. Confocal laser scanning microscopy analyzed the live/dead bacteria. Liquid chromatography quantified the amount of chlorhexidine retained.
- Statistical analysis performed

Results: After 48 hours and 7 days the 2% chlorhexidine group had significant reduction in the percentage of viable cells compared with saline. After 30 days the chlorhexidine group had an increase in viable cells similar to the saline group. Saline was ineffective at killing microorganisms. Chlorhexidine remained in dentin independent of the presence of microorganisms. After 30 days the remaining chlorhexidine was significantly reduced.

Conclusion: A negative correlation was determined between the percentage of live cells and the amount of remaining chlorhexidine (as remaining chlorhexidine decreases the percentage of viable cells increase).

LOE: 5
Title: The effect of surfactants on the stability of sodium hypochlorite preparations

Author: Guastalli A et al


Reviewer: Michelle Jordán DMD

Purpose: To examine the stability of current commercially available NaOCl preparations over a long period of time with regard to free available chlorine (FAC), pH, viscosity, and surface tension by comparing products with and without surface-active agents.

Materials and Methods:

- Five NaOCl preparations were used: two without added surfactant => Vista 6% and Hypocelle 4% Forte plain, two with surfactant => Chlor-XTRA 6% and Hypocelle 4% Forte and one domestic chlorine-based bleach (White King Lemon [WKL])
- FAC was assessed using the iodometric titration assay. Each solution was measured 3 times at 20°C and measurements were taken at different days
- pH was measured using a portable meter/probe system. Each sample was measured 3 times at 20°C and measurements were taken at different days
- Viscosity analysis was performed with Haake MARS III rotational rheometer. Measurements were taken at altered days.
- Surface tension was examined using the pendant drop method. At 20°C measurements were taken at different days.
- Bonferroni test was used for comparisons and to evaluate the presence of surfactant from the same manufacturer. Correlation analysis using linear regression techniques was performed to test the impact of time on FAC, also they examined if their degradation is homogenous in all preparations and the effect of surfactant on the preparations.

Results: All samples showed a decreased in FAC over time. Vista 6% showed a lower loss than Hypocelle 4% Forte that had the largest loss of FAC. Overall pH in samples revealed a general decline over time. Changes in viscosity were seen in all samples. Vista 6% plain, Chlor-XTRA 6% and Hypocelle 4% Forte plain showed a slow increase over time. Hypocelle 4% Forte presented a decrease in viscosity same as WKL at the end of the experiment. Preparations with surfactants demonstrated a dramatically lower surface tension values

Conclusion: A significant reduction in FAC occurs with the addition of surfactants to the preparations intended for endodontics procedures. For endodontic use, surface tension decrease is not related to changes in the tissue dissolution effect of NaOCl preparations.

LOE: 5
Title: Effects of ultrasonic activation of irrigants on smear layer

Author: Schmidt T et al.

Reviewed: Xiomara Y. Rivera DMD


Purpose: To evaluate the efficacy of passive ultrasonic irrigation (PUI) with 17% EDTA and 1% Sodium Hypochlorite (NaOCl) on smear layer removal.

Material and Methods:

- 32 human premolars (Extracted from patients between 13-17 years old) with straight or slightly curved canals were used
- Working length was obtained by introducing a #10 file into the canal and out of the apical foramen and subtracting 1mm.
- Apical region was sealed with impression material to stimulate clinical conditions.
- Canal preparations were done using rotary instrument (ProTaper Universal).
- Canals were irrigated with 2mL 1% NaOCl between each file.
- Teeth were sectioned longitudinally and coronal, mid, and apical thirds evaluated under scanning electron microscope (SEM) to assess the amount of open dentinal tubules
- Resin was used to stabilize the parts back together.
- Teeth were randomly divided into 4 groups according to the final irrigation protocol: control (NaOCl+EDTA), PUI EDTA+NaOCl, PUI NaOCl+EDTA, PUI EDTA + PUI NaOCl.
- Ultrasonic non-cutting tip #20 with a 0.01 taper was used 1mm short of WL to activate irrigant.
- All groups received 3mL of 17% EDTA for 3 mins. and 3mL of 1% NaOCl for 3 mins.
- Teeth were again separated in half and analyzed under SEM

Results: In all 4 groups, greater percentage of open dentinal tubules was observed in the cervical third, followed by middle and apical thirds. PUI EDTA had the highest percentage of smear layer removal. PUI EDTA + PUI NaOCl had the lowest percentage of smear layer removal. No significant differences found among the other groups.

Conclusion: According to the results, is can be concluded that PUI does not show higher efficacy in smear layer removal compared with conventional irrigation.

LOE: 5
Purpose: Varicella zoster virus (VZV) causes varicella and herpes zoster infection (HZI). After primary infection of erupting vesicles the virus moves to the ganglion and remains latent. Once reactivated it develops into HZI and produces painful vesicles in the skin of the affected sensory nerve, and once healed no scars are left. VZV serves as an etiological factor for the development of internal root resorption, diabetes mellitus type 1 and thyroiditis.

