Title: Effects of cryopreservation of intact teeth on the isolated dental pulp stem cells

Authors: Sheng-Yang Lee et al.


Reviewer: Daniel Cassis, DDS

Purpose: To test whether human dental pulp stem cells (DPSC) isolated from cryopreserved teeth can express stem cell-specific markers.

Materials & Methods:
- Premolars were collected from adults (18-30 years old)
- Half the teeth were cryopreserved in a program freezer supplied with a slight magnetic field. After the freezing procedure, the teeth were moved to a freezer for 7 days.
- Dental pulp cells were taken from contralateral premolars of the same patients as a control. These teeth were not frozen, nor were they stored for a week. Rather the tests were conducted immediately following extraction.
- Both groups had the dental pulp cells isolated with a modified enzyme digestion method.
- The success rate of isolation, growth curves, morphology, stem cell-specific markers and the differentiation capacity of the isolated cells were evaluated.

Results:
- Success rate of isolations - 100% for fresh teeth, 73% for cryopreserved teeth
- Morphology - No visible difference for the two groups
- Cell viability - cryopreserved teeth increased by 3.15 times, while fresh teeth grew by 3.31 times over a five day span. There was no significant difference between the groups.
- Stem cell markers - Immunostaining was positive for stem cell markers CD44 and STRO-1 in both groups. STRO-1 was also detected using flow cytometry
- Differentiation capacity - Both groups were able to differentiate into adipocytes and osteocytes as evidenced by the production of fat droplets and calcium depositions, respectively.

Discussion: The results show that the rate of cell culture growth was 73% for cells from cryopreserved teeth. Additionally these cells maintained their growth potential and demonstrated a high efficiency in osteogenic and adipogenic differentiation. Their morphology presented no visible differences. Both stem cell markers CD44 and STRO-1 were present indicating the surface markers of DPSC were unaffected by the cryopreservation techniques. Despite a previous report stating otherwise, these results show cryopreserved teeth maintain many important characteristics of fresh teeth and could be a useful resource in future studies.

LOE: 5
Title: Periapical bone regeneration after endodontic microsurgery with three different root-end filling materials: amalgam, SuperEBA™, and mineral trioxide aggregate.

Author: Seung-Ho Baek, et al

Journal: JOE, vol. 36, no. 8:1323

Reviewed By: Sheerin Yusuf, DMD

Purpose: To compare the distance from root-end filling materials to regenerated bone in contact with amalgam, SuperEBA™, and MTA in dog teeth using microradiography.

Materials & Methods: Five healthy female beagle dogs were used. The pulp tissues of molars and premolars were removed from the canals, and plaque contaminated paper points were placed into the canals and sealed with IRM. Periapical lesions formed between 4 to 6 weeks and were verified radiographically. Non surgical RCT followed by root end surgery was performed. All surgical procedures and root-end preparations were performed under an operating microscope at 8 to 24x magnification. Three different root-end filing materials were used: amalgam, SuperEBA™, and mineral trioxide aggregate. After 4 months, the dogs were sacrificed, and the jaws were prepared for histological sectioning. The distance from root-end fillings to the regenerated bone was determined by evaluation of micrographic images of sections with image software at three points: the buccal margins, the center, and the lingual margins of the root-end fillings.

Results: The distance from the center of the root-end filling materials to regenerated bone was calculated at 0.397 +/- 0.278 mm in the MTA group, 0.75 +/- 0.581 mm in the SuperEBA™ group, and 1.290 +/- 0.386 mm in the amalgam group. The MTA group showed superior bone regeneration to the other two root-end filling materials, and there is a statistically significant difference between the MTA and amalgam groups (p < 0.05). There is no significant difference in amalgam versus SuperEBA™ and SuperEBA™ versus MTA.

Conclusion: MTA group had the closest distance from the center resected root surface to bone. The distance from MTA to the regenerated bone was similar to the normal average periodontal ligament thickness in dogs.

LOE: 5
Purpose: To evaluate specific signaling molecules related to the inflammatory process and the biomineralization ability of mineral trioxide aggregate (MTA) to assess host–biomaterial interactions in vivo.

