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SHEDDING NORTHERN LIGHTS ON ENDODONTICS

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General Endodontic Posters

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GE01 - DESCRIPTIVE CLASSIFICATION FOR TRANSVERSE ROOT FRACTURES BASED ON CONE BEAM COMPUTED TOMOGRAPHY

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Aim: To formulate a descriptive classification for transverse root fracture (TRF) based on cone beam computed tomography (CBCT).

Methods: CBCT scans (4X4cm FOV, 0.125mm voxel size) of 50 anterior teeth with cervical, middle and apical TRF were retrieved. Reconstructed CBCT slices (sagittal, axial, and coronal) were assessed on a medical-grade monitor. Traumatized tooth was visualized in an axially corrected projection, aligned along the long axis of the tooth. TRF was identified as a hypo attenuated line running across the root. This feature was observed on at least two contiguous sections and reconstructed CBCT slices. Five features of TRF were included to develop the alphanumeric coded classification.

Results: First digit indicates tooth number within parenthesis. Next, the number of fracture lines (only if >1) would be denoted by an Arabic numeral. Subsequently two digits (F, L) would represent the facial and lingual location of the fracture line. A lower-case alphabet ‘c’, ‘m’ or ‘a’ would denote the location of fracture line in the respective third, placed as superscript or subscript to F and L for supra crestal/crestal and sub crestal fractures respectively. Digit D with +/- sign within parenthesis would denote the presence or absence of diastases at the fracture line. Facial(f), lingual(l) or incisal(i) displacement of the coronal fragment would be recorded within the parenthesis following the + sign. Subsequent digit ‘A’ would signify the status of the alveolar bone at the fracture site and recorded as h(healthy), r(resorbed) or f(fractured) within parenthesis. To exemplify, a single TRF in a right maxillary central incisor running in the coronoapical direction (cervical third, subcrestal on facial aspect and middle third on lingual aspect) with no diastases and healthy surrounding alveolar bone would be denoted as (11)FcLmD(-)A(h).

Conclusions: 3D classification would aid in appropriate diagnosis, reporting and predicting prognosis of TRF.

GE02

Management of external cervical resorption with MTA

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Aim

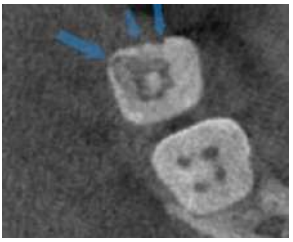
The aim of treatment for teeth diagnosed with ECR, which are considered to be restorable, is to retain them in a healthy and functional state and improve aesthetics when indicated. The objectives of treatment for ECR are excavation of the resorptive tissue, sealing of the hard tissue defect with a biocompatible material and prevention of recurrence of ECR. (1)

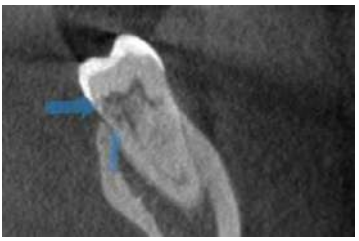
Introduction

Case Presentation

Asymptomatic patient diagnosed with external cervical root resorption. The tooth was necrotic, with a small entry point, apical to the epithelial junction.

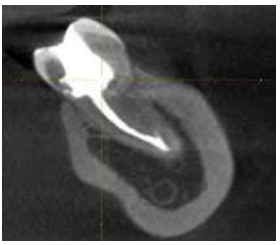


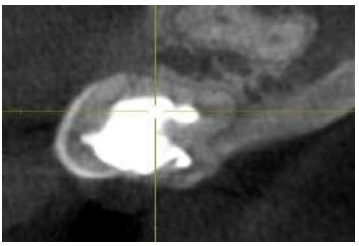




The tooth was treated in two appointments with CaOH used as inter-appointment medicament. Reciproc 25 was used, NaOCL and bioceramic sealer. The perforation was sealed with MTA.







