Title: Association of radiographically diagnosed apical periodontitis and cardiovascular: A hospital records-based study

Author: Gregory K.; et al.

Journal: Journal of Endodontics, Volume 42(6):916-920

Reviewer: Xiomara Y. Rivera, DMD

Purpose: To investigate an association between cardiovascular disease (CVD) and Apical Periodontitis (AP). Apical periodontitis is an inflammatory process of endodontic origin usually occurring at or near the apex of the tooth root. The World Health Organization defines CVD as a group of disorders of the heart and blood vessels that include coronary heart disease, congenital heart disease, cerebrovascular disease, deep vein thrombosis, and pulmonary embolism.

Materials and Methods: A total of 364 patients were randomly selected and divided into two groups: 1. AP Group- patients that had at least 1 tooth exhibiting a periapical pathology exceeding twice the width of the normal periodontal ligament space and 2. Non-AP Group-no radiographic evidence of perapical pathology. Electronic medical and dental records were gathered. Independence variables included were: gender, race, alcohol use, smoking history, BMI, history of periodontal disease, number of RCT, missing teeth, and caries. Systemic diseases were recorded based on the ICD Codes

Results: Analysis revealed statistically significant, positive relationships between the presence of AP and each of the following: CVD, hypercholesteronemia, hypertension, race/ethnicity, missing teeth, number of RCT, and caries. Among the AP group, statistically significant association between CVD and number of teeth with RCT was found. No statistically significant association between AP and diabetes, hypertension, smoking, BMI, periodontal disease and alcohol.

Conclusion: Although their findings revealed that patients with AP were 5.3 times more likely to have CVD than patients without; there is a need for further studies to clarify a definite association between specific CVD and AP.

LOE: 4
Title: Cellular profile and expression of immunologic markers in chronic apical periodontitis from HIV-infected patients undergoing highly active antiretroviral therapy

Author: Gama T, et al.

Journal: Journal of Endodontics, Volume 42,(6) pg. 921-927

Reviewer: Salome Masrani, DDS

Purpose: Determine if HIV-infected patients being treated with HAART have a similar protection against endodontic infection to non-HIV-infected patients. Antiretroviral therapy is used to treat patients with HIV. Highly active antiretroviral therapy (HAART) is a combination of at least three drugs and function to suppress the replication of the virus. This therapeutic protocol has been shown to reduce the morbidity and mortality of HIV by preserving the patient’s immunologic functions and reducing viral load.

Additional information:
Significant Laboratory Values for HIV patients

<table>
<thead>
<tr>
<th></th>
<th>Normal Range (cells/mm³)</th>
<th>Values requiring Dental Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Blood Cell Count</td>
<td>4,000-10,000</td>
<td>&lt;2,000</td>
</tr>
<tr>
<td>Absolute Neutrophil Count</td>
<td>1,500-8,000</td>
<td>&lt;1,000</td>
</tr>
<tr>
<td>Platelets</td>
<td>150,000-450,000</td>
<td>&lt;60,000</td>
</tr>
<tr>
<td>CD4 Count</td>
<td>590-1,120</td>
<td>&lt;50</td>
</tr>
<tr>
<td>Viral Load</td>
<td></td>
<td>No effect on treatment planning</td>
</tr>
</tbody>
</table>

Materials and Methods: Thirty-four patients in study were divided into groups: 17 HIV-infected receiving HAART >18 months, 17 non-HIV-infected, >20 years old, with a non-restorable tooth which were planned for extraction with chronic apical periodontitis lesion. Exclusion criteria: antibiotic prophylaxis, anti-inflammatory drugs, pregnancy, diabetes, autoimmune diseases, root fractures, endo-perio lesions or teeth with previous RCT. Medical records were used to obtain CD4 counts, viral loads, antiretroviral therapy. Lesions were obtained through curettage and specimens were sent to Oral Pathology Laboratory and processed for histology and immunohistochemical analyses. Nine sections from each lesion were analyzed. Primary antibodies in immunohistochemical analysis were seen: Anti-IL-6, Anti-IL-18, Anti-CD3, Anti-CD4, Anti-CD8, Anti-CD-20, Anti-CD68, Anti-TNFa, Anti-IFNg. Scores given based on number of positively-stained cells/area: 1= <30% cells stained; 2= >30% cells stained. Statistical analysis performed with a 5% level of significance.