Materials and Method:

- 80 dentin tubes were prepared from extracted human teeth. The teeth were irrigated with 17% EDTA and 1% NaOCl, dried and then filled with tooth colored MTA or kept empty (negative controls)
- 4 separate incisions were made at the backs of male Swiss rats and a pocket was created. Each mouse received 3 dentin tubes: 2 filled with MTA and one empty (no specimen was inserted in the fourth pocket -sham to ensure rotation of sites)
- To determine the protein level expression of IL-1B, TNF-α and IL-10, the remaining half of the samples and surrounding tissues were excised and processed for tissue homogenate.
- Histological & immunohistochemical analyses performed using primary antibodies rabbit polyclonal antimyeloperoxide, mouse monoclonal antiVEGF, rabbit polyclonal antiphospho-p65NF-kappa B, rabbit monoclonal antiphospho-c-jun AP 1, rabbit polyclonal anti –iNos. The slides were washed and incubated with ready to use secondary antibody.
- The cytokine level were determined and expressed as pictogram per milligram of tissue protein
- The retrieved dentin tubes were washed in distilled water and sputter coated with gold for SEM

Results:

- TNF-α and IL-1B peaked at 12 and 24 hours and at 3 days were significantly up in the MTA group when compared with those in empty tubes and sham.
- The MTA group showed a significant increase in IL-10 expression compared to the empty tube and the sham group at 12 hours, 1 day and 3 days.
- SEM examination of the dentin tubes showed the presence of apatite like clusters that mainly contained calcium and phosphorous. It was possible to observe apatite like clusters deposited on collagen fibrils as early as 12 hours from implantation. After 7 days a compact apatite layer was observed

Discussion/conclusions: It is suggested that MTA induces a pro-inflammatory and pro-wound healing environment. The biomineralization occurs simultaneously with the acute inflammatory response. In vivo biomineralization process promoted by MTA occurs as an interaction of MTA with dentin in a phosphate – containing fluid. IL-1 α and TNF-α have a pro inflammatory effect followed by a regulatory effect in the later stages of inflammation. Thus the regulatory effect of the cytokines signals the resolution of the inflammation reaction. MTA causes activation of NF-kappaB. This activated complex translocates to the nucleus and stimulates the expression of COX-2. Released prostaglandins in turn induce the transcription of iNOS in an autocrine manner. The productions of prostanoids by COX2 promoted the expression of VEGF and causes subsequent angiogenesis which means induction of a repair process.

LOE: 5
Title: Electropolishing enhances the resistance of nickel-titanium rotary files to corrosion-fatigue failure in hypochlorite

Author: Praisarn, et al.

Journal: Journal of Endodontics, 36:8, 1354-1357, 2010

Reviewer: Christian Kecht, DDS

Purpose: To determine the corrosion-fatigue behavior of 2 nickel-titanium (NiTi) engine-files, each having been electropolished with a different regime, subjected to rotational bending in a corrosive environment.

Materials and Methods:

- Two NiTi files tested: RaCe rotary instrument by FKG Dentaire (Switzerland) and FlexMaster® by VDW (Germany).
- RaCe rotary files are electropolished by the manufacturer.
- FlexMaster® rotary files are not electropolished by the manufacturer, but some were magnetoelectropolished secondarily for this study by an unrelated company.
- Fatigue testing consisted of rotary instrument being confined by three smooth, high-hardness stainless steel pins forming a three-point bend. Pins were replaced throughout testing when signs of wear or rust were observed.
- Files were set to rotate at 250 rpm until breakage occurred.
- Rotary files remained immersed in 1.2% sodium hypochlorite solution for the entire test.
- Number of revolutions to failure of each file was recorded by an optical counter.
- Broken fragments were measured for length using Leica stereomicroscope at 25x and fracture surface examined with scanning electron microscope.
- Diameter of fracture cross section determined by scanning electron microscope for each broken fragment.
- Effective surface strain amplitude (εa) defined by the unit deformation of the material at its outermost surface.
- Number of revolutions to failure of each file was plotted against εa in SigmaPlot 10.0 software.
- Regression line fitted to the LCF region, where appropriate, and data for the 2 instruments were compared using a two-way analysis of covariance.
- Data from non-electropolished FlexMaster® files obtained from a previous study were also compared to the magnetoelectropolished FlexMaster® files of this study.
- Statistical significance set at P = .05.

Results:

- Transition from high-cycle fatigue (HCF) to low-cycle fatigue (LCF) is demonstrated by the slope change in the data trend.
- Failure taking place at 2000 cycles or lower was deemed to be within the LCF region.
- Magnetoelectropolished FlexMaster® files were significantly (P < .05) more fatigue resistant than RaCe files.
- Magnetoelectropolished FlexMaster® files were significantly (P < .05) more fatigue resistant than untreated, commercially available FlexMaster® files.