Discussion

Conclusion & Clinical Relevance

References

(1) Patel S. et al. External cervical resorption-part 2: Management. International Endodontic Journal Vol 51, Issue 11.

Retreatment in lower premolar with complex anatomy: apical curvature and immature apex

GE03

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Aim

To treat apical periodontitis that caused loss of the buccal bone plate in a tooth with complex anatomy.

Introduction

It is known that both an abrupt curvature and an open apex are two factors that make root canal treatment difficult.

Case Presentation

Second lower premolar, previously treated with a chronic apical abscess draining through the periodontal sulcus, causing loss of buccal bone plate.
It was planned to retreat endodontically the tooth.
We treat it in 2 appointments:
First appointment:
- Root canal material removed with US, Reciproc R25 and Microdebrider
- Irrigation with NaOCl 5.25%
- Calcium Hydroxide medication

Second appointment:
- Irrigation with NaOCl 5.25% + EDTA 17%
- Negative pressure irrigation with Endovac
- Ultrasonic agitation (Irrisafe)
- MTA plug in 4-5 apical third
- Thermoplastizied gutapercha in rest of the canal
- Temporary restoration and back to GDP to final restoration

One year later, tooth is asymptomatic and functional, and it can be observed regeneration of cortical bone plate.



Discussion

In the literature it can be observed different approaches to the management of an open apex.
Revascularization could be an option, but the most predictable way is the apical plug technique with a bioceramic material.
The technical difficult in this case, was to obturate this open apex without direct vision.
The apical plug was made with the help of a pre-curved plugger, in order to compact the MTA behind the curvature, then indirectly vibrating the material with ultrasound.

Conclusion & Clinical Relevance

As it can be observed, if we can clean and seal the root canal space, even in a difficult case, there is resolution of the apical periodontitis.

GE04 - VALIDATION OF AN INNOVATIVE DYNAMIC AND STATIC TESTING DEVICE FOR MECHANICAL PERFORMANCES OF NITI ROTARY INSTRUMENTS AT DIFFERENT TEMPERATURES AND DYNAMIC EVALUATION OF THE OPERATIVE TORQUE OF 3 SIMILAR NITI INSTRUMENTS CHARACTERIZED BY DIFFERENT CRYSTALLOGRAPHIC PHASES

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Aim:
The aims of this study were:
1. Validate a testing device able to evaluate mechanical stresses at different temperatures.
2. Compare the operative torque of 3 NiTi instruments differing only in their heat treatment.

Methods: The testing machine was designed as follows: a linear guided board, moved by a stepper motor, regulates the movement of the device with a sensibility lower than 1/10 mm. A specific and multi-purpose sample holder, spliced on a load cell to measure the developed apical force, allows the insertion of different types of testing tools. The experimental methodology was validated by examining the operative torque and the apical force developed during the instrumentation of curved resin canals at 37°C with 10 Direct Gold, 10 EdgeTaper and 10 EdgeTaperPlatinum instruments and comparing the results of each dynamic test to assess the measurements' reproducibility. Pecking motion was set with a 1.5mm inward-motion and 1mm outward-motion with an axial speed of 60mm/s. The parameters considered for the validation and operative torque comparison among instruments were: number of torque peaks, maximum torque of each pecking cycle instrumentation time, and apical force developed. Mean values and SD were calculated and the testing device was considered valid if the relative standard deviation was < 8% for each parameter. Data were statistically analyzed.

Results: All measurements reported a relative standard deviation < 8%. A significant difference ($p<.05$) was found only between EdgeTaperPlatinum and EdgeTaper in terms of operative torque, with lower values for the austenitic instruments. No statistically significant difference was found in terms of apical pressure, instrumentation time, and number of peaks among the three instruments ($p>.05$).

Conclusion: Data obtained from the methodology setup are reproducible and repeatable, and this testing machine is a valid option for mechanically testing NiTi instruments. Moreover, martensitic instruments are more subjected to torsional loads.