Materials and Methods:

- Used Pubmed, MEDLINE and ResearchGate
- Inclusion criteria:
  1) Human study of 1 individual with a medical history of VZV and later developed diabetes mellitus type 1 and thyroiditis
  2) Study includes internal root resorption involving different quadrants and erosive lichen planus.
- Periapical radiographs revealed internal resorption in the coronal thirds of #5, 6 and generalized internal resorption on #18 and #31 figure 2-3
- Teeth #5, 18 and 31 were symptomatic in response to EPT and cold testing. Tooth #6 responded normally.
- After debridement, irrigation and calcium hydroxide placement for 1 week obturation was completed on #5 and 6 with lateral condensation up to the resorbed areas followed by warm vertical compaction technique. Warm vertical compaction done in relation to #18 and 31

Results: Human study was placed on 6 month recalls to determine if any internal root resorption or pathology arises. No pathology was present at 6 month and 1 year follow up

Conclusion: Widely accepted theory of resorption occurs when the infected coronal pulp tissue forms apical granulation tissue. A review of this study shows the severity of internal root resorption when the patient has VZV. This study showed the affiliation of VZV with internal root resorption, diabetes mellitus type 1 and thyroiditis. No other studies have linked VZV with these complications

LOE: 5
Title: Selective root retreatment- A novel approach

Authors: Nudera W

Journal: JOE Vol. 41, No. 8, 1382

Reviewer: Aaron Salimnia DDS

Purpose: Selective Root Retreatment is nonsurgical retreatment with the ability to do root resection in relation to the affected root. In this case report an untreated canal in relation to the distal lingual root of a molar is treated while the other treated canals are left untouched. The ‘all or none’ phenomenon applies to nonsurgical treatment where all the restorative materials are removed regardless of the presence or absence of pathology. This phenomenon doesn’t apply to surgical retreatment since only the affected root is treated.

Materials and Methods:

- Used Pubmed, Researchgate, and MDLinx
- Inclusion Criteria
  1) The study included failed treatment of a previously root canal treated tooth in relation to tooth #18
  2) Pathology present in relation to a single root of a multirooted canal
  3) Study included CBCT to confirm the presence of untreated canal and presence of a pathology- See Figure 2
- Preoperative measurements were taken with the CBCT from a coronal view- See Figure 3
- Distal lingual root of #18 was accessed, debrided, irrigated and obturated while the other canals were not retreated- See Figure 4

Results: After 1 year follow up periapical radiograph and CBCT were taken. Complete healing was evident and patient was symptom free

Conclusion: Conservative treatment can be as effective as other treatment alternatives in certain circumstances as described in this study. Only a few alternatives are available for retreatment cases such as nonsurgical retreatment, surgical retreatment or extraction. In complex situations CBCT allows for more precise endodontic diagnosis and treatment decisions. This study states that CBCT is necessary to decide whether to do selective root retreatment.

LOE: 5
Title: Use of cone beam computed tomography in endodontics 2015 update

Authors: AAE and AAOMR Joint Position Statement

Reviewer: Hari P Chebrolu DMD

Introduction: Endodontic disease adversely affects quality of life and can produce significant morbidity in afflicted patients. Radiography is essential for the successful diagnosis of odontogenic and non-odontogenic pathoses, treatment of the root canal systems of a compromised tooth, biomechanical instrumentation, evaluation of final canal obturation, and assessment of healing. These radiographic technologies provide two-dimensional representations of three-dimensional anatomic structures. The advent of CBCT has made it possible to visualize the dentition, the maxillofacial skeleton, and the relationship of anatomic structures in three dimensions. However, CBCT should not be used routinely for endodontic diagnosis or for screening purposes in the absence of clinical signs and symptoms. Clinicians should use CBCT only when the need for imaging cannot be met by lower dose two-dimensional (2D) radiography. CBCT should be used only when the patient’s history and a clinical examination demonstrate that the benefits to the patient outweigh the potential risks.

Field Of View (FOV): For most endodontic applications, limited FOV CBCT is preferred to medium or large FOV.
Dose Considerations: Because radiation dose for a CBCT study is higher than that for an intraoral radiograph, clinicians must consider overall radiation dose over time.
Interpretation: If a clinician has a question regarding image interpretation, it should be referred to an oral and maxillofacial radiologist.

Recommendations:

Diagnosis

Recommendation 1: Intraoral radiographs should be considered the imaging modality of choice in the evaluation of the endodontic patient.
Recommendation 2: Limited FOV CBCT should be considered the imaging modality of choice for diagnosis in patients who present with contradictory or non-specific clinical signs and symptoms associated with untreated or previously endodontically treated teeth.

Initial Treatment

Preoperative:

Recommendation 3: Limited FOV CBCT should be considered the imaging modality of choice for initial treatment of teeth with the potential for extra canals and suspected complex morphology, such as mandibular anterior teeth, and maxillary and mandibular premolars and molars, and dental anomalies.

Intraoperative:

Recommendation 4: If a preoperative CBCT has not been taken, limited FOV CBCT should be considered as the imaging modality of choice for intra-appointment identification and localization of calcified canals.

Postoperative:

Recommendation 5: Intraoral radiographs should be considered the imaging modality of choice for immediate postoperative imaging.

Non-surgical Retreatment

Recommendation 6: Limited FOV CBCT should be considered the imaging modality of choice if clinical examination and 2D intraoral radiography are inconclusive in the detection of vertical root fracture (VRF).
Recommendation 7: Limited FOV CBCT should be the imaging modality of choice when evaluating the non-healing of previous endodontic treatment to help determine the need for further treatment, such as non-surgical, surgical or extraction.
Recommendation 8: Limited FOV CBCT should be the imaging modality of choice for non-surgical re-treatment to assess endodontic treatment complications, such as overextended root canal obturation material, separated endodontic instruments, and localization of perforations.