Discussion:

- Previous studies have shown that 1.2% hypochlorite solution has negative effect on NiTi file fatigue resistance (25%-30% reduction of total fatigue life).
- Control group of instruments fatigued in a bland solution not included in this study for comparison for the effect of hypochlorite on NiTi files.
- Electropolished RaCe files showed better fatigue resistance than non-electropolished FlexMaster® instrument. Cannot be certain whether this effect is due to the electropolishing or to the structural design of the RaCe file.
- Magnetoelectropolished FlexMaster files showed improved fatigue resistance over non-treated FlexMaster® files. This is in contrast to previous studies that showed no effect as a result of electropolishing.

Conclusion: The resistance to LCF failure of a NiTi instrument rotating with a curvature in a corrosive environment is enhanced by a magnetoelectropolishing process.

LOE: 5
November 10

Title: Effectiveness of different final irrigant activation protocols on smear layer removal in curved canals

Author: Caron, G. and et al

Journal: JOE, vol. 36, no. 8:1361

Reviewer: Arwa Siyam, DDS.

Purpose: To study the effect of different final irrigation regimens and methods of activation on smear layer removal in curved canals after root canal instrumentation.

Materials and Methods:

- 50 freshly extracted mandibular molars were selected. Each tooth was photographed and radiographed to confirm that each root has more than 20 degrees curve.
- All mesial canals were prepared to working length by Protaper® instruments.
- The canals were irrigated passively with 0.5 ml of 3% NaOCl after each instrument with a 27-gauge Monoject syringe. The canals were also flushed with 0.5 ml of NaOCl each time a #10 patency file is inserted.
- All procedures were performed by a single operator.
- The teeth were then randomly assigned to either one of the 2 control (n=5) or 4 experimental groups (n=10), for final irrigation.
- The negative control group received no final irrigation. The positive control was immersed in 17% EDTA for 5 min followed by a 5 min immersion in 3% NaOCl.
- The final irrigation protocols included:
  1. No activation
  3. Automated Dynamic activation: RinsEndo®
  4. Sonic activation: EndoActivator®.
- The activation protocol included activation of a 17% EDTA solution for 1 minute, followed by an activation of 3% NaOCl for 30 sec. In the no activation group the irrigants were left for 1 min and 30 sec respectively.
- Mesial roots were further split into middle and apical thirds, which were further longitudinally sectioned and prepared for SEM examination.
- The amount of smear layer and the size of dentinal tubules were scored and data was analyzed.

Results: In the middle third only the “no-activation group” scored a 3 with a thin smear layer and showed a statistical difference with the three other activation groups (p < 0.05) in which smear layer scores were always inferior to 3. In the apical third comparisons between each group showed a statistically significant difference (p < 0.005). The sonic group showed a statistical difference when compared to all the test groups (p < 0.05). There was no statistical difference between manual-dynamic activation group and the EndoActivator® group, but the latter showed a consistent score lower than 2 in the apical third samples.

Conclusion: The activation of irrigating solutions yielded cleaner canals compared with no activation, and a tapered activator that closely adapts to the dimensions of a shaped canal is the most effective. (i.e., the master gutta-percha cone and Endoactivator®)

LOE: 5
**Title:** Antimicrobial effects of calcium hydroxide and chlorhexidine on *E. faecalis*

**Authors:** Ronan J.R. Delgado et al.

**Journal:** JOE, vol. 36, no. 8:1389

**Reviewer:** Nicole Vu, DMD

**Purpose:** To test the efficacy of calcium hydroxide and chlorhexidine gel on the elimination of intratubular *E. faecalis*

**Materials and Methods:**

- 60 extracted teeth stored in 10% formaldehyde
- 15 were used as negative control, 45 were used in the experimental group
- Crowns, 2-3 mm from CEJ and 3-5 mm of apical, were removed
- Roots of 8 mm were stored in saline and were inoculated with $6.3 \times 10^8$ colony-forming units per mL of *E. faecalis*
- The teeth were then filled with Ca(OH)$_2$, 2% chlorhexidine gel, 2% chlorhexidine gel plus Ca(OH)$_2$, and a negative group was filled with sterile saline. All were sealed with temporary filling
- Dentinal fragments were collected using Gates #5 for the depth of 0 to 100 µm and #6 for 100 to 200 µm, then incubated, then CFUs were counted
- For fluorescence microscopy analysis, samples were stained with 2.5 µL of calcein-acetoxymethylester (viable bacteria stained in green) and 1 µL of propidium iodide (nonviable bacteria stained in red), then analyzed

**Results:** Saline treatment didn’t influence the viability within the tubules. Ca(OH)$_2$ reduced # of CFUs. 2% chlorhexidine treatment presented the least # of CFUs with or without Ca(OH)$_2$. The bacterial viability was evaluated with SEM and yielded results of chlorhexidine eliminating more *E. faecalis* when compared with Ca(OH)$_2$. No differences were noted between antimicrobial activity of chlorhexidine with or without Ca(OH)$_2$.