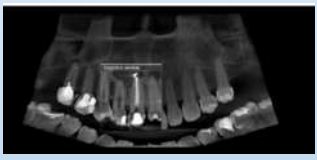
GE05

TREATMENT OF APICAL PERIODONTITIS: APICOECTOMY

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Endodontic Department, Boston University Henry M. Goldman School of Dental Medicine





Aim

To evaluate the treatment outcome of apical surgery for large periapical radiolucency.

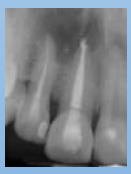
Introduction

The goal of endodontic surgery is to eliminate the disease and to prevent it from recurring. The surgical option should be considered only when a better result cannot be achieved by nonsurgical treatment. Indications include: Failure of previous endodontic therapy, procedural errors, anatomical deviations, exploratory surgery.

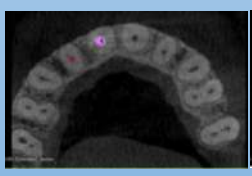


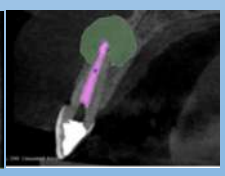
Case Presentation

Patient presented with a large buccal swelling and tenderness on mastication on his front upper teeth. Upon clinical examination, they were found to be non-vital. Non-responsive to the cold test as well as the electric pulp test . Tooth # 8 had an incomplete apex so apexification (using BC putty) followed by apicoectomy was performed on teeth #7 and 8











Methodology

#8- root canals enlarged using step-back to file #110.
Apexification was carried out using BC putty.
#7- orthograde RCT using resin-based sealer (AH 26 and warm vertical multiple wave





A full thickness periosteal flap was raised extending from the distal papilla of the central incisor with the vertical releasing incision on the mesial of canine. Thin cortical bone was removed to create a window and the lesion was excised. Periapical curettage was performed. 3mm apical resection was made along with retrograde canal preparation and filled with BC putty. Suturing was done with 5/0 vicryl.



Discussion

Peri-radicular surgery is an important treatment option in modern endodontic practices. *Torabinejad et al*., found a success rate of 77.8% for peri radicular surgery at 2-4 y and a rate of 71.8% at 4-6 years

A major step in apical surgery is to identify possible leakage areas at the cut root face and subsequently to ensure adequate root-end filling. Only a tight and persistent apical obturation will allow periapical healing with good long-term prognosis.

Conclusion & Clinical Relevance

Apical surgery can now consider a predictable treatment option in saving a tooth with apical pathology that cannot be managed by conventional, non-surgical endodontics. The use of surgical microscope, and the application of microsurgical principles are also important factors to obtain successful outcomes of apical surgery

References

Torabinejad M, Corr R, Handysides R, Shabahang S, Outcomes of nonsurgical retreatment and endodontic surgery: a systematic review J Endod 2009 35:930-37

Apical surgery: A review of current techniques and outcome, Thomas von Arx, Saudi Dent J. 2011 Jan; 23(1): 9–15

GE07

Treatment of Tooth with Endodontic and Periodontal Problems Using the Intentional Replantation Procedure: Case Series Report

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Aim: To present the clinical impact, healing patterns and treatment outcomes of intentional replantation (IR) for periodontally hopeless teeth.

Introduction: IR is defined as the deliberate extraction of a tooth that is difficult to treat with conventional methods and the evaluation of the root surfaces, and the placement of the tooth back in its original socket after endodontic manipulation. As an alternative to extraction and implant placement, IR offers a biological treatment option for teeth with an indication for extraction.



