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2018 ABSTRACTS

The Ohio Association of Endodontists
Spring Scientific Meeting
Columbus, Ohio
May 23, 2018

2018 Graduate Research Presentations

9:00	**Welcome & Introductions**	
9:15	The Diagnostic Ability of Ultrasound as a Real-time Non-ionizing Tool in Detecting the Second Mesiobuccal Canals	**M. Beshay, BDS** **Case Western Reserve University**
9:30	The Residual Antibacterial Effects of Radiopaque Double Antibiotic Paste After Various Treatment Times	**Dr. RT Biggerstaff** **Indiana University**
9:45	Nano-computed Tomography Analysis of Five Root Canal Obturation Methods in TrueTooth 3-D Printed Tooth Replicas	**Jacob K. Butler, DMD** **University of Detroit Mercy**
10:00	Anesthetic Efficacy of a Combination of 4% Prilocaine/2% Lidocaine with Epinephrine for the Inferior Alveolar Nerve Block: A Prospective, Randomized, Double-blind Study	**Olivia Cook, DMD, MS** **Presented by Jeremy Capetillo, DDS** **The Ohio State University**
10:15	**Break**	
10:45	Clinical Decision-Making in the Treatment of Cracked Teeth	**Matthew J. Walker, DDS** **University of Louisville**
11:00	The Antibacterial Stability of a New Radiopaque Double Antibiotic Paste	**Dr. KE Epkey** **University of Indiana**

11:15	The Antibacterial Effects of Radiopaque Double Antibiotic Pastes Against Clinical Bacterial Isolates from Mature and Immature Teeth with Necrotic Pulps	**Dr. CF Ibrahim** **University of Indiana**
11:30	The Effect of Endodontic Treatment on the Medical Status of Patients with End-stage Renal Disease: A Retrospective Cohort Study	**Navid Khalighinejad, DMD** **Case Western Reserve University**
11:45	Presence of Apical Periodontitis Compared to Apical Extent of Root Filling Material using CBCT Imaging	**Andrea Tory, DDS** **University of Louisville**
12:00	Evaluation of the Genotoxic Effect of Intracanal Medicaments on Human Periodontal Ligament Fibroblasts	**David Selis, DDS** **University of Detroit Mercy**
12:15	An Evaluation of Postoperative Pain Using Ibuprofen Versus Ibuprofen/Acetaminophen in Patients with Symptomatic Irreversible Pulpitis	**Alex Stamos, DDS, MS** **Presented by Kathryn Watts, DMD** **The Ohio State University**
12:30	OAE Business Meeting	
12:45	Lunch	

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The Diagnostic Ability of Ultrasound as a Real-time Non-ionizing Tool in Detecting the Second Mesiobuccal Canals

Beshay M., BDS; Aminoshariae A., DDS, MS; Montagnese T., DDS, MS; Mickel A., DDS, MSD

Abstract

Introduction: Missed canals, particularly in teeth with complex anatomy have been reported to be the leading cause of endodontic failure. The application of cone-beam-computed-tomography (CBCT) in locating the second mesiobuccal-canal (MB2) has been well-studied. However, a recent study has questioned the value of pre-operative CBCT in detecting MB2 compared to direct accessing the tooth. Ultrasound is a non-invasive real-time diagnostic tool and its use has been investigated in the dentistry. However, no study has assessed the ability of ultrasound in detecting MB2.

Purpose: To investigate the diagnostic ability of ultrasound in detecting MB2.

Methods and Materials: Thirty extracted human maxillary first molars were collected and mounted. Samples were independently scanned using (CBCT) and high frequency Ultrasound transducer (15 MHz). Two observers evaluated the presence of an MB2. Additionally, teeth were accessed and the presence of MB2 was assessed under the dental operating microscope by an endodontic resident who was blind regarding the presence or absence of MB2.

Results: Data were further analyzed using fisher exact test. Review of CBCT and ultrasound scans found the presence of an MB2 canal 87% and 82% of the time respectively.