**Discussion:** The results were similar to others findings showing *E. faecalis*’s resistance to Ca(OH)$_2$. Furthermore, *E. faecalis* has been shown to be more susceptible to chlorhexidine. Ca(OH)$_2$ is alkaline which destroys cytoplasmic membrane, denature proteins, and damages bacterial DNA. Chlorhexidine disintegrates the membrane and may induce reactive oxygen species.

**Conclusion:** Chlorhexidine was more effective for antimicrobial activity than Ca(OH)$_2$ in endodontic therapy.

**LOE:** 5
Title: Investigation of apex locators and related morphological factors

Author: Ding, J. et. al.

Journal: JOE, vol. 36, no. 8:1399

Reviewer: Andrew Cho, DMD

Purpose: Investigate the ability of three electronic apex locators (EALs) to detect the minor foramen and morphological influencing factors relative to working length determination.

Materials and Methods:

- 356 permanent teeth with single, straight root canals were decoronated and coronally flared with Gates Glidden drills 1-3.
- A file was introduced into the root canal until the tip became visible at the most coronal border of the major foramen as viewed under microscope and was recorded as \( L_o \).
- Next a modified mounting and measuring unit (MMU) was used for electronic measurements which consisted of a digital micrometer connected to a #10 k-file.
- The root apices were immersed into a container filled with 0.9% sodium chloride and the Root ZX ®, Raypex ® 5, and Elements Apex Locator were used to detect the minor foramen and was recorded as \( L_e \).
- \( L_e \) minus \( L_o \) was calculated as the distance between the major foramen and the file tips (DMFF). A positive value means the file tip is short of the major foramen and negative value means the file tip is beyond the major foramen.
- The apical anatomic features of the tooth including the minor foramen’s morphology (area, diameter, perimeter, and roundness) and the major foramen’s location, were identified with the aid of a stereomicroscope

Results:

- The average DMFFs were:
  1. Root ZX ® - 0.261mm
  2. Raypex ® 5 – 0.376mm
  3. Elements Apex Locator – 0.383mm
- There was statistical difference between the Root ZX ® and both Raypex ®5 and Elements Apex Locator
- For each EAL, the DMFFs showed a significant difference in teeth with different major foramen locations. In general, the major foramen located at the tip of the root had a greater DMFF compared to when the foramen was located laterally.
- In general, the file tips were mostly located within the range of 0-0.5mm coronal to the major foramen (Root ZX ® – 82.87%, Raypex ® 5 – 67.7%, Elements Apex Locator – 64.05%)
- The DMFFs determined by EALs were significantly associated with the apical anatomic features of the teeth.

Discussion:

- With the Root ZX®, the DMFF was found to increase as the minor foramen’s area increased.
- With the Raypex® 5, the DMFF was found to increase as the area and the narrow diameter of the minor foramen increased.
- The Elements Apex locator DMFF values varied with the area and wide diameter of the minor foramen.
- The differences between the 3 apex locator models may be due to their differing design concepts for processing the impedance from electrical currents.
- The ability of the 3 EALs to detect the minor foramen was found to be significantly different. When the minor foramen reading was given, the file tips determined by the Root ZX® were much closer to the major foramen than when the Raypex® 5 and Elements Apex Locator were used. The minor foramen’s morphology and the major foramen’s location were both important influencing factors on the performance of EALS.

Conclusion: The ability of the 3 EALs to detect the minor foramen was found to be significantly different. When the minor foramen reading was given, the file tips determined by the Root ZX® were much closer to the major foramen than when the Raypex® 5 and Elements Apex Locator were used. The minor foramen’s morphology and the major foramen’s location were both important influencing factors on the performance of EALS.

LOE: 5
Title: Comparative evaluation of the antimicrobial efficacy of a 5% sodium hypochlorite subsonic-activated solution.

Authors: Pasqualini et al.

Journal: JOE, Vol 36, no 8:1358

Reviewer: Ferras Mashtoub, DDS

Purpose: To evaluate the efficacy of subsonic activation (using Endo Activator (EA) by Dentsply, Tulsa Dental Specialties) of NaOCl in reducing bacterial load in the root canal system.