Surgical Retreatment

Recommendation 9: Limited FOV CBCT should be considered as the imaging modality of choice for pre-surgical treatment planning to localize root apex/apices and to evaluate the proximity to adjacent anatomical structures.
Title: A comparison of different volumes of articaine for inferior nerve block for molar teeth with symptomatic irreversible pulpitis.

Author: Abazarpoor R et al

Journal: JOE, Vol.41, No.(9) 1408

Reviewer: Alshammari Abdulaziz DDS

Purpose: The study compared the success rate of 1.8ml and 3.6ml Articaine inferior nerve block (IANB)

Material and Methods:
- Inclusion criteria: healthy adult 18-65 year old mandibular first molars with symptomatic irreversible pulpitis and normal periapical radiograph.
- Teeth were tested by EPT and Cold test.
- Exclusion criteria: Sensitive teeth, patients who were pregnant or had systemic disease.
- Two groups: group 1) take IANB 1.8ml Articaine and mock injection , group 2) take 3.6 ml Articaine with first practitioner and the other practitioner do the cold test, access cavity and instrumentation
- Heft- Parker visual analog pain scale (VAS) was used.

Results: No side effects were found in the patients like syncope, CNS reaction, cardiovascular or allergic reaction. No significance difference in sex or age in both groups. The success rates were: group 1 (27.5%) and group 2 (77.5%). No difference during dentin penetration and root canal instrumentation however group 1 have more pain in exposed to pulp

Conclusion: The study showed the higher success rate in the 3.6ml Articaine for IANB injection than 1.8 ml Articaine however it may require supplemental anesthetic techniques to get complete pain control.

LOE: 2
Title: Direct pulp capping with calcium hydroxide or mineral trioxide aggregate: A meta-analysis

Author: Li Z et al

Journal: Journal of Endodontics Vol 41 (9): 1412-1417

Reviewer: Salome Masrani DDS

Purpose: The meta-analysis was done to compare the overall success, dentin bridge formation, and inflammatory response in teeth that had received direct pulp capping with either mineral trioxide aggregate (MTA) or Calcium hydroxide (Ca(OH)$_2$) and establish an alternative medicament. Direct Pulp Capping is the procedure of placing a medicament that will promote healing directly on the site of an exposure. Calcium hydroxide has been considered the “gold standard” material. However, Ca(OH)$_2$ can cause pulp surface inflammation, necrosis, tunnel defects in the dentin bridge leading to microleakage, is soluble in oral fluids, lack of adhesion and degradation. MTA is an aggregate of tricalcium silicate, dicalcium silicate, tricalcium aluminate, and bismuth oxide (radiopacity). MTA’s advantages include a more homogenous and thicker dentinal bridge, decreased inflammatory response and necrosis. However, disadvantages include discoloration, difficult handling, long setting time and difficulty in removal.

Materials and Methods:

- Used PubMed, Cochrane Library, Embase, and Web of Knowledge databases
- Inclusion Criteria: Randomized controlled trials, retrospective non-randomized trials; in vivo studies; studies comparing MTA and Ca(OH)$_2$; studies in which the success, inflammatory response, and dentin bridge were recorded.
- Exclusion Criteria: in vitro studies, experimental studies performed on animals or primary teeth, absence of a comparison of materials
- Extracted Data: author, year of publication, country of origin, study design, number of teeth, tooth type, success, inflammatory response, dentin bridge formation
- Quality Appraisal: Cochrane Collaboration’s tool for assessing risk of bias
- Statistical analysis using Revman 5.0 software

Results:

- Included studies: 10 RCTs, 3 RNTs included resulting in 673 cases and 536 controls on human premolars and third molars
- Low risk detection bias determined using Cochrane Collaboration’s tool for assessing risk of bias; publication bias due to increased publication of statistically significant results, use of 4 databases with language restriction
- Success Rate: Defined as showing no signs or symptoms including spontaneous pain, tenderness upon percussion, swelling, fistulation, pathological mobility, furcation radiolucency, PDL widening, or root resorption
  - 5 articles included; used Fixed Effects Model
  - MTA higher success rate than Ca(OH)$_2$-capped group
- Inflammatory Response: 9 studies used; Fixed Effects Model
  - Incorporated histologic analysis
  - MTA significantly less inflammation
- Dentin Bridge Formation: 9 studies used; MTA groups higher area of dentin bridge formation

Conclusion: Direct pulp capping serves to allow injured pulp to heal through stimulating a dentin bridge formation. Bridge formation serves to provide a defense to the pulp from further injury. MTA provided a more predictable result in regards to inflammation, success rate, and dentin bridge formation. Calcium hydroxide may no longer be considered the ”gold standard” material.

LOE: 2
Title: Evaluation of four different irrigating systems for apical extrusion of sodium hypochlorite

Author: Yost R et al

Journal: Journal of Endodontics Vol 41(9): 1530-1534

Reviewer: Michelle Jordán DMD

Purpose: To compare the potential for apical extrusion of NaOCl when using Endo Vac, EndoActivator, Max-i-Probe, and PIPS/PHAST tip 10 mJ and 20 mJ (photon induced photoacoustic streaming/photo hydroacoustic systems technology) during final irrigation in a closed system in vitro model.

