Title: Histologic outcomes of uninfected human immature teeth treated with regenerative endodontics: 2 case reports

Author: Nosrat A et al


Reviewer: Michelle Jordán DMD

Purpose: Apexification using MTA apical plug has been shown to produce successful outcomes, the main shortcoming of this procedure is that it doesn’t promote continuation of root development and these remain susceptible to coronal root fracture. An ideal treatment for these teeth is pulp regeneration. The benefit of regeneration is not only revitalization but also continued root development. To examine clinically and histologically the outcome of 2 non-infected human teeth treated with regenerative endodontics.

Materials and Methods:

- Two birooted fully erupted immature maxillary first premolar teeth from 2 patients aged 9 and 10 years old were studied.
- Local anesthesia 3% carbocaine without epinephrine was used. RD isolation, access cavity and WL were established 1mm short of the open apex. Canals were instrumented, in the 9y/old pt were taken to size 90 master file. In 10 year old to a size 60 master file.
- Irrigation with 1.25% NaOCl and 17% EDTA done 1 mm short WL. Bleeding was induced by overextension of file #30 2 to 3 mm beyond WL. Blood clot was allow to form for 10 min
- MTA was placed over blood clot and access was filled with composite.
- Followed by teeth were schedule for extraction 4 months after treatment and they were embedded in paraffin and stained with hematoxylin-eosin.

Results:

<table>
<thead>
<tr>
<th></th>
<th>9 year old</th>
<th>10 year old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roots</td>
<td>showed well developed dentin layer surrounded by PDL</td>
<td>Well-developed dentin surrounded by PDL</td>
</tr>
<tr>
<td></td>
<td>A thick layer of hard tissue was observed beneath MTA</td>
<td>Dentin layer in this tooth was much ticker</td>
</tr>
<tr>
<td></td>
<td>No inflammatory cells were found</td>
<td>MTA was also observed but the hard tissue close to MTA was not as thick as in the other specimen</td>
</tr>
<tr>
<td>Tissues within</td>
<td>displayed features mimicking odontogenic fibroma-PDL-type histology</td>
<td>Tissues within the roots displayed features of periodontum structure</td>
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<tr>
<td>the roots</td>
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<td></td>
<td>Tissues within the roots displayed features of periodontum structure</td>
<td>No inflammatory cells were observed</td>
</tr>
</tbody>
</table>

Conclusion: Based on histological features the tissue that regenerates in the canal is not a true pulp tissue instead it resembles periodontal tissue. Stem cells in blood clot might not differentiate into odontoblasts.

LOE: 5
Purpose: Immature and mature teeth with necrotic pulp and apical periodontitis have been successfully treated with RET. RET results in resolution of apical periodontitis. In RET there are no pulp tissues but similar tissues that are vital tissues which are from the immune defense mechanisms which can restore vitality and defense capability of damaged tissue. The purpose of this case report was to describe the results of RET on 2 previously treated individuals with apical periodontitis

Materials and Methods:

- 2 male patients at the age of 12 and 26 experienced apical periodontitis after root canal treatment
- #9 and 19 were mature teeth and after removal of gutta percha canals were debrided, irrigated and dressed with metapaste
- On the following appointment a #25K file was used to penetrate the periapical tissue and provoke bleeding
- Once the bleeding became semicoagulated MTA plug 3mm in thickness was placed over the blood clot followed by a moist cotton pellet and IRM
- Once the MTA was set the access cavity was restored with composite

Results: Periapical lesion decreased in size and healing was evident radiographically on follow up examination within 7-8 months and 13-14 months.

Conclusion: Teeth with persistent apical periodontitis after RCT are usually treated non-surgically or surgically. RET is a viable option for certain retreatment cases as described in this study.

LOE: 5
Title: Use of EndoVac system for aspiration of exudates from a large periapical lesion: A case report

Author: Keles, A et al.