Case Presentation

Case 1: A 59-year-old female patient referred to our clinic for the evaluation of her lower anteriors. In the history taken from the patient, it was learned that she had no systemic diseases. As a result of clinical and radiographic examinations, bone loss pattern in mesial and distal areas in the mandibular anteriors and radiolucency compatible with apical periodontitis in tooth 41 were detected. After explaining the treatment options to the patient, IR was decided as treatment method. Root canal treatment (RCT) to tooth 41 was completed right before the operation. After atraumatic extraction tooth is immediately placed in tetracycline solution. After all granulomatous tissue was removed from the roots and socket, the tooth was replanted in its socket. A composite splint was applied to the lingual of the mandibular anteriors. In the 12-month follow-up visits, the patient was asymptomatic, and mobility was considerably reduced.



Case 2: A 36-year-old systemically healthy female patient referred to our clinic for the mobility in her upper anteriors. As a result of clinical and radiographic examinations, bone loss pattern in mesial and distal areas in the teeth 11 and 12. After explaining the treatment options to the patient, IR was decided as treatment method. The same treatment protocol described in Case 1 was used for this case. However, splint was not applied in this patient. At 7-day, the first follow-up visit was performed, and she reported no symptoms. At 9-month, the patient remained asymptomatic, and periodontal tissues appeared healthy.



Case 3: A 36-year-old systemically healthy female patient applied to our clinic for the mobility in her upper anteriors. As a result of clinical and radiographic examinations, bone loss pattern in mesial and distal areas in the maxillary right anteriors. After explaining the treatment options to the patient, IR was decided as treatment method. The same treatment protocol described in Case 1 was used for this case. However, splint was applied on labial surfaces. This treatment has just been completed and the patient is still under follow-up. At the 1-month follow-up, the patient is asymptomatic, and mobility is considerably reduced.

Discussion

IR can be an alternative approach to extraction in cases where advanced periodontal destruction is present and no other treatments could be considered.

Conclusion & Clinical Relevance

IR is an acceptable viable treatment option for endodontically treated teeth with excessive periodontal problems.

Keywords: Intentional replantation, tooth, root canal treatment, case report.

References

1.Javed F et al. Outcome of intentional replantation of endodontically treated teeth with periapical pathosis: A systematic review and meta-analysis. Aust Endod J. 2022 Nov 10

2. Zhang J et al. Intentional replantation of periodontally involved hopeless teeth: a case series study. Clin Oral Investig. 2020 May

3. Plotino G et al. Present status and future directions: Surgical extrusion, intentional replantation and tooth autotransplantation. Int Endod J. 2022 May

4. Grzanich D et al. Saving Natural Teeth: Intentional Replantation-Protocol and Case Series. J Endod. 2017 Dec

Nonsurgical root canal therapy of a large, cyst-like periapical lesion of endodontic origin: case report

GE08



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European Society of Endodontology

Aim: To report the healing of an extensive periapical lesion of endodontic origin, following nonsurgical treatment.

Introduction: According to clinical evidence, lesions that are larger in size, are most likely radicular cysts. Still, some of these large lesions may appear to be granulomas(1).

Case Presentation: 64 year old patient was referred for root canal treatment of tooth 21.

Complains: constant pain, tenderness to percussion.

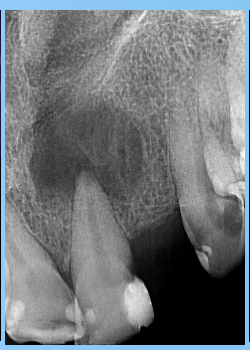
Intraoral examination: cold, heat and electrical pulp test were done, which elicited negative responses.

CBCT Imaging and periapical Xray: a huge radiolucent cyst-like lesion around tooth 21(fig1 and fig2).

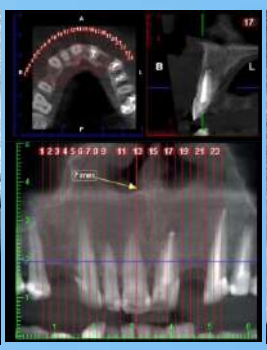
Treatment: after cleaning the root canal system chemomechanically, Ca(OH)2 paste was inserted for 2 weeks. Disinfection was done with heated 2,5% NaOCL and citric acid. The canal was obturated using bioceramic sealer and hydraulic condensation technique.