Materials and Methods:

• 18 extracted human mandibular incisors and 18 human maxillary incisors were used.
• Inclusion criteria: one canal, minimum WL measurement of 20mm, straight roots with less than 15% curvature, closed apex, absence of cracks or apical resorption
• Teeth were accessed with #2 round bur, coronal flaring was done with #2,#3,#4 Gates Glidden burs. WL was established 1mm short of where #15 K-file became visible at the apical foramen.
• Mandibular incisors instrumented to ISO 35/.04 and maxillary incisors to 55/.04 with a crown down technique. Followed by LightSpeed LSX files were used in the canal by hand to gauge the non-instrumented apical foramen.
• Teeth were submerged in 5% sodium thiosulfate for 2 min. followed by intracanal irrigation of 5% sodium thiosulfate to neutralize the NaOCl. Final 5 mL irrigation with phosphate buffered saline (PBS) was done.
• Teeth were embedded in the prepared gels (0.2% agarose gel containing 0.1% m-cresol purple) to the level of the CEJ and teeth were secured in position by using self-curing resin and allowed to cure for 3 hours before testing.
• All 4 irrigation systems were tested according to the manufacturer’s irrigation instructions. Passive extrusion groups were used as negative control
• Images were captured before irrigation and 3 min after the final irrigation. Analyzed using ImageJ software to determine the extend of the extrusion.

Results: No significant differences between EndoVac and EndoActivator were seen. Average extrusion of 10 mJ PIPS/PHAST was less than 20mJ. EndoVac displayed extremely less extrusion compared with PIPS/PHAST and Max-i-Probe groups. 10mJ and 20mJ PIPS/PHAST was not quite different than Max-i-Probe group. EndoActivator group revealed significantly less extrusion than 10mJ and 20mJ PIPS/PHAST group but was not significantly different than Max-i-Probe group.

Conclusion: The study did not find significant differences in ISO 35/.04 and 55/.04 when tested with the same irrigation system. EndoVac and EndoActivator showed the lowest potential for apical extrusion of the irrigant. EndoVac displayed significantly less extrusion compared with PIPS/PHAST and Max-i-Probe groups.

LOE: 5
Title: Influence of eugenol-based sealer on push-out bond strength of fiber post luted with resin cement: Systematic review and meta-analysis

Author: Altmann A et al.

Journal: JOE, Vol 41(9): 1418-1423

Reviewer: Salar Sanjari DDS

Purpose: Eugenol base sealers still used in endodontics. It is proposed that when eugenol comes in contact with free radicals of a resin cements, inhibition of polymerization can occur. However, it is unclear if the presence of eugenol impairs the retention of fiber posts cemented using resin cement. This study used meta-analysis to find evidence of eugenol impairment of fiber posts cemented using resin cement.

Materials and Methods: Systematic electronic search PubMed, Scopus, Lilacs and Web of Science (Fen 2015) were used. No language filter was done. Selected papers that assessed the immediate push-out (apex to crown direction) strength of posts cemented to root dentin after removal of eugenol based sealer were compared with eugenol free group.

- Excluded studies with performance of any kind of ageing process. 2 reviewers involved
- Additionally reviewers collected following information from authors: tooth type, endo sealer, eugenol contact time, type of resin cement, type of fiber post, storage time, sample size, mean bond strength, and standard deviation.
- Articles where then categorized to high, medium and low risk based on answers to following questions (high risk no answer to 5 or more, medium 4-3 and low 2 or less):
  - Screening for caries and crack on teeth
  - Straight root
  - Tooth storage media before test
  - Tooth randomization
  - Single operator
  - Use of material according to manufacturers’ instructions

Results: Nine articles selected to be included in the study from the total of 24 papers. Seven had low bias, one medium and one high. Two papers were based on bovine teeth and the other 7 used human teeth. Endofill (DENTSPLY) was the most commonly used sealer. The mean sample size was 40 specimens per study. Global analysis indicated that eugenol sealers significantly decrease bond strength of the post (P<0.001) with a mean difference of 0.80MPa.

Conclusion: Eugenol base sealers decrease the bond strength of resin posts cemented using resin cements. Authors recommend the bond will even loose more strength over time and that eugenol based cements should be avoided if resin cementation of the post is part of the restorative plan.

LOE: 2
Title: Ethnicity and pathways of fear in endodontics

Author: Carter A et al

Journal: JOE Vol 41(9): 1437

Reviewer: Christina Lee DDS

Purpose: To identify the most common pathways of fear related to endodontic therapy in different ethnic groups of one multicultural society. There are five pathways related to dental fear: conditioning, parental, informative, verbal threat, and visual vicarious. Conditioning comes from direct dental traumatic experiences. Parental is dental fear learned from parents/guardians. Informative comes from fearful experiences learned/heard from others. The verbal threat pathway uses the dental environment as punishment for bad behavior in children. Visual vicarious is dental fear caused by fear-inducing dental situations seen in the media.

Materials and Methods: Patients visiting Griffith University Dental Clinic, Gold Coast, Australia were asked to answer a questionnaire if they had undergone root canal therapy or were scheduled to and met inclusion/exclusion criteria. Participants were separated into four ethnic groups: White, East Asian, Aboriginal/Pacific Islander, or Arab/African. Participants completed the “My Endodontic Fear” questionnaire (developed by Carter et al in an earlier study)

Results:

- 879 participants 20-90 years old
- 253 participants used more than 1 pathway as the origins of their dental fear
- Patients aged 40-64 and 65+ were less fearful than the 20-39 age group
- 54.5% of whites used the conditioning pathway most commonly
- Most common for the East Asian group was visual vicarious, Aboriginal/Pacific Islander was the parental pathway, and for the Arab/African group was the parental pathway

Conclusions: Different pathways of dental fear are adopted by different ethnic groups. Dentists should understand the variable origins of patients’ fear in order to adopt management strategies that are individualized.