Conclusions: Direct accessing the tooth led to an MB2 detection of 85%. There was no significant difference in the detection rate of MB2 between different methods ($P>0.05$) According the results, the use of ultrasound as a real-time non-ionizing diagnostic tool can be further investigated in Endodontics as a real time non-invasive diagnostic imaging modality.

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The residual antibacterial effects of radiopaque double antibiotic paste after various treatment times.

Biggerstaff RT, Ehrlich Y, Spolnik KJ, Bringas JS, Gregory RL, Yassen GH

Introduction: Low concentrations of double antibiotic paste (DAP), equal parts of metronidazole and ciprofloxacin, have been proposed as intracanal antimicrobials for regenerative endodontics.

Objective: The aim of this study was to investigate the residual antibacterial effects of radiopaque DAP (RoDAP) with 30% barium sulfate (w/v) against biofilm bacteria from an immature tooth with necrotic pulp.

Materials and Methods: Standardized human dentin samples (n=140) were prepared, sterilized and treated for one or four weeks (n=10) with 25mg/mL RoDAP, 10mg/mL RoDAP, 1mg/mL RoDAP, placebo RoDAP, calcium hydroxide, and sterile water. Sterile uninfected control group was included. After treatment, pastes were rinsed off with 17% EDTA and aged in PBS for one week. Then, samples were infected with standardized bacterial isolate obtained from immature tooth with necrotic pulp and biofilms were allowed to grow anaerobically for three weeks. The biofilms were detached, spiral plated and quantified to calculate CFUs/mL. Two-way ANOVA followed by Fisher's Protected Least Significant Differences were used for statistical analyses (α=0.05).

Results: Treatment time and RoDAP concentration demonstrated significant effects. The residual antibacterial effect of RoDAP was concentration dependent. All tested concentrations of RoDAP demonstrated significantly higher antibacterial effects in comparison to calcium hydroxide and other control groups. Antibiotic-free placebo paste and calcium hydroxide did not exhibit significant residual antibacterial effect.

Conclusion: RoDAP as low as 1 mg/mL exhibited significant residual antibacterial effects. Further studies are warranted to investigate the cytotoxic effects of various concentrations of RoDAP.

Nano-computed Tomography Analysis of Five Root Canal Obturation Methods in TrueTooth 3D Printed Tooth Replicas

Jacob K. Butler, DMD University of Detroit Mercy

Purpose: The purpose of this study was to perform a nano-CT 3-dimensional analysis of five root canal obturation methods in 3D printed TrueTooth Replicas (Dental Engineering Laboratories, Santa Barbara, CA) prepared with ESX 40.04 rotary instruments (Brasseler USA, Savannah, GA). It has been previously reported in a meta-analysis that root canal fillings that extend to within 2 mm of the radiographic apex and root canal fillings without voids lead to a significantly higher success rate in primary root canal treatment.

Methods: Fifty effectively identical TrueTooth 3D printed maxillary left central incisor tooth replicas (9-001A) were selected for use in the study. The TrueTooth consists of a single main canal with an apical accessory canal and a mid-root lateral canal. The replicas were printed with a pre-cut access cavity and a waxy simulated pulp-like material. All teeth were prepared with an ESX 40.04 rotary instrument to 2.0mm short of anatomical apex. The prepared replicas were randomly assigned to one of the following obturation groups (n=10): single-cone with EndoSequence Points (Brasseler USA, Savannah, GA) and ThermaSeal Plus RIBBON Sealer (Dentsply, Tulsa, OK); single-cone with EndoSequence BC Points 150 Series and EndoSequence BC Sealer (Brasseler USA, Savannah, GA); warm vertical with ThermaSeal Plus RiBBON Sealer and backfill with Calamus 3D Obturation System (Dentsply, Tulsa, OK); GuttaCore Crosslinked Gutta Percha Core Obturator (Dentsply, Tulsa, OK) with ThermaSeal Plus RIBBON sealer; cold-lateral with ThermaSeal Plus Ribbon Sealer. Specimens were immobilized inside a plastic tube, and scanned using a nanotom S nanoCT (phoenix x-ray, GE Measurement & Control; Wunstorf, Germany). The X-ray tube was powered to 110kV and 270 µA, utilized a diamond coated tungsten target, a 0.5mm Aluminum filter, and was set to a spot size of 0. Imaging was done at 12 µm voxel size using an exposure time of 1000ms; 3 frames averaged and 1 skipped for each rotation. The sample stage rotated through 360 degrees and collected 1000 images per scan. Reconstruction of raw data was performed using Datos.rec (phoenix x-ray, GE Measurement & Control; Wunstorf, Germany). A visual analysis of gutta percha, sealer, and air voids within the root canal system was done with Dragonfly 3D imaging software (Object Research Systems, Montreal, Quebec, CA).