Results: No significant difference when comparing HIV-infected patients and non-HIV-infected patients in terms of radiographic size of lesion, frequency of cysts versus granulomas, immunoexpression of inflammatory cell markers. Median CD4 count was 450 cells/mm³ and 82.3% had undetectable viral loads

Discussion: HIV-infected patients undergoing HAART have a no difference in immune capacity when compared to non-HIV-infected patients.

LOE: 4
Title: Efficacy of four irrigation protocols in killing bacteria colonized in dentinal tubules examined by a novel confocal laser scanning microscope analysis

Author: Azim A et al

Journal: JOE Volume 42(6) page 928-934

Reviewer: Aaron Salimnia DDS

Purpose: The purpose of this study was to compare the bacterial viability in root canals treated by four different irrigation methods

Materials and Methods:

- Mandibular premolars and molars were vertically split into mesial and distal roots by a high speed bur
- Canals were instrumented up to 25/.04
- Canals were filled with *E. faecalis* with a 30-gauge needle
- Roots were then placed in a BHI broth to allow colonization of the bacteria into the dentinal tubules for 21 days
- 15 teeth per group
- Canals were irrigated by four methods which were standard needle irrigation (SNI), EndoActivator (EA), XP Endo, and photon induced photoacoustic streaming (PIPS)
- Bacteria collected from the canals were subjected to 3-dimethylthiazol-2,5-diphenyltetrazolium (MTT) assay to detect the viable bacteria
- Confocal laser scanning microscope (CLSM) measured the intensities of red (dead bacteria) and green fluorescence (live bacteria)
- For CLSM analysis roots were scanned at the coronal, middle and apical portion of the root and 3 measurements were taken at 50µm, 100µm and 150µm

Results: Bacterial Viability in Canal Space: Bacterial reduction ranged between 89.6% and 98.2%; Statistically significant difference between XP Endo and PIPS as well as XP Endo and EA. Bacterial Viability in Dentinal Tubules: XP Endo had the highest level of dead bacteria in the coronal, middle, and apical portion of the root at 50µm; PIPS had the greatest bacterial killing efficiency at 150µm depth in all 3 portions of the root.

LOE: 5
Title: Disinfecting effects of rotary instrumentation with either 2.5% sodium hypochlorite or 2% chlorhexidine as the main irrigant: A randomized clinical study

Author: Rôças IN et al


Reviewer: Adnan Kazim DMD

Purpose: This study compared the antibacterial effects of irrigation with either 2.5% sodium hypochlorite (NaOCl) or 2% chlorhexidine (CHX) during the preparation of infected root canals with rotary nickel-titanium instruments.

Materials and Methods: Fifty single-rooted teeth with apical periodontitis were separated into twenty-five teeth per experimental group. Inclusion criteria were: single canal, carious lesion, necrotic pulps confirmed by pulp tests, clinical and radiographic evidence of asymptomatic apical periodontitis. Exclusion criteria were: extensive destruction of tooth crown, root or crown fracture, previous endodontic treatment, symptomatic teeth, deep periodontal pockets (>4mm), patient who received antibiotic therapy within the previous 3 months. Culture-independent molecular microbiological sampling was taken under strict asepsis: Initial (S1) - Sterile saline, sterile size 15 hand K-file instrumentation, paper point left for 1 minute and Postinstrumentation (S2) - Total volume of 15mL of either NaOCl or CHX used per canal. Irrigant was applied before and after root canal instrumentation. Aseptic technique used. As a sterility control measure, samples were taken from the cavosurface angle of the access cavity with sterile paper points before sampling from root canal. Only teeth with negative sterility were included. Quantitative Real-Time PCR Analysis data analysis was done. Data presented as the counts of cell equivalents per sample. All measurements taken in triplicate for samples, standards, and controls.

Results: In the NaOCl group, a mean number of $3.7 \times 10^{5}$ bacterial cell equivalents was present in S1 samples, with a substantial reduction in S2 to a mean of $5.49 \times 10^{2}$ cell equivalents ($P < .001$). In the CHX group, a mean bacterial load of $8.77 \times 10^{4}$ cell equivalents occurred in S1, with a significant reduction in S2 to a mean of $2.81 \times 10^{3}$ cells ($P < .001$).

- Mean reduction in bacterial counts from S1 to S2 in NaOCl group was 95.5%.
- Mean reduction in bacterial counts from S1 to S2 in CHX group was 95.4%.
- The differences in quantitative data were not statistically significant ($P > .05$)

Conclusion: NaOCl or CHX can be used during the treatment of teeth with infected canals. Properties that may influence the choice for 1 of the 2 irrigant solutions is the tissue dissolving ability of NaOCl or the substantively property of CHX. Longitudinal studies required to determine if the long term treatment outcome differs when using NaOCl or CHX as main irrigant.