Reviewer: Xiomara Y. Rivera DMD

Journal: Journal of Endodontics, Volume 41, Number 10; 1735-1737

Purpose: This study presented an alternative method for the nonsurgical management of a large periapical lesion by decompression through the root canal space by using EndoVac system. Ninety percent of periapical lesions can be classified as dental granulomas, radicular cysts, or abscesses. Preliminary clinical diagnosis of cysts can be made based on the following:

- Periapical lesion involves one or more non-vital teeth
- Periapical lesion is greater than 200mm in area radiographically
- Radiographically, the lesion is circumscribed and seen as a well-defined radiolucent area bound by a thin radiopaque layer
- Straw-colored fluid is produced upon aspiration or on drainage through the root canal

Materials and Methods:

- 21 year old male with occasional pain on anterior mandible
- Tooth #24: Necrotic with drainage of yellow serous exudate.
- Instrumentation was done with hand files from #40-#60. EndoVac negative pressure system was used before, during, and after instrumentation and tooth was sealed without intracanal medicament.
  - 1st week: aspiration with EndoVac was repeated
  - 2nd, 3rd, 4th week: decompression with EndoVac was done
  - 5th weeks: patient was asymptomatic and only blood was aspirated. Canal was irrigated with NaOCl and medicated with Ca(OH)₂. (Repeated one week later)
- Teeth #23 & #26: necrotic but no drainage was obtained. Instrumentation done with hand files up to #40. Calcium hydroxide was used as intracanal medicament.
- Obturation was done with lateral condensation and AH Plus sealer.
- Patient was recalled after a 6-month interval and after 2 years.

Results: After 1 week mobility of tooth #24 decreased. At week 7 patient was asymptomatic with no exudate was present. After 2 years healing of periapical lesion was observed.

Conclusion: Aspiration technique using EndoVac supports the healing of cyst-like periapical lesions.

LOE: 5
Intraosseous lymphoma is a rare condition that may mimic other dental lesions. The purpose of this study is to report a case of mandibular intraosseous lymphoma mimicking a periapical lesion and to highlight the importance of differential diagnosis and appropriate treatment.

Case Report:

48 y/o male patient was referred for evaluation.

- CC: lower lip numbness and cold sensitivity in the right inferior premolars lasting for about 5 months.
- Past dental history: A general dentist replaced an amalgam filling of first and second premolars (#28, #29) first. Because of persistent symptoms, endodontic treatments were performed on adjacent canine and premolars (#27-#29). The lip numbness remained and swelling was noticed after root canal therapy.
- Intraoral examination: A swelling was observed on the buccal side of #27-#29, asymptomatic, fibrous consistency on palpation.
- Radiographic examination: A periapical radiograph and a panoramic showed a diffuse ill-defined radiolucency involving # 27, 28, 29 apexes. A CT showed irregular destruction of buccal cortical bone and external resorption of #27-#29
- Treatment: An incisional biopsy was performed. The diagnosis of diffuse large B-cell lymphoma was established using histopathological and immunohistochemical analysis. The patient was referred to a hematologist-oncologist for evaluation and treatment. An 18-FDG-PET/CT showed a high metabolic activity only in the right mandible. Bone marrow aspiration showed no tumor cells. Six cycles of rituximab, cyclophosphamide, hydroxydaunorubicin, vincristine and prednisone chemotherapy were done. Complete tumor remission was observed, slight bone recovery and improvement of numbness in the lower lip was reported. No signs of tumor recurrence 7 months after the last cycle of chemotherapy.

Discussion/Conclusion: The literature reviewed showed 29 complete detailed cases of lymphoma appearing in the periapical area. Mandible was the more commonly affected site (58.6%); the most common type of lymphoma was diffuse large B-cell lymphoma (DLBCL). Endodontic treatment was performed in 51.7% of cases previously to the diagnosis of lymphoma. Intraosseous lymphoma is very uncommon and may mimic endodontic or periodontal disease. An important clinical feature is numb chin syndrome (NCS) or mental nerve neuropathy. The main etiologic factors of NCS include trauma, systemic disease or malignant neoplasm. 40% of NCS is caused by metastatic breast cancer followed by NHL in mandible or skull base.
Title: The precision of electronic apex locators in working length determination: A systemic review and meta-analysis of the literature.

Author: Tsesis I. et al.

Journal: JOE, Volume 41, Number 11; 1818-1823

Reviewed by: Shin-Chieh Yang DMD

Purpose: Apical foramen anatomy might deviate from the long axis of the tooth, and may enlarge with the patient’s age, tooth adaptation to the functional activity and pathological changes. This study evaluated the precision of electronic apex locators (EALs) in locating the Apical constriction (AC) as well as the effects of possible influencing factors by a means of a systematic review of the literature and meta-analysis.