Ongoing research: While a visual analysis with preliminary conclusions can be made, the project presented describes ongoing research. A calculation of the volume percentage of gutta percha, sealer, and voids in the apical 10 mm of the canals will be performed. In addition, an analysis regarding the ability of the different obturation methods to fill lateral/accessory canals will be done. The findings may aid the clinician in the decision making process when choosing between obturation methods.

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Anesthetic Efficacy of a Combination of 4% Prilocaine/2% Lidocaine with Epinephrine for the Inferior Alveolar Nerve Block: A Prospective, Randomized, Double-blind Study

Olivia Cook, DMD, MS, John Nusstein, DDS, MS, Melissa Drum, DDS, MS, Sara Fowler, DMD, MS, Al Reader, DDS, MS, John Draper, PhD

Introduction
Prilocaine plain has a high pH and concentration (4%), which could decrease the pain of injection and increase success. The purpose of this study was to compare pain associated with anesthetic solution deposition and the degree of pulpal anesthesia obtained with the combination of prilocaine and lidocaine versus a lidocaine and lidocaine combination when used for inferior alveolar nerve blocks (IANBs).

Methods
One hundred eighteen asymptomatic subjects were randomly given a combination of 1 cartridge of 4% prilocaine plain plus 1 cartridge of 2% lidocaine with 1:100,000 epinephrine or a combination of 2 cartridges of 2% lidocaine with 1:100,000 epinephrine for the IANB at 2 separate appointments. Subjects rated the pain associated with anesthetic solution deposition of injection. Mandibular teeth were tested with an electric pulp tester every 4 minutes for 57 minutes. Anesthesia was considered successful when 2 consecutive 80 readings were obtained within 17 minutes and the 80 reading was continuously sustained for 57 minutes. Comparisons for anesthetic success were analyzed using the exact McNemar test, and pain ratings associated with anesthetic solution deposition were analyzed using multiple Wilcoxon matched pairs signed rank tests; both were adjusted using the step-down Bonferroni method of Holm.

Results
Four percent prilocaine plain was significantly less painful upon anesthetic solution deposition. Pulpal anesthetic success was not significantly different between the 2 combinations.

Conclusions
The combination of 4% prilocaine plain plus 2% lidocaine with 1:100,000 epinephrine did not increase pulpal anesthetic success for IANBs compared with a combination of 2 cartridges of 2% lidocaine with 1:100,000 epinephrine. Pain associated with anesthetic solution deposition from the first cartridge of 4% prilocaine plain was significantly less when compared with the first cartridge of 2% lidocaine with 1:100,000 epinephrine.

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Clinical Decision-Making in the Treatment of Cracked Teeth

Matthew J. Walker, DDS, Roycelyn Gray, DMD MS, Scott Shuler, DMD MS, Stephen J. Clark, DMD

Objective: The prognosis for a cracked tooth following endodontic treatment may be affected by several factors. However, the factors affecting the prognosis of a cracked tooth after endodontic treatment are not well known and there is limited evidence upon which to make treatment recommendations. The purpose of this study was to determine the factors that most influence practicing endodontists in their decision to provide endodontic treatment or recommend extraction of a cracked tooth.
Methods: An invitation for a questionnaire on Survey Monkey was sent via email to 4,110 active and international members of the American Association of Endodontists. Respondents were given multiple hypothetical scenarios and asked to assess how these different situations would affect their decision to treat or extract a cracked mandibular molar. Odds ratio and ordinal logistic regression were used to evaluate the data.
Results: 755 endodontists completed the questionnaire for a response rate of 18.4%. Cracked teeth with symptomatic irreversible pulpitis and symptomatic apical periodontitis (SAP) (2.13) or pulp necrosis (PN) and SAP (1.37) were significantly more likely to have completion of endodontic treatment compared to PN and acute apical abscess.