LOE: 4
Title: Contamination controls for analysis of root canal samples by molecular methods: An overlooked and unsolved problem

Author: Figdor D et. Al

Journal: JOE Volume 42, Number 7, July 2016, 1003-1008

Reviewer: Adnan Kazim, DMD

Purpose: To assess studies that have used molecular approaches for the analysis of root canal microbiota and evaluated their cleaning, disinfections, and nucleotide decontamination protocol; whether a contamination control samples was taken; and how it was processed in the laboratory. A critical evaluation of results was performed.

Materials and Methods: Pubmed was used to search using the following terms: PCR + root canal, PCR + endodontic, Molecular + endodontic, and Molecular + root canal. In vivo studies were selected, a total of 136 articles were included in this study. Studies that performed surface cleaning, collected a contamination control sample, and processed it by PCR were selected for detailed analysis.

Results: Eight of 136 used no or had no information about a surface decontamination procedure. The majority of articles (89/136) reported cleaning tooth by no description of a contamination control samples. In 16/136 articles the tooth surface was cleaned and the sterility was checked by culture. Only 23/136 articles were identified that performed surface cleaning and checking nucleotide decontamination by taking a contamination control samples processed by PCR. Only one article of 136 reported current best practice cleaning, disinfection, and taking a site-specific (Access cavity) contamination control sample processed by PCR.

Discussion: A 2-step clean was performed in 11 of 12 studies that described some positive results for contamination control samples; however, 4 of 6 studies that reported negative results for their control used a single-clean protocol. The samples should be consistently taken at the access cavity. When using PCR analysis, higher cycle numbers increase sensitivity, the article recommends using greater than 35-cycle amplification. From the one study that used current best practice cleaning, disinfection, and taking a site-specific contamination control sample 100% of control samples were positive for contaminating DNA. Author suggests it is time for advanced methods to get back to basics.

LOE: 3
Title: A randomized controlled study of mineral trioxide aggregate and super ethoxybenzoic acid as root-end filling materials in endodontic microsurgery: Long-term outcomes

Author: Kim S et al.


Reviewer: Reza Akhavan, DMD

Purpose: The purpose of this study was to evaluate the long-term clinical outcomes of endodontic microsurgery when mineral trioxide aggregate (MTA) and super ethoxybenzoic acid (Super EBA) are used as the root-end filling material in a randomized controlled study. Further, this study aimed to compare the clinical outcome of endodontic microsurgery at 1-year and 4-year follow-ups.

Materials and Methods: This study was a continuation of a previously published 1-year follow-up study: 260 teeth examined at the 1-year follow-up revealed a success rate of 95.6% for MTA and 93.1% for Super EBA. Patients were recalled 4 years after surgery (n=182), and treated teeth were classified as successes or failures. Success was defined as the absence of clinical signs and symptoms and radiographic evidence of complete or incomplete healing. Radiographic healing was classified as complete healing, incomplete healing (scar tissue), uncertain healing, or unsatisfactory healing. Pearson chi-square test and the McNemar test were conducted to analyze and compare the success rates.

Results: The success rate was 91.6% for MTA and 89.9% for Super EBA. Statistical analysis of the success rate did not show any significant difference between the two materials (P = .8). The overall success rate at the 4-year follow-up was 89.5%, which was slightly lower compared with 94.3% at the 1-year follow-up. However, there was no significant difference between the follow-up periods (P = .063).

Conclusions: This study identified no significant difference in the 4-year success rates of MTA and Super EBA as root-end filling materials in endodontic microsurgery. Further, compared with short-term outcomes, long-term follow-up outcomes were not significantly different.

LOE: 2
Mandibular canal location: cone-beam computed tomography examination

Koivisto T et al.

JOE, Vol. 42, (7): 1018-1021

Sodam Lee, DMD

Purpose: To perform measurements by using existing CBCT scans to investigate the Mandibular Canal (MC) location below mandibular posterior teeth, thickness of the buccal and lingual bone over the MC, the diameter of the MC, and the anterior loop (AL) location (if present) and size near the mental foramen.