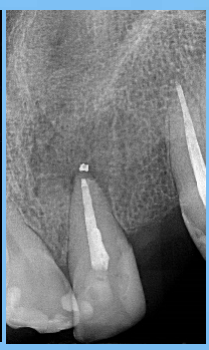
Control visits: CBCT examination and the X-ray after 18 months showed fully repaired bone structure(fig3 and fig4).





(fig1 and fig2)





(fig3 and fig4)

Discussion: If the microbal etiology of a large cyst-like periapical lesion in the root canal is removed by nonsurgical root canal therapy, the lesion might regress. In this case, both radicular cyst and periapical granuloma were in the differential diagnosis list. The conclusive and definite diagnosis of a cyst can be made only through histopathological findings.

Conclusion & Clinical Relevance

Successful management of a large periapical lesion is achivable with non-surgical root canal therapy. This conservative method, being minimaly invasive, usually requires a relatively extensive treatment period. Non-surgical root canal therapy should be our primary treatment for pulp necrosis and periapical lesions, regardless of the size of the lesions.

References:1.Natkin E Or, Carnes LI. The relationship of lesion size to diagnosis, incidence and treatment of periapical cysts and granulomas. Oral Surg Oral Med Oral Pathol.1984;57:82-94.
2.Lin LM, et al.Nonsurgical root canal therapy of large cyst-like inflammatory perapical lesions and inflammatory apical cysts.J.Endod.2009;35(5);607-615.

GE09 - THE EVALUATION OF TREATMENT STATUS AND TREATMENT QUALITY OF TEETH WITH PERIAPICAL LESIONS IN SELECTED POPULATION OF YOUNG TURKISH AND FOREIGNERS LIVED IN TURKEY: A CROSS-SECTIONAL STUDY

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[1]Akdeniz University, Faculty of Dentistry, Department of Endodontics

Aim: This study aimed to evaluate the treatment status and quality of teeth with periapical lesions in selected population of young Turkish and foreigners lived in Turkey.

Methodology: The patient file pool at the Faculty of Dentistry, Akdeniz University (Antalya, Turkey), was screened. Digital orthopantomography (OPTGs) taken from patients in 18-30 year-old as a part of diagnostic and planning procedures between January 2018 and January 2023 were assesed. For each patient, the following information was recorded: gender, age, nationality, number of teeth present, number and location of endodontically treated teeth, the number of teeth with periapical lesions (PL), periapical status and quality of root canal treatment (RCT). A total of 393 foreign patients were included in this study and 393 Turkish patients among the 30405 of them were selected by systematic sampling.

Results: The OPTGs of 738 patients including 21126 teeth were evaluated. The average age of patients was 23. The number of teeth with RCT was 1100 teeth (5.2%). In the Turkish population, 10668 teeth were examined; RCT was present in 332 teeth (3%), of which 221 (66%) had PL. In the Foreigner population, 10458 teeth were examined; RCT was present in 768 teeth (7%), of which 477 (62%) had PL. Molars (58%) were the most commonly treated teeth with PL in both Turkish and foreign patients. The working length of RCT was adequate for 50% of teeth in the Turkish population and 48% of teeth in Foreigner population. The percentage of teeth with PL without RCT were 44% and 32 in the Turkish population and in the Foreigners, respectively.

Conclusions: In both populations molars were the most endodontically treated teeth. The quality of RCT in a selected Turkish population and Foreigners was in general below than acceptable standard.

Combined non-surgical and surgical management of a left mandibular central incisor

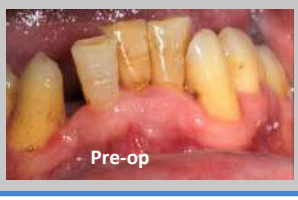
GE10

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[2] Professor, National and Kapodistrian University of Athens, School of Dentistry, Department of Endodontics

Aim: To describe the management of a left mandibular central incisor with non-surgical root canal treatment as well as surgical endodontic treatment.