Materials and Methods: Included studies that reported the precision of EALs in locating the AC in primary RCT of human teeth compared with a histologic evaluation of the AC. The search covered all articles published in dental journals from 1966- January 2014. The following electronic databases were searched: Medline, Embase, Scopus, and Cochrane Central Register of Controlled Trials. The articles were evaluated for relevance based on titles and abstracts by two reviewers. The following variables were recorded:

- the distance between the file tip during the EAL measurement and the actual AC location as determined histologically
- the type of EAL: Root ZX (J Morita), Justy II (Germany), Endy 5000(Germany) and endox (Italy)
- Status of the pulp
- type of irrigant used during measurement

Result: A total of 10 articles were selected; 3 considered having a low risk of bias and 7 studies were considered to have a high risk of bias. They include studies reporting a total of 1105 EAL measurements by 4 types of EALs

- root ZX (37.28%), Justy II (29.95%), Endy 5000 (18.28%), and Endox (14.4%)  
- The mean distance between the file tip and AC measured by Endox was significantly longer.
- In the presence of hydrogen peroxide, root Zx and Justy II was significantly shorter compared with the measurement in the presence of NaOCl.
- The status of pulp: only 194 measurements. 68.55 % were performed in vital teeth. The distance between file tip and the Ac did not differ significantly for any of the electronic devices tested.

Discussion/Conclusion: The precision of EALs depends on the type of device and irrigation and not influenced by the status of the pulp tissue. Root ZX, Justy II and Endy 5000 are significantly more accurate than Endox.

LOE: 1
Purpose: Reciprocating motion (RM) had been extensively used with stainless steel (SS) files in the development of endodontic mechanical instrumentation. However, RM applied to NiTi files has many differences from the one used with SS. The purpose of this article is to review the mechanical instrumentation of root canals beginning with SS reciprocating files (RFs) and their evolution up to the latest applications of RM to greater taper NiTi files.

Materials & Methods: A search of the existing literature was performed on PubMed, Cochrane Library, Web of Science, and EMBASE electronic databases. The key words used were “Reciprocating”; “Reciprocation”; “Oscillating”; “Oscillation” combined with “Mechanical” AND “Preparation”; “Mechanical” AND “Instrumentation”; “Instruments”; “Files”; and “Technique.” The research was limited to dental publications and articles written in English, and no time limits were given to the research. An additional hand search was also performed in few other journals.

Evolution of Reciprocating Motion in Endodontics: A Historic Perspective: Different handpieces were manufactured initially in the 1960s including the Giromatic. The end results of shaping were similar to a classic manual approach, however, a higher incidence of root canal iatrogenic errors was observed.

Modern Reciprocation for NiTi Files with Greater Taper: The use of greater taper NiTi files has improved the overall quality of RCP even in the most challenging internal anatomy. The main problem with the NiTi rotary instruments has been the fracture rate of these files. This “separation” problem can be attributed to its use in continuous rotation. In 2004, one study investigated the endurance limit (EL) of NiTi files, this can be defined as the level of torsional stress or strain at which the file can be subjected to a virtual infinite cycles without failure, where a cycle is intended as a loading stress or strain and releasing. This value will be a specific deflection angle (DA) characteristic of each instrument, and it will depend on the size and design features.

Conclusion: RM is defined as a repeated backward and forward (CW/CCW) movement; this reciprocal movement can be applied to many endodontic files, and it has been extensively used in endodontics for many years. There are many variations of RM, including complete reciprocation (oscillation), partial reciprocation (rotational effect), and hybrid reciprocation (combined movements). Hybrid reciprocation can be fixed or flexible (ie, they can shift from one type of reciprocation to the other in the canal based on mechanical resistance and torque). This kind of movement has been extensively used for the entire shaping phase with SS instruments. Nowadays, it is still possible to use this mechanical movement with SS files as a tool for initial scouting and glide path establishment phases of the treatment. The evolution of this movement and its application to NiTi instruments with greater taper seem to cover a promising role in the modern endodontic instrumentation of RCS; this is extensively reviewed in the second part of this article.

LOE: 1
Title: Treatment outcome of repaired root perforation: A systematic review and meta-analysis

Author: Siew K et al

Source: JOE. Vol 41, No.11;1795

Reviewer: Alshammari, Abdulaziz DDS

Purpose: This study reviewed the treatment outcomes of repaired root perforation.