LOE: 5
Title: Advanced caries microbiota in teeth with irreversible pulpitis

Authors: Rocas Iet. al

Journal: JOE Vol. 41 (9); 1450-1455

Reviewer: Jeffrey Yui DDS

Purpose: To evaluate the prevalence of several caries and endodontic bacterial pathogens in the most advanced layers of dentinal caries in teeth with irreversible pulpitis.

Materials and Methods:

- 30 patients with deep occlusal caries and irreversible pulpitis selected
- Teeth were isolated with rubber dam and disinfected with 2.5% NaOCl
- Deepest layer of dentinal caries in direct contact with pulp were collected with a spoon excavator; DNA from the samples were extracted
- Reverse-capture checkboard assay used to analyze for presence and relative levels of 33 oral bacterial taxa
- Total bacteria load and levels of streptococci and lactobacilli were quantified using quantitative PCR
- The presence and absence of bacteria was analyzed in relation to clinical signs and symptoms by using the Fisher exact test

Results:

- Of the taxa targeted in the checkerboard, the most prevalent were: 
  Atopobium genomospecies (53%), Pseudoramibacter alactolyticus (37%), Streptococcus species (33%), S. mutans (33%), P. micra (13%), F. nucleatum (13%), Veillonella (13%)
- Association found for S. mutans with pain to percussion; P. micra and Dialister invisus for throbbing pain
- Lactobacillus occurred in cases with continuous pain
- Analysis revealed a mean total bacterial load of 1x10^8 cell equivalents per mg of dentin

Discussion: Bacteria present in the advanced front of carious dentin can be considered as etiologically significant in the development of pulpitis. Some of them were significantly associated with symptoms. Knowledge of the microbiota involved in irreversible pulpitis may be invaluable for the development of therapeutic approaches to improve the predictability of pulp therapy. The use of antimicrobial agents that selectively target the species associated with irreversible pulpitis may open new perspectives on the conservative treatment of teeth with this condition.

LOE: 4
Title: Patient-centered outcomes of root canal treatment: A cohort follow-up study

Author: Montero J et al.

Reviewer: Xiomara Y. Rivera DMD

Journal: Journal of Endodontics, Volume 41, Number 9, September 2015, pp1456-1461

Purpose: To evaluate the impact of pulpal pathology on oral health-related quality of life and root canal treatment in terms of pain during and at 7 days after treatment.

Materials and Methods:

- 250 patients requiring at least one root canal treatment (RCT)
- 57% female with mean age of 46 years
- Socio-demographic and clinical data of patients were collected.
- Impact on the quality of life was recorded via a 14 items questionnaire (Oral Health Impact Profile- OHIP).
- Manual instrumentation and lateral condensation were done.
- Pain and discomfort before, during and after the procedure were quantified with Visual Analog Scale (VAS) from 0-10 (none-intolerant)

Results:

- Quality of life:
  - Pain and psychological dimensions were affected the most at baseline
  - Men reported more pain and functional limitations
  - Older individuals had greater physical and psychological disabilities
  - Molars generate the most severe impact on the patients quality of life
- Necrotic teeth had significantly less intra- and postoperative pain than vital teeth.
- Before Procedure: 41.2% of patients reported a lot of pain
- During Procedure: 62% of patients did not feel any pain
- After Procedure (at day 7): 60.4% reported slight post-treatment pain
- In 64% of cases post-treatment medication was prescribed
- Preoperative pain was correlated with intraoperative pain but not with postoperative pain
- Intraoperative pain was directly correlated with postoperative pain
- Patients with little pain at baseline had the lowest postoperative pain.

Discussion: Oral health-related quality of life is compromised in patients requiring RCT, mainly in the pain and psychological discomfort domain. At 7 days after RCT patients usually report total or partial reduction of pain. Severity of preoperative and postoperative pain depends on the pulpal status.

LOE: 4
Title: Oxygen saturation in dental pulp of permanent teeth: Difference between children/adolescent and adults.

Author: Stella J et al

Journal: JOE, Vol.41, No(9):1445

Reviewer: Alshammari Abdulaziz DDS

Purpose: Use a pulse oximeter to measure oxygen saturation values in permanent teeth with normal pulp in two groups of patient is different ages to use as reference.

Material and Methods:

- Cross-sectional, Observational study.
- Inclusion criteria: Normal healthy maxillary central incisors (no caries, restoration and sign of necrosis) good general health status, no systemic diseases and not use systemic medication.
- Exclusion criteria: Presence of Fistula, edema, darkened crown, mobility or history of trauma.
- Sample 110 teeth composed 54 teeth from 28 children/adolescents aged 7-13 years. (12 males, 16 females). 56 teeth from 29 adults aged 22-36 years (17 males and 23 females).
- After full mouth cleaning use handheld pediatric pulse oximeter with stainless steel adapter fabricated specially to the tooth.
- Light emitting diode is placed in contact to the Buccal surface of the tooth and the receptor to the Palatal surface.
- Oxygen measured twice for each tooth with interval for 30 seconds and mean value recorded.
- Other measures (Variables): Heart rate, oxygen saturation for index finger, tooth crown dimension and oximeter reading time.

Results: Overall mean oxygen saturation for the entire sample was 81.25% ±8.19%. The mean oxygen saturation level for the children and adolescent group (84.3%) show higher than adults (77.8%) and the female (82.9%) is higher than male(79.3%). No correlation between the oxygen saturation and the finger, tooth crown dimension and heart rate or oximeter time.