Case Presentation:
- 42 years old male
- Medical history: non-contributory
- Referred for the completion of the root canal treatment (RCT) of tooth #31, due to the persistence of the buccal fistula.
- RCT initiated 1 month before.



Clinical examination
- Percussion -
- Palpation +
- Buccal fistula
- Pocket depths up to 7mm
- Mobility grade 2

Radiographic examination
- Periradicular radiolucency (mainly #31 and also, #41 and #32

Pulp sensitivity tests
- Positive for #32, #41
- Negative for #31

Diagnosis (#31)
- Chronic apical abscess

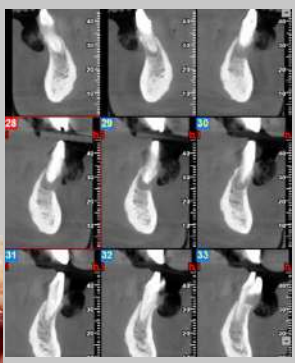
Treatment
- RCT

Prognosis
- Questionable





Root canal treatment
- Master apical file #70 K-file
- 2,5% NaOCl, 17% EDTA, PUI
- $Ca(OH)_2$ for 2 visits (1 month) - fistula didn't subside.
- RCT finished
- **Decision for surgical endodontic treatment**



CBCT images
- Large periradicular radiolucency
- Dehiscence of the buccal cortical bone

Surgical endodontic treatment
- Dental operating microscope
- Local anesthesia
- Full-thickness mucoperiosteal flap (rectangular)
- Osseous entry and apex located
- Osteotomy (surgical burs)
- Surgical curettage
- Root end resection (3mm)
- Root end preparation (ultrasonics)
- Root end filling (TotalFill putty)
- Suturing (P.G.A 5/0)

Histologic evaluation
Lesion consistent with periapical granuloma









6 months recall
- No signs and symptoms
- Significant part of the lesion healed
- No periodontal pockets
- Mobility grade 1
- Pulp sensitivity tests for #32 and #41: positive









Discussion: Surgical endodontic treatment is a method used in treated teeth with recurrent or residual disease, after non-surgical root canal treatment. It presents high healing rates long-term (1 year: 91.6% , 5 years: 91.4%, 10 years : 81.5%).

Conclusion & Clinical Relevance:
The use of a microsurgical technique and biocompatible materials can result in a high clinical success rate after surgical endodontic treatment.

Reference: von Arx, T., Jensen, S.S.; Janner, S.F.M.; Hänni, S.; Bornstein, M.M. A 10-year Follow-up Study of 119 Teeth Treated with Apical Surgery and Root-end Filling with Mineral Trioxide Aggregate. J. Endod. 2019, 45, 394–401.

GE11 - CYCLIC FATIGUE OF ENDODONTIC FILES: EFFECT OF PECKING MOTION

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[1]Boğazici University, Department of Mechanical Engineering

Aim: To evaluate the influence of the pecking motion (reciprocal axial motion) surgical technique on the durability behavior of the Nickel-Titanium (Ni-Ti) endodontic files using Finite Element Analysis.

Methods: Endodontic file ProTaper Universal F2 is selected for this study due to its common utilization for canal treatment procedure and the broadly available test data in the literature. Canal treatment procedure is simulated on a test-bench (simulated canal) proposed by G. Gambarini for cyclic fatigue loading of endodontic files with and without the pecking motion via Finite Element Analysis (FEA). Abaqus FEA software is utilized for the simulations which has the in-built Super-elasticity material model which is able represent the inner loop effect of shape memory alloys. The hysteresis energy density is used as evaluation criteria for low cycle fatigue life estimation of Shape Memory Alloy files. In an additional study, the canal treatment procedure is also simulated for an FEA model of a molar tooth with significant canal curvature to understand the influence of the realistic curvature of a tooth canal on the fatigue behavior of endodontic files.