Materials and Methods:
- Previous CBCT scans from 2012-2013 were examined from patients (age 18-69)
- Exclusion Criteria: Missing >1 posterior mandibular tooth (excluding 3rd molars), Nonvisible MC from the sagittal view, Presence of severe bone loss in the posterior mandible, Artifacts that affected diagnostic quality
- 106 patients (34 males + 72 females), 636 teeth
- CBCT: Next Generation i-CAT
- Measurements taken from cross-sectional slices at levels of root apices
- Data grouped by side of mandible, tooth root, age (<40 or ≥40), and sex

Results: Locations of MC below teeth:

<table>
<thead>
<tr>
<th>Teeth</th>
<th>Buccal</th>
<th>Inferior</th>
<th>Lingual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second molar</td>
<td>57%</td>
<td>40%</td>
<td>3%</td>
</tr>
<tr>
<td>First molar</td>
<td>18%</td>
<td>55%</td>
<td>27%</td>
</tr>
<tr>
<td>Second premolar</td>
<td>33%</td>
<td>56%</td>
<td>11%</td>
</tr>
</tbody>
</table>

- Approximately 50% of the time, MC was directly below the root.
- In general, anteriorly from the mesial root of the second molar, buccal bone thickness over MC decreased, while the lingual bone thickness increased.
- No significant sex differences for bone thickness in women or men aged ≥40 or <40
- Average diameter of MC from 2nd Molar to 2nd premolar: Left MC-3.03mm Right MC-2.91mm
- AL was present in 10.4% of patients.

Conclusions: CBCT allows clinicians to see a cross-sectional view of the mandible to locate key anatomic features. When planning a surgical procedure apical to the tooth in the posterior mandible, CBCT is highly recommended to avoid nerve damage to the IAN.

LOE: 5
Title: Kinematic effects of nickel-titanium instruments with reciprocating or continuous rotation motion: A systematic review of *in vitro* studies

Author: Ahn S et al

Journal: Journal of Endodontics, Volume 42 (7): 1009-1017

Reviewer: Laura Hayoung Kim, DDS

**Purpose:** This is a review article looking at the kinematic effect of NiTi instruments with reciprocating motion and continuous rotation motion. This paper examined cyclic fatigue resistance, shaping ability for canal transportation, apical debris extrusion, and formation of dentinal defects or cracks with reciprocating motion and continuous rotation motion files.

**Materials and Methods:** This study examined *in vitro* studies written in English that assessed reciprocating and rotary instruments. A PubMed search was done on MEDLINE database.

**Results/Discussion:** Reciprocating motion had better cyclic fatigue resistance than continuous rotation in most studies except one, which showed no significant difference. As for shaping ability for canal transportation, *in vitro* studies showed less canal transportation with reciprocating motion. *Ex vivo* studies that used extracted teeth, however, had inconsistent results. This can be due to more irregularities present in extracted natural teeth and also because continuous rotating instruments use files in a more gradual sequence, which may produce better centering during instrumentation. However, because the apical transportation value was less than 300μm, both reciprocating and continuous rotating motion can be used without negatively affecting the apical seal. There are still controversies between reciprocating and continuous rotating motion in dentin debris extrusion and formation of dentinal defects.

**LOE:** 1
Title: 12-month healing rates after endodontic therapy using the novel GentleWave® System: A prospective multicenter clinical study

Author: Sigurdsson A et al

Journal: JOE Volume 42, (7): 1040-1048

Reviewer: Aaron Salimnia DDS

Purpose: To assess the rate of healing for a 12 month follow up period of in vivo cases treated by the GentleWave® System

Materials and Methods:

- 89 patients were included in the study
- Patients age ranged between 18 to 75 years
- 1st or 2nd molars were treated by 6 endodontists
- Teeth were instrumented with K-files up to size #20 and ProTaper file F1 (20/.07)
- The irrigation solution consisted of 3% NaOCl and 8% EDTA
- GentleWave® provides a broad spectrum of sound waves and is placed on the access opening of the molars
- Canals were obturated using warm vertical technique and AH plus sealer
- Based on clinical signs/symptoms and periapical index (PAI) scores, teeth were classified as healed, healing, or diseased
- PAI scores ranged from 1 for normal to 5 for severe periodontitis

Results: Seventy-five patients returned for the 12 month follow up. Sixty-nine teeth were considered healed, 4 teeth were classified as healing, and 2 were classified as diseased at the 12 month follow up.

Conclusion: These results potentially reduce the instrumentation of the root canal system and preserve the root structure when using the GentleWave® System in vivo.