Conclusion: Oxygen saturation values measured in maxillary central incisors using a pulse oximeter found the children/adolescents have higher level than adults.

LOE: 4
Title: Proximity of premolar roots to maxillary sinus: A radiographic survey using cone-beam computed tomography

Author: von Arx T et.al

Journal: JOE, volume 40, number 10; 1541-1548

Reviewer: Shin-Chieh Yang DMD

Purpose: The anatomic relationship between the teeth and the maxillary sinus has been a constant challenge in dentistry, in particular for endodontics as well as for extraction of posterior maxillary teeth. This study performed a detailed analysis of the radiographic relationship between the apices of maxillary premolars and the floor of the maxillary sinus using CBCT imaging. A correlation of the data with age, sex, side of evaluation, and status of premolars will be made.

Materials and Methods: CBCT images of the maxilla taken from October 2012 to July 2013 were retrospectively evaluated.

- CBCT images of 192 patients were reconstructed with slices at an interval of 0.5 mm in sagittal, coronal, and axial planes to quantify the distances between the root apices of the maxillary premolars and the adjacent maxillary sinus.
  - Shortest vertical/oblique distance from the root apex of any buccal, palatal of premolars to the closest border of the maxillary sinus in sagittal and coronal view.
  - Shortest horizontal distance from the root apex of any buccal, palatal of premolars to the closest border of the maxillary sinus.
- Measurements were taken for each root, and data were correlated with age, sex, side and presence of both or absence of 1 of the 2 premolars.
- Cases presenting with the following findings were excluded from the study
  - Premolars showing periapical or periradicular lesions.
  - Status after sinus floor elevation
  - Foreign material in the region of interest
  - Images with artifacts such as motion, beam hardening or scatter

Results: A total of 296 teeth (177 first and 119 second premolars) in 192 patients were evaluated. The mean distances from the buccal and palatal roots of both premolars to the border of the maxillary sinus. In the sagittal and coronal plane, the palatal roots were about 1 mm closer to the maxillary sinus floor than the buccal roots. Measurements obtained in the coronal planes were always greater than those in the sagittal planes, indicating the maxillary sinus is gradually ascending anteriorly over the premolars. Comparing axial and sagittal measurements, higher values in the axial plane shows that the maxillary sinus is closer to the apices in the vertical than in the horizontal dimension. Comparing coronal and axial measurements, coronal values were higher than axial values, reflecting maxillary sinus moves away from the root apices (pyramidal shape with its base medially and apex laterally). The frequency of a premolar root protrusion into the maxillary sinus was very low in first premolars (0-7.2%), but higher in second premolars (2.5-13.6%). Gender, age, side, and presence / absence of premolars failed to significantly influence the mean distances between premolar roots and the maxillary sinus.

Conclusion: Palatal roots of first premolars were always located close to the maxillary sinus than buccal roots irrespective of the CBCT plane. Roots of second premolars were positioned much closer to the sinus than roots of first premolars. Protrusion of roots inside the maxillary sinus was rare in first premolars and low in second premolars. Gender, age, side and absence of 1 premolar failed to have a significant effect on the mean distance between premolar roots and the border of the maxillary sinus.

LOE: 4
Title: Effects of in vitro osteogenic induction on in vivo tissue regeneration by dental pulp and periodontal ligament stem cells

Author: Cha Y et al

Journal: Journal of Endodontics Vol 41(9): 1462-1468

Reviewer: Michelle Jordán DMD

Purpose: To examine the regeneration effects from predifferentiated dental pulp stem cells (DPSCs) and periodontal ligament stem cells (PDLSCs) with different periods of time.

Materials and Methods:
- 16 human permanent teeth were extracted for dental treatment. The pulp and PDL tissues were subjected to primary culture.
- Explants were cultured in growth medium. The cells were assigned to one of three groups: 0 (control), 4 and 8 days.
- Cells in the 4-day group were cultured in growth medium for 4 days and then exposed to the odontogenic/cementogenic medium for the subsequent 4 days.
- Those in the 8-day group were cultured in the odontogenic/cementogenic medium for 8 days.
- Cells in the 0 day group were not exposed to odontogenic/cementogenic stimuli.
- The cells were transplanted via biphasic calcium phosphate (MBCP) into the dorsal surface of immunocompromised mice. The cells were harvested for 9 weeks and then analyzed by histology and immunohistochemistry.
- DPSC were immunostained for dentin sialoprotein (DSP) and osteocalcin (OC). Whereas the PDLSC were immunostained for collagen type XII (Col XII) and OC.
- Alkaline phosphatase activity (ALP) was measured using SensoLyte ALP assay kit.
- PCR was used to analyzed the expressions of the different genes in DPSC (DSPP, DMP1, RUNX2, OC) and PDLSC (RUNX2, OC, COL XII, CP23, POSTN).

Results: In DPSC the amount of new tissue was similar in all groups. Predifferentiated DPSCs generated hard tissue closer to dentin than undifferentiated transplants. The expression of OC and DSPP was significantly higher in predifferentiated groups than in undifferentiated transplants. ALP activity did not differ significantly between groups. In PDLSC the newly formed hard tissue exhibited a fibrous matrix resembling cementum. Also the expression of genes POSTN, CP23 and Col XII were highest in the 8-day group. ALP activity was significantly higher in the 4 and 8 groups.