Completion of endodontic treatment with a 2-3 mm probing depth adjacent to the fracture was 127 times more likely to be recommended than completion of treatment with a 7-8 mm probing depth. With increased years of experience, recommendation for completion of endodontic treatment with the increased probing depth was decreased by a factor of 13%.

Periodontal probing depths adjacent to a fracture and apical extent of fracture as observed clinically had the most significant weighted average when participants were asked to rank multiple factors on level of importance.
Patient motivation (16%) and parafunctional habits (8%) were the most frequently reported additional factors in clinical decision-making suggested by respondents to the survey.
Conclusion: In conclusion, better evidence is needed to assist endodontists in the decision to treat or extract a tooth diagnosed with a crack. Periodontal probing depths adjacent to the fracture and apical extent of the crack clinically appeared to be very influential in the clinical treatment decision.

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The Antibacterial Stability of a New Radiopaque Double Antibiotic Paste

Epkey KE, Ehrlich Y, Spolnik KJ, Warner N, Bringas JS, Yassen GH

Introduction: Regenerative Endodontic procedures (REPs) aim to encourage continued root development and enhance formation of a pulp like tissue while controlling infection. The uses of low concentrations of double antibiotic pastes (DAP, equal parts of ciprofloxacin and metronidazole) in a methylcellulose vehicle have been shown to have antibacterial effects. It was also found not to be cytotoxic to dental pulp cells. However, one of the challenges faced with all of these antibiotic medicaments is that they are not radiopaque and not visible on radiographs. Clinicians would be more likely to use these materials if they can be recognized radiographically after being placed within the root canal system.

Objective: The purpose of this in vitro study will be to evaluate the antibacterial stability (shelf life) of a new radiopaque DAP (RoDAP).

Materials and Methods: Uniform sterilized radicular dentin specimens were infected with the immature tooth bacterial biofilm and incubated anaerobically for three weeks. Infected samples were randomized into 6 experimental groups (n=7) and treated for one week with 1 and 10 mg/mL RoDAP, calcium hydroxide (Ultracal), placebo pastes and no treatment. A biofilm-free negative control group was also included in the study. After one week, the specimens were rinsed, the biofilms were detached and spiral plated using a biofilm disruption assay. The antibacterial properties of the radiopaque pastes were also tested after aging for three and six months.

Results: Both 1 and 10 mg/mL of RoDAP as well as calcium hydroxide offered significant antibacterial effects regardless of aging time. After 6 months of aging, both 1 and 10 mg/mL of RoDAP offered significantly better antibacterial effects in comparison to calcium hydroxide. On the other hand, DAP-free radiopaque paste did not demonstrate significant antibacterial effects

Conclusion: The RoDAP at low concentrations (1 or 10 mg/mL) demonstrated significant and stable antibacterial effects even after 6 months of aging.

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The antibacterial effects of radiopaque double antibiotic pastes against clinical bacterial isolates from mature and immature teeth with necrotic pulps

Ibrahim CF, Ehrlich Y, Spolnik KJ, Bringas JS, Gregory RL, Yassen GH

Introduction: Low concentrations (1-10mg/mL) of double antibiotic paste (DAP) have demonstrated antibacterial properties in regenerative endodontics. The application of DAP can be better visualized in clinical scenarios when it is made radiopaque with barium sulfate. The antimicrobial effect of radiopaque DAP (RoDAP) has not been thoroughly investigated yet.

Objective: The aim of this study was to evaluate if radiopaque DAP with barium sulfate in an aqueous methylcellulose system has antibacterial effects against bacterial isolates from a mature and immature tooth with necrotic pulp.