LOE: 3
Title: The influence of an isthmus on the outcomes of surgically treated molars: A retrospective study

Author: Kim S, et. al

Journal: JOE Volume 42, (7): 1029

Reviewer: Rachel Mitrani DDS

Purpose: The purpose of this study was to investigate the effects of an isthmus on the success rate of surgically treated molars.

Materials and Methods:
- The clinical database was searched for patients with a history of endodontic microsurgery between July 2001 and May 2014
- A total of 106 teeth were included in the study, with mean observation time of 42.8 months: of these 106 teeth, 72 had an isthmus and 34 did not
- 1st or 2nd molars were treated by 6 endodontists
- Inclusion criteria: 1) Cases involving surgery of the maxillary first molar or the mandibular first molar, 2) Two or more root canals within one root, 3) Documented follow-up of one year
- Exclusion criteria: 1) Intraoperative findings of an apical lesion, 2) Complete denudement of the buccal plate
- The patients were followed-up once annually subsequent to treatment. Clinical and radiographic examinations were completed
- Two examiners blindly evaluated the periapical radiographs for each patient’s final visit

Results: Of the 106 treated teeth, 27 were cauterized as failures, and 79 were successfully treated. Of the 27 failures, 24 underwent isthmus preparation, and 3 did not. Ten teeth were extracted following surgical RCT. Analysis revealed that the cumulative survival rate after surgery was 61.5% for 4 years when an isthmus was present and prepared and 87.4% when an isthmus was absent and unprepared.

Discussion: According to the statistical analysis, the teeth with a prepared isthmus recorded lower cumulative survival rate than the teeth that had no isthmus. Teeth with a Type II isthmus (two canals with a definite communication between the canals) had the highest failure rate. Isthmus-present teeth require the removal of a thickness of dentin which increases vertical fracture susceptibility, so ultrasonic tips should be used carefully to minimize the weakening of the remaining dentin.

Conclusion: These results potentially reduce the instrumentation of the root canal system and preserve the root structure when using the GentleWave® System in vivo.

LOE: 3
Title: A comparison of cone-beam computed tomography with periapical radiography in the detection of retained separated instruments located in the apical third of filled root canals.

Author: Rosen Eet al.

Reviewer: Xiomara Y. Rivera DMD


Purpose: This study compares the diagnostic efficacies of CBCT imaging and periapical radiography for the detection of retained separated instruments located at the apical third of filled root canals.

Materials and Methods: Sixty single-rooted extracted human teeth were included. Exclusion criteria were previous endodontic treatment, root caries, root perforation, root resorption, visible fractures or cracks.

- Control Group (n=20): no separated instrument at apex
- Experimental Group (n=40): K-file #30 was separated apical segment
  - Group 1: SS file + laterally condensed with GP and AH 26 sealer
  - Group 2: NiTi file + laterally condensed GP and AH 26 sealer
  - Group 3: SS file + laterally condensed GP and Roth sealer
  - Group 4: NiTi+ laterally condensed GP and Roth sealer
  - Group 5: lateral condensation with GP and AH 26 sealer
  - Group 6: lateral condensation with GP and Roth sealer
- Teeth were invested in 5 mandible-shaped putty models
- CBCT and periapical radiographs were taken and evaluated twice in a 2 week interval

Results: Periapical radiography: 71.25%- mean sensitivity and 93.75% mean specificity. CBCT Imaging: 41.25%- mean sensitivity and 71.25% mean specificity. CBCT imaging was less successful than periapical radiography in the detection of retained separated instruments located at the apical third of filled root canals, regardless of the instrument type (NiTi or SS) or sealer type (AH or Roth).

Conclusion: CBCT imaging is inferior to periapical radiography in the detection of retained separated instruments located at the apical third. The results of this study stressed the importance and validity of periapical radiography modality when used for diagnosis and treatment planning before endodontic retreatment.

LOE: 4
Title: Simvastatin promotes dental pulp stem cell-induced coronal pulp regeneration in pulpotomized teeth

Author: Jia Wet al.

Journal: Journal of Endodontics, Volume 42(7): 1049-1054

Reviewer: Salome Masrani DDS

Purpose: Simvastatin is an inhibitor of 3-hydroxy-3-methylglutaryl coenzyme A reductase. It is used to treat high cholesterol. It has been previously shown to stimulate odontogenic differentiation and mineralization. This study the effect of Simvastatin on the proliferation and differentiation of Dental Pulp Stem Cells (DPSCs) and to explore its use in pulp and dentin regeneration after pulpotomy.