Conclusion: DPSCs and PDLSCs that had been predifferentiated in vitro for 8 days were as effective at generating new tissues transplanted in vivo as those that had been predifferentiated for 4 days and transplanted. Predifferentiated PDLSCs appeared to generate higher quality and more tissue for dental regeneration than their undifferentiated counterparts.

LOE: 5
Title: Bioaggregate inhibits osteoclast differentiation, fusion, and bone resorption in vitro

Author: Tian, J. et al.

Journal: JOE, Volume 41, Number (9): 1500

Reviewer: Salome Masrani DDS

Purpose: In this study, Bioaggregate extract (BA) is used to examine its effects on Osteoclasts (OC) precursor cells in terms of migration, fusion, and resorptive activity. Osteoclasts are derived from hematopoietic stem cells through the monocyte/macrophage lineage. Mononuclear precursors migrate and fuse to form multinucleated osteoclasts. Osteoclast differentiation is dependent on RANKL. RANKL is produced by osteoblasts and activated by T cells. Through binding of RANKL to RANK (receptor), the TRAF6-NFκB-NFATc1 signaling pathway is initiated resulting in the expression of osteoclast specific genes for differentiation and resorptive activity. Bioaggregate (Innovative Bioceramix, Canada) is a nanoparticulate bioceramic. It is composed of calcium silicates, calcium phosphate, amorphous silicon oxide, and tantalum oxide as a radiopacifier. It is considered an alternative for MTA and can be used for root end fillings, perforation repair, capping and pulpotomy procedures. It is biocompatible, osteoconductive and suppresses osteoclast differentiation and resorption.

Materials and Methods:

- BA extract was prepared according to manufacturer’s directions, under sterile conditions. 25% and 50% dilutions were created in Dulbecco’s Modified Eagle’s Medium (DMEM)
- The composition and ions released were analyzed using inductively coupled plasma optical emission spectrometry
- Cell Culture: OC Precursor cells were cultured with RANKL for 4 days; cell fusion seen at 2.5 days
- Cell Proliferation Assay: OC Precursor cells seeded with and without BA and evaluated at 1, 2, 3, 4 days using Cell Counting Kit-8 (CCK-8)
- Tartrate Resistant Phosphatase Staining: Cell culture was stained with TRacP -> TRacP(+) cells with 3 or more nuclei were classified as osteoclasts and fusion index was calculated
- Transwell Cell Migration Assay: OC Precursor cells inserted into permeable Transwell supports (allow migration through pores) and seeded with Growth medium containing sRANKL and BA extract and incubated
- Resorption Pit Assay: Cells cultured in dentin disks for 4 days with BA extract; after cells removed, resorption pits were measured using ImageJ
- Western Blot Analysis: Nuclear and cytoplasmic proteins extracted; Primary antibodies used: anti-RANK, anti-TRAF6, anti-DC-STAMP, anti- NFκB, anti-c-Jun, anti-actin; Secondary antibody: Horseradish peroxidase-conjugated IgG
- Enzyme-linked Immunosorbent Assay for NFATc1 Activation Detection: activation of NFATc1 in nuclear extract
- Statistical Analysis: All experiments performed at least 3 times; 1-way analysis of variance; Student-Newman-Keul Test, P<0.05 statistically significant

Results:

- BA extract is composed of Si, Sr, Ca, P, Fe, K, Mg, Na, Zn ions and has a pH of 8.15, which decreases with dilution
- BA dose dependently inhibits osteoclastogenesis, but is not cytotoxic
- BA inhibits migration of cells, therapy reducing fusion index, dose dependently. Decreased expression of DC-STAMP, which is required for cell-fusion.
- BA inhibits mineralized tissue resorption by down-regulating Cathepsin K, which is the primary protease mediating destruction
- Decreased expression of RANK and TRAF6, thereby, decreased translocation of active NFκB to nucleus of Precursor OC cells, and reduced expression of NFATc1, the master transcription factor for OCG

Conclusion: Bioaggregate directly inhibits differentiation of precursor OC cells to mature osteoclasts and bone resorption. No toxic elements were detected, which supports the biocompatibility of BA. Previously, Biosilica has been shown to inhibit OCG by increasing Osteoprotogerin expression in Osteoblast-like cells. Si as well as Sr has been shown to inhibit OC formation, differentiation, and activity. The effect of BA on OCG may be due to its composition as well as alkalinity.

LOE: 5
Title: *Ex vivo* evaluation of the accuracy of electronic foramen locators in root canals with an obstructed apical foramen

Author: de Vasconcelos B et al.

Reviewer: Xiomara Y. Rivera  DMD

Journal: Journal of Endodontics, Volume 41, Number (9):1551-1554

Purpose: To assess the accuracy of 3 electronic foramen locators (EFLs) in teeth without foramina patency and to compare them with measurements that are 1.0mm short (-1.0) and at the apical foramen (AF).

Materials and Methods:

- 30 human inferior molars were obtained and only mesial root canal was used
- Inclusion Criteria: fully formed root with Vertucci type IV configuration
- Exclusion Criteria: moderate to severe curve (>25 °) large foramina (200um), or radicular fractures
- Real length of teeth (RLT) was determined using hand files. (#25)
- Apical portion if teeth were immerse in alginate along with lip clip of EFL
- Working lengths were measures at -1.0mm & 0mm with each EFL, measurements were verified using a digital caliper
- Hedstroem were used to create dentinal debris that was compressed into apical portion
- Hand instrument inserted up to obstruction, measured using a digital caliper and compared to the distance to the AP displayed by each EFL

Results:

- Precision rates at 0.0mm, -1.0, obstructed apical foramina, respectively: Root ZX II: 94.7%, 43.9%, 1.8%; Propex II: 93%, 54.5%, 54.4%; Apex ID: 93.0% 68.5%, 75.4%,
- At 0.0mm, no significant differences were found between devices (~100% precision)
- Significant differences found between Apex ID and Root ZX II at 1.0mm short and obstructed foramen.
- Significant differences were also observed between Propex II and Root ZX II in canals without foramina patency
- At -1.0mm, the Apex ID was the most precise
- With obstruction Root ZX II was the least precise

Conclusion: The inability to reach the AF due to the presence of a dentinal debris obstruction, affects the accuracy of all the EFLs devices differently.