Materials & Methods:

- 112 extracted human single canal teeth with no hx of RCT and that had substantially similar canal curvature and morphology
- Root surfaces debrided, then teeth submerged in a 5% NaOCl solution for 1 hour, and then stored in saline until prepared.
- Each tooth sectioned to provide a root length of 15mm.
- Each tooth was preflared using K-Flexofiles to #20 and then shaped with ProTaper (S1-S2-F1-F2-F3) to working length. (working length established under 10x magnification when tip of file visible at apex)
- Irrigation performed under 30 gauge needle using 33ml of 5% NaOCl sol’n and alternating with 10% EDTA. Total irrigation time was 10 minutes per tooth.
- Teeth dried w/ paper points and then roots were inspected under 10x magnification to verify no cracks present and for canal cleanliness.
- Root surfaces sealed with varnish and sticky wax. Each tooth fixed to Eppendorf tube with cyanoacrylic cement and placed in a plastic support box.
- Teeth then sterilized with ethylene oxide gas (sterilizes w/out leaving residue that would interfere with growth of bacteria to be inoculated subsequently)
- Sterilized roots were then inoculated with E. faecalis
- Teeth further incubated aerobically for 2 hours.
- 2 teeth used as negative controls, 10 used as positive controls, remaining 100 broken into four groups (of 25)
  - Group 1: (NaOCl 15) teeth irrigated for 40 seconds with 2ml of 5% NaOCl w/ 30-guage needle 2mm short of apex. NaOCl left in canal for 15 seconds before removal with 5ml saline.
  - Group 2: (NaOCl 30) same procedure as above, except NaOCl left for 30 sec before removal
  - Group 3: (EA 15) Irrigated for 40 sec with 5% NaOCl solution with 30-guage needle 2mm short of apex. NaOCl immediately activated subsonically for 15sec (EA 15/.02 tip placed 2mm short of apex, driver set at 10.000 cpm). Irrigant then removed with 5ml of saline.
  - Group 4: (EA 30) Same procedure as above, except activated for 30 seconds.
- Positive controls were irrigated for 40 sec with 2ml of sterile water
- After each irrigant treatment, the tooth would be dried to working length and sampled with sterile paper point. Paper points would then be transferred to tubes with saline, diluted, and CFU’s counted to determine bacterial load present.

Results: Decrease in bacterial load was: NaOCl 15=98.6%, NaOCl 30=98.7%, EA 15=99.1%, EA 30=99.6%. Statistically significant difference in decrease was found between standard groups and EA 30 only.

Discussion: Study indicates that sonic activation of 5% NaOCl solution for 30 seconds appears to be slightly more efficacious in disinfecting root canals compared with standard irrigation. Sonic activation for 15 seconds does not appear to improve disinfection.

LOE: 5
Title: Prospective, randomized single-blind study of the anesthetic efficacy of 1.8 and 3.6 milliliters of 2% lidocaine with 1:50,000 epinephrine for inferior alveolar nerve block

Author: Wali, M et al.

Journal: JOE vol. 36, 9:1459

Reviewer: A. Jayson Tengonciang, DMD

Purpose: The purpose of this study was to compare the degree of pulpal anesthesia obtained in vital, asymptomatic teeth by using 1.8 mL and 3.6 mL of 2% lidocaine with 1:50,000 epinephrine compared with 1.8 mL of 2% lidocaine with 1:100,000 epinephrine for the inferior alveolar nerve (IAN) block.

Materials and Methods: Thirty adult subjects – 8 women and 22 men, 22 to 44 years of age, good health, no medications, all tested teeth were free of caries, large restorations, and periodontal disease, no history of trauma or sensitivity

• Subjects randomly received each of 3 solutions in an IAN block at 3 separate appointments, spaced at least 1 week apart
  1. 1.8 mL of 2% lidocaine with 1:100,000 epinephrine
  2. 1.8 mL of 2% lidocaine with 1:50,000 epinephrine
  3. 3.6 mL of 2% lidocaine with 1:50,000 epinephrine
• Fifteen sets of 3 IAN block injections were administered on the right side, and 15 sets of 3 IAN block injections were administered on the left side. The same side randomly chosen for the first injection was used again for the second and third injections. (Each subject served as his or her own control)
• EPT tested teeth were: mandibular first molar, first premolar, and lateral incisor (contralateral mandibular canine was used as the unanesthetized control)
• The side and the order of the anesthetic solutions was randomly assigned to determine which solutions were to be administered at each appointment
• At the beginning of each appointment the experimental teeth and control contralateral canine were tested 3 times with the pulp tester to record baseline vitality
• All injections were given by a single person and all subjects received a conventional IAN block
• EPT sequence
  1. At 1 minute - the first molar was pulp tested
  2. At 2 minutes - the first premolar and lateral incisor were tested
  3. At 3 minutes - the contralateral canine was pulp tested
  4. This cycle of testing was repeated every 3 minutes for 60 minutes
• If profound lip numbness was not recorded within 20 minutes, the block was considered unsuccessful
• No response from the subject at the maximum output (80 reading) of the pulp tester was used as the criterion for pulpal anesthesia. Anesthesia was considered successful when 2 consecutive 80 readings were obtained within 15 minutes, and the 80 reading was continuously sustained through the 60th minute