Materials and Methods: Clinical bacterial isolates were obtained from the canals of mature and immature teeth with necrotic pulps during root canal therapy or a regenerative procedure, respectively. Bacterial isolates were grown anaerobically for three weeks on 4x4mm standardized dentin specimens prepared from extracted human teeth (n=48 per biofilm type). The dentin specimens were allocated into six groups (n=16 per group) and treated as follows: 1mg/mL RoDAP, 10mg/mL RoDAP, calcium hydroxide (UltraCal), placebo (barium sulfate in methylcellulose), no treatment, and no bacteria or treatment (sterile control). After one week of treatment, the biofilms were detached and biofilm disruption assays were conducted to determine the bacterial numbers (CFUs/mL). Wilcoxon Rank Sum tests followed by pairwise comparisons (α=0.05) were used to analyze the data.

Results: 1 and 10 mg/mL RoDAP as well as calcium hydroxide demonstrated significant antibacterial effects against the tested bacterial isolates. The placebo paste did not demonstrate any significant antibacterial effects. No significant difference in antibacterial effects was found against isolates from both mature and immature teeth regardless of the type of treatment.

Conclusion: Both 1 and 10 mg/mL RoDAP demonstrated significant antibacterial effects against bacterial isolates from mature and immature teeth with necrotic pulps. Use of RoDAP may be beneficial clinically since its adequate placement within the canal system can be confirmed radiographically.

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The Effect of Endodontic Treatment on the Medical Status of Patients with End-Stage Renal Disease: A Retrospective Cohort Study

Navid Khalighinejad, DMD; André K. Mickel, DDS, MSD; Anita Aminoshariae DDS, MS

Abstract

Introduction: Apical periodontitis (AP) has been associated with systemic increase in the level of inflammatory cytokines. Also, AP has been linked with the inflammatory-based systemic conditions such as end-stage-renal-disease (ESRD). Hypercytokinemia, as a result of untreated AP could influence the medical status of ESRD patients such as blood-ureanitrogen (BUN) level. No study has assessed the effects of endodontic treatment on the BUN level of ESRD patients.

Methods: In this retrospective cohort study, 20 ESRD patients with stable renal condition under hemodialysis with at least one AP were included in the study group. All patients in this group had received NSRCT during the study period. Twenty matched ESRD patients regarding medical status and AP with no history of endodontic intervention during study period were included in the control group. The BUN level was measured at the beginning of the study (baseline) and following the endodontic intervention. Data was analyzed using Mann-Whitney and Wilcoxon (a=0.05). After reviewing 251 CBCT records of patients, the following data was recorded: age, presence of MM, MB-ML distance and Weine anatomical classification. Data was analyzed using binary-logistic-regression (α=0.05).

Results: The BUN level significantly decreased following NSRCT (60.45 ± 22.6 mg/dl) compared to base line (74.16 ± 29.4 mg/dl) in the study group ($P<0.05$). Also, ESRD patients with endodontic intervention showed significantly lower BUN level compared to control group at the end of study timeline.

Conclusion: Considering the potential indirect effect of endodontic intervention on the BUN level of ESRD, the treatment of AP should be considered in the medical treatment strategy of ESRD patients undergoing hemodialysis.

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Presence of Apical Periodontitis Compared to Apical Extent of Root Filling Material using CBCT Imaging

Andrea Tory DDS, Bruno Azevedo DDS, M.S., Stephen Clark DMD

Background: Sjogren reported on the correlation between success of root canal treatment and the apical extent of canal obturation in teeth with apical periodontitis (AP). This study investigated the correlation between the occurrence of AP with the apical extent of canal obturation in previous non-surgical root canal treatment by analyzing cone beam computed tomography (CBCT) images taken for both endodontic and non-endodontic reasons.

Materials & Methods: This retrospective study reviewed mandibular molars imaged between 2013 and 2018. Two calibrated observers evaluated CBCT images for presence of apical periodontitis, type of restoration, voids in canal obturation, and the distance between the apical extent of the root canal filling from the radiographic apex (RA) (>2mm short of the RA, 0-2mm short of the RA, extended beyond the RA) in both the coronal and axial views. Chi square and ANOVA were used for data analysis.