LOE: 4
Title: Production of human dental pulp cells with a medicinal manufacturing approach

Author: Ducret M et al.

Journal: JOE, Vol 41, Number (9): 1492-1499

Reviewer: Salar Sanjari DDS

Purpose: Human dental pulp cells (HDPC) are previously isolated and cultured under harsh conditions and using xenogeneic products - which could change the fate of the cells- and are in non-compliance with FDA guidelines of medicinal manufacturing. The aim of this study was to develop a method to isolate, amplify and store dental pulp cells using a medicinal manufacturing approach.

Materials and Methods:

- Healthy impacted 3rd molars collected from 13-17 year old donors. Third molars selected had full crown formation to 1/3 root formation. Apical part of the radicular pulp was removed and pulp tissue was removed using a fine tweezer.
- Harvested pulp was washed w/ buffer + antibiotics mixture, cut into small pieces and plated on plates that where coated with collagen type I and III.
- Xeno-free recombinant protease enzyme used to detach the overgrowth from plates
- Part of the HDPC overgrowth was then cryopreserved for 510 days and the rest was cultured in 3 serum free media:
  - SFM1: SPE-IV, IGF-1, FGF2
  - SFM2: FGF2/insulin containing medium
  - SEM3: Insulin/transferrin/selemin-containing media
- Cells where then observer for their ability to growth and tested for their metabolic rate.
- Multicolor flow cytometry was performed using 17 fluorochrome conjugated antibodies. Non-viable cells also stained.
- P1-P4 progenitor cells were tested for viability and doubling time by staining and counting the cells
- Karyotyping was performed
- Osteo/odontoblastic differentiation and mineralization was quantified by growing cells in different media and assaying using PCR and RT-PCR (using proteins such as: osteocalcin, alkaline phosphatase and dentin sialophosphoprotein).

Results: Cells from SFM1 demonstrated maximum overgrowth compared to SFM2 and 3. Metabolic activity of cells was also significantly higher in SFM1. Fibroblast-like HDPCs started to grow in SFM1 after 3 to 5 days. Therefore only cells form SFM1 were used for the rest of the study. All HDPCs expressed the cell surface marker CD73. Almost all CD73 positive HDPCs expressed mesenchymal cell markers. One to forty percent of the cells expressed stem/progenitor cell markers (depending on what marker was looked at). The rate was the same among P1-P4 cells. Viability of post-thaw cells was significantly decreases compared to fresh cells. P1-P4 doubling time stayed the same for fresh and post-thaw groups. The morphology of post-thaw cells were the same as those of fresh cells (fibroblast-like). Normal karyotype observed in post-thaw cells.

Conclusion: A specific method that follows FDA’s guidelines for “good practices” is developed to isolate, amplify and store dental pulp cells. The method requires minimal tissue manipulation, is enzyme free, and uses serum free medium and xenogeneic free products.

LOE: 4
Title: Bioactivity of a calcium silicate-based endodontic cement: Interactions with human periodontal ligament cells in vitro

Author: Camps J et al

Journal: JOE Vol. 41, Number 9: 1469

Reviewer: Aaron Salimnia DDS

Purpose: A new calcium silicate-based root canal sealer BioRoot RCS is recommended because of its potential for regeneration of surrounding tissues, improved handling properties and prevention of tooth discoloration. Calcium silicate materials such as ProRoot MTA were not recommended because of its consistency, handling properties and potential for tooth discoloration. Biodentine is not recommended because of its handling properties. The purpose of this study was to examine the effect of BioRoot RCS on PDL cells and to compare it to ZOE based sealer.

Materials and Methods:

- Used Pubmed, ResearchGate and Pubfacts
- Inclusion Criteria: Materials compared were BioRoot RCS and Pulp canal sealer (PCS)
- Direct Contact:
  - Direct contact between PDL cells and materials was done to access cell viability
  - Cells were stained with phenol red and images were taken around the material
  - Number of cells within 200um around the material were counted
- Indirect Contact:
  - Root canal treatment was performed on 30 extracted maxillary incisors
  - Teeth were randomly divided into two groups that were condensed using lateral condensation technique
  - Apex of the roots were placed in MEM for 24 hours to assess cell proliferation and to identify secreted growth factors
- Statistical analysis was determined by Mann-Whitney test and data was analyzed by standard deviation

Results: Direct contact demonstrated PDL cells in contact with BioRoot RCS were significantly higher than PCS. Indirect contact showed a decrease in cell viability in both BioRoot RCS and PCS after 2 days. At the fifth and seventh day there was no change in viability of cells in contact with BioRoot RCS but a decrease in PCS. BioRoot RCS induced the secretion of FGF-2 and BMP-2 significantly more than PCS.

Conclusion: This study concludes that BioRoot RCS is bioactive and less toxic compared to PCS.

LOE: 5