Material and Methods: Electronic databases search using PubMed, Web of Knowledge, EMBASE, and SCOPUS, as well as by manual search by search word ‘perforation or root perforation or strip perforation or furcal perforation or furcation perforation or lateral root perforation and [root canal]”. The search covered all articles published from 1950 to July 2014. Two reviewers (K.L.S., A.H.C.L.) independently screened all titles.

- Inclusion Criteria: Follow-up time was more than 1 year, in the permanent dentition, X-Ray and Clinical Exam available in Follow up and articles in English or Chinese.
- Exclusion Criteria: Follow-up period was less than 1 year, study without treatment, publications were in the form of letters, commentaries, or narratives, No specified criteria were provided for evaluating the outcome of treatment, or there was no mention of how to determine the healing outcome and Patient had impaired immune response, or patient was diabetic or receiving long-term medication.
- 17 article included for systematic review and 12 included for meta-analysis.

Results: Success of perforation repair depends on a good seal of the perforated site with a biocompatible material that contributes to the well-being of the periodontal ligament. A major limitation of this present study is the small number of clinical studies that had been conducted on the outcome of such treatment. Little information is available on the long- term periodontal healing of repaired perforations. Preoperative conditions could hardly be standardized because of the accidental nature of perforation during root canal treatment. The clinical procedures in 9 of the 17 studies reviewed here were carried out by practitioners with or under training in endodontic specialty at either university hospitals or private endodontic clinics. Maxillary teeth showed a significantly higher success rate when compared with mandibular teeth. Higher success rate of nonsurgical root canal retreatment for maxillary than mandibular teeth. Proper disinfection and achievement of a good seal for the perforation site are important in ensuring a successful outcome. In addition, some radiolucent lesions might have escaped detection because of the presence of overlapping radiodense structures in the maxilla. Success rate reduced when a preoperative radiolucent area adjacent to the perforation site was present.

Conclusion: The perforated root non-surgically, with an overall chance of success of about 73% for all types of repair materials combined. The use of MTA material may further enhance the success rate it’s a worthwhile attempt to save the affected tooth.

LOE: 2
Purpose: The purpose of this study was to correlate the evidence of apical periodontitis evaluated with 2-D periapical radiographic images and 3-D CBCT volumes with clinical signs and symptoms.

Materials and Methods: Clinical records were reviewed from patients examined at the graduate endodontics clinic. The examination included clinical examination, sensibility tests, PA radiographs, and limited field-of-view CBCT scans. Of 498 cases, 67 fulfilled the inclusion criteria and were evaluated for apical periodontitis and symptomology. CBCT slices and PA radiographs were evaluated for the presence of apical periodontitis.

Results: No factors were significant predictors of the presence of apical periodontitis visible on CBCT imaging only. Twenty-two percent of the cases included in this study had evidence of apical periodontitis on CBCT imaging that was not visible on PA radiography.

Conclusion: In comparing CBCT imaging with PA radiography, we found that the detection of apical pathosis is higher when assessed with CBCT imaging (79% probability) than with PA radiography alone (57% probability). This research has important implications to prevent overexposure to radiation and to provide treatment for those patients with persistent symptoms lacking proper diagnosis based on conventional (2D) radiographs

LOE: 3
Title: Spectrophotometric analysis of coronal tooth discoloration induced by various bioceramic cements and other endodontic materials

Author: Kohli M et al


Reviewer: Christina Lee DDS

Purpose: To evaluate coronal tooth discoloration induced by bioceramic materials, EndoSequence Root Repair Material, and Biodentine in comparison with other materials used during endodontic treatment.

Materials and Methods:

- 80 extracted maxillary anterior teeth were prepared to hold the test material within the root canal
- Specimens divided into 8 groups: Root Repair Material, Root Repair Material-Fast set, Biodentine, white MTA, gray MTA, AH plus sealer, triple antibiotic paste (metronidazole/ciprofloxacin/minocycline), and no filling (negative control)
- Color change was evaluated with a spectrophotometer at day 0 (prior to material placement), day 7, 1 month, 2 month, and 6 months
- Color measurements from the spectrophotometer were calculated into color difference for each specimen
- Visual records via photographs under magnification were taken

Results: At baseline each group had a similar color. No filling, AH plus, Root Repair Material, Root Repair Material-Fast set, and Biodentine groups induced color changes exceeding the human perceptibility threshold at any time. Discoloration was visually and mathematically observed in all specimens in the gray MTA, white MTA, and triple antibiotic paste groups by day 7 and the discoloration increased over time.