Results and Discussion:

• Anesthetic Success
  1. 1.8 mL of 2% lido with 1:100,000 epi – 1st molar – 43%, 1st premolar – 60%, lat. incisor – 40%
  2. 1.8 mL of 2% lidocaine with 1:50,000 epi– 1st molar – 33%, 1st premolar – 50%, lat. incisor – 37%
  3. 3.6 mL of 2% lidocaine with 1:50,000 epi– 1st molar – 40%, 1st premolar – 60%, lat. incisor – 47%

• Lip Numbness – significant difference of onset time difference between 1.8 mL of 2% lido with 1:50,000 and the other solutions – longest for onset
• Pulpal Anesthesia – no significant difference of onset time between the solutions

Conclusion: Increasing the epinephrine concentration to 1:50,000 epinephrine in a 2% lidocaine solution or increasing the volume to 3.6 mL of 2% lidocaine with 1:50,000 epinephrine did not result in more successful pulpal anesthesia when compared with 1.8 mL of 2% lidocaine with 1:100,000 epinephrine by using the IAN block

LOE: 4
Title: Diagnosis of vertical root fractures in endodontically treated teeth based on clinical & radiographic indices: a systematic review

Author: Tsesis I et al.

Journal: JOE 2010; 36(9):1455-8

Reviewer: Ken Lin, DMD

Purpose: The aim of this study was to systematically search and evaluate the literature regarding the diagnosis accuracy of clinical signs and symptoms and radiographic indices for the diagnosis of vertical root fractures (VRF) in endodontically treated teeth by means of a systematic review.

Materials & Methods:
- This review included clinical studies that assessed the diagnosis of VRF and has to include patients with confirmed VRFs in endodontically treated teeth – confirmed during surgical flap procedure, after tooth extraction, or identified radiographically as clearly discernible separation of segments of fracture roots.
- Table 1 summarizes the criteria for inclusion of studies in the systematic review.
- MEDLINE & Scopus & Embase search engines were used to identify related studies. A manual search of related articles and literatures in the MEDLINE search engine and textbook chapters were also conducted.

Results:
- 27 studies were identified – 19 (out of 197) from MEDLINE & 5 (out of 117) from Scopus, in addition to 3 from manual search – eligible on the basis of their titles and abstracts.
- None of the articles submitted to full text evaluation fulfilled the inclusion criteria

Discussion/Conclusion:
- In VRF diagnosis, there is no known single pathonomonic sign, symptom, or radiographic feature to make the diagnosis easy and definitive. When VRF diagnosis is made, a quick decision to extract the tooth or root is necessary – otherwise, the inflammation in the supporting tissues would lead to periodontal breakdown followed by the development of a deep osseous defect and resorption of the bone facing the root fracture.
- The most common signs and symptoms of VRF described in the literature are deep osseous defects (buccal aspect) and highly located sinus tract (closer to gingival margin).
- The most common radiographic features of VRF are the “halo” appearance, lateral periodontal radiolucency, or angular radiolucency from the crestal bone. In mandibular molars, RL in furcation area can often be observed, coupled with the types of RLs described above.
- The evidence-based data regarding to the diagnosis accuracy and usefulness of the commonly used clinical and radiographic evaluation methods for the diagnosis of VRF in endodontically treated teeth are lacking. This makes the determination of a fracture root more of a prediction rather than a definitive diagnosis.

LOE: 2
Title: The effect of premedication with ibuprofen and indomethacin on the success of inferior alveolar nerve block for teeth with irreversible pulpitis.

Author: Parirokh, M et al.

Journal: JOE, Volume 36, Number 9: 1455

Reviewer: Christian Lehr, DMD

Purpose: To compare two types of NSAID medication with a placebo regarding their effects on the success rates of Inferior alveolar nerve block (IANB) for endodontic treatment of mandibular molar teeth with irreversible pulpitis.

Materials and Methods: One hundred fifty patients diagnosed with irreversible pulpitis of a mandibular first or second molar, as diagnosed by a response to EPT and a prolonged or exaggerated response to cold, were randomly divided into one of three groups, each with 50 participants.