Materials and Methods: Dental pulp stem cells were isolated from upper incisors of two beagle dogs and cultured in αMEM + 10% Fetal bovine serum (FBS). cDPSCs were supplemented with Simvastatin in 3 different concentrations (0.01, 0.1, or 1μmol/L). After 1, 3, and 5 days, the viable cells were counted with cell counting kit-8, proliferation measured by optical absorbance through microplate reader. Mineralization assay was performed by measuring alkaline phosphatase activity. Mineral nodule formation was assayed by alizarin red S staining. cDPSCs either cultured with 1μmol/L Simvastatin or no Simvastatin, were mixed with hydroxyapatite particles, and transplanted subcutaneously into the dorsal surface for four, 8-10 week old immunocompromised mice. The transplants were harvested after 8 weeks and prepared for histologic analysis to quantify mineralized tissue formation. Pulpotomy procedures were performed on 18 immature premolars from two beagle dogs under general anesthesia. Pulp capping was performed with either MTA, Gelatin sponge, cDPSCs on gelatin sponge, or Simvastatin supplemented cDPSCs on gelatin sponge and sealed with glass ionomer and resin composite. Radiographic examination performed every two weeks until the apices closed. Teeth were then extracted and prepared for histologic analysis. Areas showing pulp regeneration was calculated. Statistical analysis performed (p<0.05 and 95% confidence interval).

Results: cDPSC proliferation suppressed when incubated with 1μmol/L Simvastatin for 3 and 5 days. Number of viable cells diminished with concentrations of Simvastatin >5μmol/L. Alkaline phosphate activity increased dose-dependently. Mineral nodule formation increased dose-dependently. The formation of mineralized tissue was calculated from transplant sample (% area of mineralized tissue/total area)- with Simvastatin, the cDPSCs produced 22.8% mineral tissues, but without Simvastatin, 17.4%. When Simvastatin + cDPSCs were used on a gelatin sponge as a pulp capping agent, the ratio of regeneration was 85.8%, compared to 76.8% (without Simvastatin), and 47.3% in the gelatin sponge group. In the MTA pulp-capping group, a dentin bridge was formed and pulp tissue could not enter the pulp cavity. In the Simvastatin-supplemented group, the regenerated pulp filled a large percent of the pulp cavity. There were newly formed dentin deposits, and odontoblastic cells.

Discussion: Simvastatin has been previously shown to increase expression of BMP-2, promoting bone formation by bone marrow stem cells. At low concentrations, it did not affect the proliferation of cDPSCs. Dose-dependent mineralization, and nodule formation occurred up to 1μmol/L. When cDPSCs were placed on gelatin sponge scaffold and used as a pulp-capping agent, cDPSCs were able to regenerate pulp tissues, and when treated with Simvastatin, there was increased pulp tissue regeneration and dentin formation.

LOE: 5
Title: Removal of root canal fillings in curved canals using either reciprocating single- or rotary multi-instrument systems and a supplementary step with the XP-endo® finisher

Author: Alves F et al

Journal: JOE Volume 42(7): 1114-1119

Reviewer: Sodam Lee DMD

Purpose: This study compared the efficacy of a reciprocating single-instrument system (Reciproc) with a rotary multi-instrument system (Mtwo) both using instruments with a similar cross-sectional design. A comparison of the effects of using two instruments sizes of the Reciproc system (R25 and R40) on filling removal was observed. An evaluation of the additional cleaning effects of a new instrument (XP-endo Finisher) as an adjunctive approach was done.

Materials and Methods: Forty mesial canals from extracted mandibular molar were instrumented and filled. Each mesial canal was retreated by either Reciproc(VDW, Germany) or Mtwo(VDW) and two systems were used in the same root but alternating the mesial canals from root to root. The working time was recorded. The percentage of removed filling volume was analyzed by microCT scan before and after retreatment. Canals still showing remnants of filling material were cleaned with XP-endo finisher (FKG Dentaire, Switzerland) as supplementary approach and another microCT scan was taken. Statistical analysis for data made with a significance level of 5%.

Results/Conclusions: The filling material removed with Mtwo(96%) was significantly higher than Reciproc(89%) when both used up to size40. Mtwo required less time to remove the filling material than Reciproc. Therefore Mtwo retreatment technique was more effective and faster than Reciproc in removing filling material from curved canals. Intragrupal analysis in Reciproc system showed that R40 removed significantly more filling material than R25. Supplementary approach with XP-endo finisher was effective in significantly enhancing the removal of filling material.