Results: 317 patients with 344 teeth (1,086 canals) were evaluated in this study and included 206 first molars and 138 second molars. The overall frequency of AP was 30.5% with 38.4% found in first molars and 18.7% in second molars.

AP was found in 26.3% of canals filled within 0-2mm from the RA, 40.2% of teeth filled >2mm short of the RA (p=.001) and 50.6% of teeth filled beyond the RA (p=.000). Cohen's kappa value for the two calibrated observers was .817 for the sagittal view and .782 for the coronal view.

Occurrence of voids in the canal obturation was 8.8% in the first molar and 5.2% in the second molar. AP was found in 29.6% of canals without voids and in 41.3% of canals with voids (p=.03).Missed canals occurred 3.1% in the first molar and 1.7% in the second molar.

Conclusion: The results of this study indicate that teeth obturated 0-2mm from the RA have the lowest incidence of AP. These findings support a standard of care for ideal root filling length during endodontic treatment.

Evaluation of the Genotoxic Effect of Intracanal Medicaments on Human Periodontal Ligament Fibroblasts

David Selis, DDS
University of Detroit Mercy

Purpose:
This study is set to assess the genotoxic effect of hydroxy isocaproic acid (HICA) on human periodontal ligament fibroblasts (HPLF), by evaluating the presence of DNA double-strand breaks. In a previous study, we showed that HPLF exposed to calcium hydroxide had reduce viability compared to those exposed to HICA.

Methods:
Human periodontal ligament fibroblasts were treated with varying concentrations of HICA (1.25,2.5,5,10 mg/ml) for 24 and 48 hours. The genotoxic effect of the tested substances was assessed using immunohistochemistry for DNA double-strand break markers: γH2AX and 53BP1. Cells were imaged by fluorescence microscopy and γfoci with colocalized γH2AX and 53BP1 were considered indicative of DNA double-strand breaks. Cells with 4 or more foci per nucleus were counted as positive. The number of positive cells in a total of 100 counted cells was determined for each medicament, at the two time points.

Results:
We found that HICA becomes genotoxic at 5mg/ml, evidenced by significantly higher percentage of positive cells in the 5 and 10mg/ml concentrations compared to baseline. No statistically significant differences were noted between the 24 and 48 hour exposures to any concentrations. Further studies are necessary to determine the concentration at which this potential intracanal medicament retains the antibacterial efficiency without damaging the host cells.

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An Evaluation of Postoperative Pain Using Ibuprofen Versus Ibuprofen/Acetaminophen in Patients With Symptomatic Irreversible Pulpitis

Alex Stamos DDS, MS, M. Drum DDS, MS, A. Reader DDS, MS, J. Nusstein DDS, MS, S. Fowler DMD, MS, M. Beck DDS, MS

Introduction: Oral surgery studies have claimed better postoperative pain control with the combination of ibuprofen and acetaminophen versus individual medication use. However, more research is indicated when using this combination in an endodontic pain model. Therefore, the purpose of this study was to compare ibuprofen versus an ibuprofen/acetaminophen combination for postoperative pain control in patients diagnosed with symptomatic irreversible pulpitis.

Methods: One hundred and five patients presenting with moderateto-severe pain from a maxillary or mandibular posterior tooth diagnosed with symptomatic irreversible pulpitis and symptomatic apical periodontitis were included. Emergency endodontic treatment was performed. Patients randomly received identical capsules containing either 600 mg ibuprofen or 600 mg ibuprofen /650.1 mg acetaminophen at the end of the appointment to be taken every 6 hours as needed for pain. Patients were given a prescription for an escape medication to take if the study medication did not control their pain. A five-day pain diary was used to record pain and medication use. Post-operative data was analyzed using randomization tests and step-down Bonferroni method of Holm.

Results: There were no statistically significant differences between the two groups in postoperative pain or medication use (study or escape). Both treatment groups saw a reduction in post-operative pain by day.

Conclusion: There was no statistically significant difference between ibuprofen and the combination of ibuprofen and acetaminophen in the reduction of post-operative pain following emergency endodontic treatment in patients with symptomatic irreversible pulpitis.

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