- Group 1 was given placebo
- Group 2 was given 600 mg Ibuprofen
- Group 3 was given 75 mg Indomethacin

All medications were taken 1 hour before starting the treatment. Also before treatment, patients were asked to assess their pain on a visual analog pain scale. IANB was administered using 1 carpule of 2% Lidocaine with 1:80,000 epinephrine and 15 minutes later, signs of soft tissue anesthesia were assessed. If the patient did not report profound lip numbness, the IANB was considered a failure and the patient was excluded from the study. In IANB successful patients, the teeth were again tested with cold and the patients were asked to rate their pain using the same visual analog scale. An access cavity was prepared and patients were instructed to rate any pain experienced during each step (pain within dentin, when entering the pulp chamber, or when a file was inserted into the root canals). No or mild pain (faint, weak, and mild pain) were classified as successful while moderate and severe pain were classified as failure of anesthesia. Any patient who reported pain during treatment was given additional anesthesia by another method.

Results:

- Patients in the Indomethacin group showed significantly greater preoperative pain than the other groups.
- The overall success rate for the placebo group was 32%.
- The overall success rate for the Ibuprofen group was 78%.
- The overall success rate for the Indomethacin group was 62%.
- The Ibuprofen and Indomethacin groups showed significantly higher success rates compared to the placebo group.
- Overall, 64 of the 150 patients failed to show complete success of anesthesia (placebo group = 64, Ibuprofen group = 11, Indomethacin group = 19). Thirty of these patients showed sensitivity to cold 30 minutes after anesthesia. See attached table for a detailed distribution of success and failures.

Discussion: The results of this study show that premedication with Ibuprofen or Indomethacin significantly increased the success rate of IANB anesthesia for mandibular molar teeth with irreversible pulpitis. In this study, however, of the 120 patients who reported no response to a cold test 15 minutes after anesthesia, 34 reported pain during the access cavity preparation or during instrumentation. Therefore, no response to a cold test is not a guarantee that complete pulp anesthesia has been achieved and that no pain will be felt during root canal treatment.

Conclusion: Although more effective anesthesia was obtained when an NSAID was used before treatment, the dentist should still be prepared to use other supplementary anesthetic techniques to overcome a patient’s discomfort whenever pain is encountered treating teeth with irreversible pulpitis.

LOE: 2
Title: A cone-beam computed tomography study of maxillary first permanent molar root and canal morphology in a Chinese population

Author: Zheng Q et al

Journal: JOE, Vol. 36, No. 9:1480

Reviewer: Sheerin Yusuf, DMD

Purpose: To evaluate root and canal morphology of permanent maxillary first molars in a Chinese population using cone-beam computed tomography (CBCT). The prevalence of additional canals in the mesiobuccal root (MBR) was also evaluated by sex, age, tooth position, and unilateral or bilateral occurrence.

Materials and Methods: CBCT images of 775 maxillary molars from 701 patients were identified using the Accuitomo CBCT machine (MCT-1[EX-2F] from J. Morita. Subjects with fully erupted permanent maxillary first molars were selected. Qualified maxillary molars had fully formed apices and lacked root canal fillings, posts, and crown restorations. Seventy-four of these patients had bilateral qualifying molars. Axial, coronal, and sagittal two-dimensional section images were displayed on a monitor and inspected by two endodontists using one Data Viewer software (J. Morita Manufacturing Corp). They evaluated the images twice, with a 1-week interval between the assessments. The reliability data were analyzed with a kappa test. The frequency of root and canal numbers; the incidence of additional canals in the MBR; and correlations with sex, age, tooth position; and bilateral and unilateral appearance were determined.

Results:
- Most (97.29%) molars had three separate roots, whereas all roots were fused in 0.48% of teeth.
- Most teeth had one foramen per root (MBR = 87.98%, DBR = 99.04%, and PR = 98.88%).
- Two canals identified 0.31%, three canals in 47.21%, four canals in 50.40%, five canals in 1.75%, and six canals in 0.31% of teeth.
- Additional canals were detected in 52.24% of mesiobuccal roots, 1.12% of distobuccal roots, and 1.76% of palatal roots.
- Patients aged 20 to 30 years showed a higher prevalence of additional mesiobuccal root canals.
- Most (71.11%) of the additional mesiobuccal root canals in subjects with bilateral qualifying molars were symmetric.

Conclusion: Cone beam computed tomography scanning is an effective method for studying external and internal dental morphology. It can be concluded that more than half of maxillary first molars have four canals and three roots in the Chinese population. Most of the additional canals were located in the MBR and had one foramen. The incidence of additional MBR canals did not differ with sex or tooth position and was usually bilateral. More additional canals were detected by CBCT in patients between 20 and 30 years of age.

LOE: 5
The fracture resistance of teeth restored with post-retained restorations: an overview.

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To review and critically analyze the concerned topics and controversy related to the fracture resistance of teeth restored with dowel-retained restorations.