LOE: 5
Title: Bactericidal effect of strong acid electrolyzed water against flow Enterococcus faecalis biofilms

Author: Cheng X et. Al

Journal: JOE, Vol 42(7):1120 – 1125

Reviewer: Salar Sanjari DDS

Purpose: This study evaluated the bactericidal effect of strong acid electrolyzed water (SAEW) against flow Enterococcus faecalis biofilm and its potential application as a root canal irrigant.

Materials and Methods: SAEW was prepared by the electrolysis of tap water containing 0.05% sodium chloride with an electrolyzing apparatus to a pH of 2.3 +/- 0.15. Flow E. faecalis biofilms were generated under a constant shear flow and a static condition on coverslip surfaces. Both the flow and static E. faecalis biofilms were treated with SAEW. Sodium hypochlorite (NaOCl, 5.25%) and normal saline (0.9%). Bacterial reductions were evaluated using confocal laser scanning microscopy and the cell count method. Morphological changes of bacterial cells were observed using scanning electron microscopy.

Results: The confocal laser scanning microscopic and cell count results → SAEW had a bactericidal effect similar to that of 5.25% NaOCl against both the flow and static E. faecalis biofilms. The scanning electron microscopic results showed that smooth, consecutive, and bright bacteria surfaces became rough, shrunken, and even lysed after treated with SAEW, similar to those in the NaOCl group.

Conclusion: SAEW had an effective bactericidal effect against both the flow and static E. faecalis biofilms, and it might be qualified as a root canal irrigant for effective root canal disinfection.

LOE: 4
Title: Visualization enhancement of dentinal defects by using light-emitting diode transillumination

Author: Coelho M et al

Journal: JOE, Vol. 42(7): 1110-1113

Reviewer: Reza Akhavan DMD

Purpose: This study investigated whether LED transillumination enhances the visualization of dentinal defects by using a root sectioning methodology. Authors hypothesized that root assessment of uninstrumented roots with the aid of LED transillumination will reveal dentinal defects that are not detected through the classic sectioning methodology.

Materials and Methods:

- 40 extracted teeth with 2 canals, mature apices, and separate mesial and distal roots were chosen for the study.
- Mesial roots were separated by using a carborundum disk, inspected under microscope to ensure no external sign of micro cracks.
- Roots sectioned horizontally by using a low-speed under water irrigation at 3, 6, and 9 mm from the apex.
- Slices photographed under microscope before (n=120) and after LED transillumination (n=480).
- Images evaluated by 2 endodontists for LED images, only 1 defect observed in any of the 4 pictures was necessary to include that specimen as having a defect.

Results:

| Table 1. Comparison of Slices (n = 120) and Specimens (n = 40) Presenting Defects |
|---------------------------------|---------------------------------|
| Total slices with defects | Total specimens with defects |
| Non-LED | 4/120 | 4/40 (10%)³ |
| LED | 27/120 | 19/40 (47.5%)³ |

Values with different superscript letters were statistically different at P = .05.

<table>
<thead>
<tr>
<th>Table 2. Number and Percentage of Slices with Defects at Each Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 mm</td>
</tr>
<tr>
<td>Non-LED</td>
</tr>
<tr>
<td>LED</td>
</tr>
</tbody>
</table>

Conclusions: LED transillumination enhanced the visualization of dentinal defects in uninstrumented roots. Uninstrumented control groups in several published studies that used traditional (non-LED) inspection methodology have reported no observed dentinal defects. Based on the results in this study, authors put in question the reliability of the prior methodology.

LOE: 5
Title: Comparison of canal transportation and centering ability of K-files, ProGlider file, and G-files: a micro-computed tomography study of curved root canals

Author: Paleker F et al

Journal: JOE, Vol. 42(7): 1105

Reviewer: Rachel Mitrani DDS

Purpose: The study compared centering ability and apical canal transportation of K-files (KF), ProGlider (PF), and G-files (GF) after glide path enlargement in curved canals by using micro-computed tomography. ProGlider files and G-files are both nickel titanium (NiTi).