Conclusions: Significant coronal tooth discoloration was caused by triple antibiotic paste, gray MTA, and white MTA but not by AH plus or the bioceramic materials Biodentine, Root Repair Material, and Root Repair Material-Fast set.

LOE: 5
Title: Comparative evaluation of the efficiency of manual rotary gutta-percha removal techniques

Author: Colaco A et al


Reviewer: Michelle Jordán DMD

Purpose: To evaluate and compare the efficiency of the manual technique and rotary retreatment systems in removing gutta-percha (GP).

Materials and Methods:

- 40 extracted intact single rooted human teeth were used. Working length (WL) was established and canal cleaning and shaping were done with ProTaper (Dentsply Maillefer) rotary files up to file size F2.

- Canals were obturated and teeth were divided in 4 groups:
  - Group 1: GP removal using Hedstrom (H) files and xylene (H+X): 0.1 mL of xylene was deposited and a size 20 H-file was used until the WL was reached. A size #30 H-file was used to remove the remaining GP. The total operating time was calculated (which is the time taken to reach WL and complete the removal of the obturation material).
  - Group 2: H-files and System B (H+SB): GP was softened using 0.06 taper plugger (SybronEndo), 3mm short of WL. Then the total operating time was measured.
  - Group 3: PTUR system: Using D1 (size 30, .09 taper), D2 (size 25, .08 taper), and D3 (size 20, .07 taper) to remove GP until the WL was reached. The total operating time was measured.
  - Group 4: D-RR system: Using DR1 (size 30, .10 taper) and DR2 (size 25, .04 taper) to remove GP until the WL was reached. DR1 was used at a speed of 1000 rpm and DR2 file was used at a speed of 600 rpm. The total operating time was measured.

- Roots were grooved longitudinally in a buccolingual direction and they were analyzed using Image J software. The percentage of GP remnants was calculated using A= (area of the remnants X 100)/ (area of the root canal)

Results: Rotary Techniques (PTUR and D-RR) were significantly faster and left lesser GP remnants than manual techniques. H+X was significantly faster and left lesser GP remnants than H+SB. D-RR was significantly faster than PTUR but there was no significant difference between them regarding GP remnants. D-RR most effective faster and least amount of GP remnants. On the contrary, H+SB was the least effective.

Conclusion: Rotary techniques were more efficient than manual techniques in GP removal. Because all the techniques showed GP remnants on the canal walls and radiograph failed to show these remnants additional measures would be required to ensure complete GP removal.

LOE: 5
Title: Effectiveness of the GentleWave System in removing separated instruments

Author: Wohlgemuth P et al

Journal: JOE, Vol. 41, No. 11: 1895-1898

Reviewer: Aaron Salimnia DDS

Purpose: The purpose of this study is to evaluate the success rate of the GentleWave System in removing separated stainless steel hand files from the mid and apical portion of molar teeth. GentleWave System cleans the root canal system by providing a broad spectrum of waves within the irrigant.

Materials and Methods:
- 36 extracted human first and second molars
- Intact mesiobuccal canals of maxillary molars and mandibular molars were selected
- Notches were placed on #10, #15 and #20 K files with a diamond disc, 2.5mm from the tip of the instruments
- Root curvatures were measured with ImageJ
- Radiographs taken to confirm instrument separation
- GentleWave System treatment was performed with 3% NaOCl for 5 minutes, distilled water for 30 seconds, 8% EDTA for 2 minute and distilled water for 15 seconds
- Each GentleWave System treatment cycle was 7 minutes and 45 seconds and a maximum of 3 cycles were performed
- Statistical Analysis was done with Fisher exact test and the independent 2 sample t test at P=.05

Results: File fractures occurred 18 times in the apical region and 18 times in the midroot region. Instruments were successfully removed 83% of the time in the midroot region and 61% in the apical region. No significant difference in the removal of the separated instruments from the locations of file and file size. Files were removed 91% of the time when curvature was less than 30 degrees and 42% when curvature exceeded 30 degrees. The association between the removal of the separated instruments and the curvature was statistically significant

Conclusion: GentleWave System doesn’t compromise the dentinal integrity because it doesn’t involve shaping or instrumentation. The median for successful removal of the instruments was 10 minutes and 44 seconds and mode was 7 minutes and 45 seconds.

LOE: 4