A systematic review of Pubmed/MEDLINE (from 1960 to 2010), Cochrane, and Scopus databases (to 2010) was completed. Single or combined keywords (fracture resistance, endodontic post and core, fiber posts, adhesive luting, and endodontically treated teeth) were used to obtain the most possible comprehensive list of articles. In vitro and ex vivo (laboratory, computer-based finite element, and photoelastic stress analysis studies) were included in this review.

Factors that affect the fracture resistance of post-restored teeth
- Post length: optimum post length depends on several factors including root length, crown height, level of bone support, and technique of cementation. Adhesive cements, ferrule effect, and full coronal restoration may reduce the effect of post length on fracture resistance.
- Post diameter: a smaller post diameter is recommended to retain more dentine during preparation of post channel, which enhances the fracture resistance of dowel-restored teeth. The ability of a tooth to resist fracture is directly related to the amount of remaining dentine around the post. Optimum post root diameter should be approximately 1:4
- Post Design: Tapered metal posts cause greater cervical stress than parallel posts (due to wedging effect). Apical stresses tend to be higher in parallel posts due to the sharp angles and reduced tooth structure at apical area. Threaded metal posts have more stress concentrated at dentine-thread interface and can predispose to crack formation.
- Post Material: Posts with higher modulus of elasticity like metals are associated with higher failure. Being more rigid than tooth, high modulus of elasticity posts produces stress concentration at critical areas of the root and causes more fractures. Materials with low mod of elasticity bend more under load and tend to fail. Many studies showed better fracture resistance of teeth restored with fiber-reinforced resin posts (which had similar rigidity to dentin) when compared with metal or zirconia posts. Corrosion resistance of posts may influence the fracture resistance. Metal posts were found to corrode over time and the products migrate through dentinal tubules and build up intratubular pressure.
- Post fitting: sliding friction was the main factor that affected resistance to dislocation of resin-bonded fiber posts. Poorly fitted posts might create levers within the root canal making it more liable to fracture. Close adaptation of posts to the canal walls was found to increase the fracture resistance of restored teeth significantly.
- Core material: less stiff cores are expected to deform under occlusal loads and thus reduce the stress concentration. Composite resins were reported to fracture under loads lower than those necessary to fracture tooth (this is considered a protective mechanism). Cast metals P/C were associated with more root fractures than prefab P/C.
- Ferrule effect: a meal collar extension beyond the gingival margin of the core to encircle the tooth. Most researchers recommended a min of 1-2mm of ferrule height and a uniform height at the whole tooth circumference was recommended. However this should be in balance with the remaining tooth structure and C:R ratio.
- Luting cement: luting cement provides a buffer zone between the post and dentine, which might affect stress distribution upon loading. Brittle cements like Zn Phosphate may disintegrate and cause levers that conc. stresses and cause fracture. Using adhesive cements allows even stress distribution over the entire bonded surfaces. Cements with higher mod of elasticity caused a higher stress cone. within the cement layer. Self etching adhesives were better than etch rinse adhesives for luting posts.
- Coronal leakage: Crowning endo treated posterior teeth and badly damaged ant teeth increases their resistance to fracture, whereas crowning endo treated ant teeth with intact coronal structure does not improve their fracture resistance.
- Remaining coronal tooth structure: fracture resistance would be reduced if more coronal dental structures were lost. Fracture resistance of teeth with no remaining coronal walls was not improved when fiber posts were used.
- Loading conditions: Magnitude and direction of functional loads play a major role in stress cone. within dowel- restored teeth. Higher occlusal forces, like in cases of parafunctional habits were associated with higher failure rates of such teeth. Horizontal loads cause a significantly higher stress cone. within dentine than loads more parallel to the long axis of the tooth. Because of the inclination anterior teeth are most likely subjected to more horizontally directed loads. Posts might magnify stresses produced within dentine. This is the reason that preservation of the coronal tooth structure is more effective than posts.
- Alveolar bone support: a lower fracture resistance was reported among roots of perio compromised teeth reconstructed with P/C. the loss of alveolar support will lower the level of mechanical fulcrum, which in turn will jeopardize the fracture resistance of post restored teeth. At least 1:1 C:R ratio should be ensured and the post should extend beyond the level of alveolar bone.
Conclusion: Previously the argument was in favor of reinforcing teeth by posts. Today researchers agree that posts do not offer reinforcement. Their insertion involves procedures that usually sacrifice tooth structure and reduce the fracture resistance of teeth. Endo treated teeth with posts might be more successful if tooth structure loss is limited, a ferrule is obtained, a post with similar physical properties to natural dentine is used, and adhesive techniques for post luting and coronal restoration are used.

LOE: 4