Materials and Methods: Ninety separate MB and ML root canals with curvatures of 25-30° were selected from 50 extracted teeth. Thirty canals were assigned to each experimental group. After access preparation, the canals were enlarged using one of the following three methods: pre-curved stainless steel K-files, G-file system or ProGlider files. The teeth were scanned before and after instrumentation using micro-CT. Canals from the post-treatment scan were super-imposed over corresponding pre-treatment scans to measure the changes after instrumentation. Changes in root canal diameter were measured at three levels: D1 (1mm from apical foramen), Dmc (point of maximum curvature), and D7 (7mm from the apical foramen). Canal transportation was assessed in eight directions at D1.

Results: K-files exhibited significantly more canal transportation at the D1 level. At Dmc and D7, the ProGlider files produced a more centered enlargement compared to both GF and KF. The ProGlider files exhibited statistically significantly less apical canal transportation than K-files, but transportation values for G-files and ProGlider files were similar in all directions.

Conclusions: Glide path enlargement with stainless steel K-files was less centered than the NiTi groups at all levels examined. The ProGlider files exhibited superior overall centering ability in comparison to the other groups. Additionally, this system best maintained the original shape of the canal. The advantages of the ProGlider system may be due to its flexibility, variable progressive taper, square cross section, and smaller ISO tip size.

LOE: 5
Title: Evaluation of apically extruded debris from curved root canal filling removal using 5 nickel-titanium systems

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Purpose: ProTaper Universal retreatment system has 3 files with triangular cross sections. D-Race retreatment system has 2 files with alternating cutting edges and triangular cross sections. R-endo retreatment system has a hand file and 4 NiTi files with triangular cross sections with 3 equally spaced cutting edges on the NiTi files. The Mtwo retreatment system has 2 files with cutting tips at constant helical angle. Reciproc system has one file that that uses a reciprocal motion. This study examined amount of apically extruded debris in retreatment of curved canals using five nickel-titanium (Ni-Ti) systems— ProTaper Universal Retreatment, Mtwo Retreatment, D-Race Retreatment, R-Endo Retreatment, and Reciproc systems.

Methods/Materials:

- One hundred extracted human mandibular premolars with a single root canal, mature apex, and root canal curvature of 20° - 40° were used for the experiment.
- Initial treatment: Reciproc #25 .08 NiTi was used to prepare teeth to WL (1mm short of visible diameter of apical foramen). Cold lateral condensation technique was used with #25 .08 gutta percha as master cone and AH Plus Jet sealer.
- Teeth were stored in incubator at 37°C and 100% humidity for 8 weeks to allow sealer to set.
- Teeth were placed in vial system with a rubber stopper at the cementoenamel junction so that the extruded debris can be collected in the vial.
- Retreatment: Teeth were divided randomly into five groups and treated with the following systems. For group 1 to 4, gentle in-and-out motion was used to working length, following the manufacturer’s recommendation.
  - Group 1: ProTaper Universal retreatment files D1 (#30 .09), D2 (#25 .08), and D3 (#20 .07)
  - Group 2: The same procedure as in group 1 using Mtwo retreatment files (#15 .05 and #25 .05).
  - Group 3: The same procedure as in group 1 using D-Race retreatment files DR1 (#30 .10) and DR2 (#25 .04).
  - Group 4: The same procedure as in group 1 using R-Endo retreatment files Rm (#25 .04 hand file), Re (#25, 12), R1 (#25 .08), R2 (#25 .06), and R3 (#25 .04).
  - Group 5: A Reciproc R25 file (#25 .08) was used for the WL.
- Dentinal debris was washed with 1mL distilled water and then the water was evaporated in incubator at 68°C for 5 days.
- The vial with debris was weighed and the amount of debris was determined by subtracting the original weight of the vial without the debris.

Results/ Discussion:

- Debris extrusion in order from most to least: Reciproc > ProTaper retreatment and Mtwo retreatment > D-Race and R-endo retreatment system.
- No significant difference in apical debris extrusion was observed between groups 1 and 2 and between groups 3 and 4.
- Reciproc had the shortest treatment time than all other groups.
- Possible causes for results discussed:
  - Reciproc uses reciprocal motion that continuously pushes the file forward, which may contribute to apical extrusion of debris.
  - D-Race and R-Endo may have had similar results due to similar design in the apical third (triangular cross sections and noncutting tips).
  - NiTi systems with less taper may cause less extrusion of debris for curved canals.

Conclusion: Reciproc system extruded significantly more debris than other rotary retreatment NiTi systems tested, and ProTaper retreatment and Mtwo retreatment extruded significantly more debris than R-Endo and D-Race retreatment systems.

LOE: 5