Results: For the simulated canal, analysis accurately predicts the file's failure location, and fatigue life estimates based on the hysteresis energy density is shown to increase significantly with the introduction of the pecking motion, an observation as confirmed by reported experimental results. Simulations with the molar tooth indicate longer file fatigue life compared to that evaluated for simulated canal and confirm that the pecking motion improves file durability.

Conclusion: Simulations indicate that the pecking motion technique increases the fatigue life of endodontic files for simulated as well as real canals and the hysteresis energy is confirmed as an acceptable parameter to quantify fatigue life of Nickel-Titanium endodontic files.

GE12 - EFFICACY OF DIFFERENT ACIDIC IRRIGATING SOLUTIONS ON DISSOLVING HYDRAULIC CALCIUM SILICATE-BASED MATERIALS: AN IN VITRO STUDY

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[1]Institute of Dentistry, Faculty of Medicine, Vilnius University, [2]Department of Applied Chemistry, Faculty of Chemistry and Geoscience, Vilnius University

Aim: To evaluate and compare the efficacy of EDTA and citric acid (CR) irrigating solutions combined or not with ultrasonic activation (UA) on dissolving BioRoot RCS (BR), TotalFill BC (TF) and AH Plus Bioceramic (AHPB) sealers.

Methods: Forty specimens (5x2 mm) of each material were prepared and stored in gelatinized Hank's balanced salt solution at 37°C. After 59 days, specimens were rinsed in distilled water, dried at 37°C for 24h and then randomly allocated to eight groups (n=5) according to the irrigating solution and activation used: 17% EDTA, 17% EDTA+UA, 20% CR, 20% CR+UA, 40% CR, 40% CR+UA, distilled water and distilled water +UA. The ultrasonic activation was performed using size 25 IrriSafe file 1 mm above the specimen for 4min, maintaining the total exposure time of 5min for all irrigating solutions in all experimental groups. The mass loss of each specimen was calculated, and the changes in surface morphology and chemical composition were analyzed by scanning electron microscopy and X-ray diffraction.

Results: All tested materials demonstrated the highest solubility in 40% CR, followed by 20% CR. The percentage of lost mass in 40% CR without activation varied from 6.80±1.41% (BR group) to 23.90±1.01% (AHPB group). The ultrasonic activation was capable to increase the materials degradation speed from 1.56- to 1.98-fold in both CR solutions. The distilled water had the lowest impact on materials degradation, with no significant differences between activated and not activated groups. BR exhibited the highest resistance to all tested irrigating solutions, while AHPB was apparently more degradable material.

Conclusions: Within the limitations of this study, 40% CR, followed by 20% CR, has more acceptable properties to dissolve hydraulic calcium silicate-based materials as compared to EDTA and distilled water. Further studies are needed to evaluate and confirm the potential application of citric acid in endodontic retreatment procedures.

Decision Making for Separated Endodontic Instrument : Bypass, Retrieval, or Leave In Situ ?

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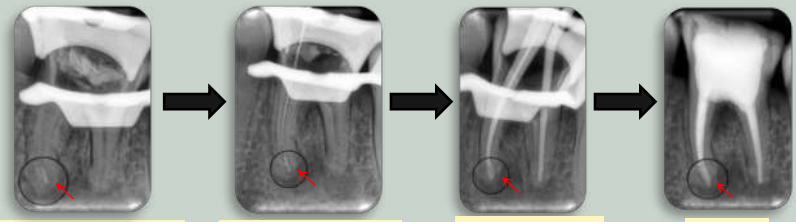
GE13

Aim : To present the management of separated instrument with different approach.

Introduction : Instrument separation could interfere complete cleaning and shaping of the root canal. The separated instrument in the canal system will not reduce the prognosis of the root canal treatment outcome but the remaining necrotic and infected tissue in the apical could lead to post-treatment disease. Treatment options for separated instrument are bypass, retrieval or leave in situ. This poster will present the case series of managing separated instrument with different approaches.

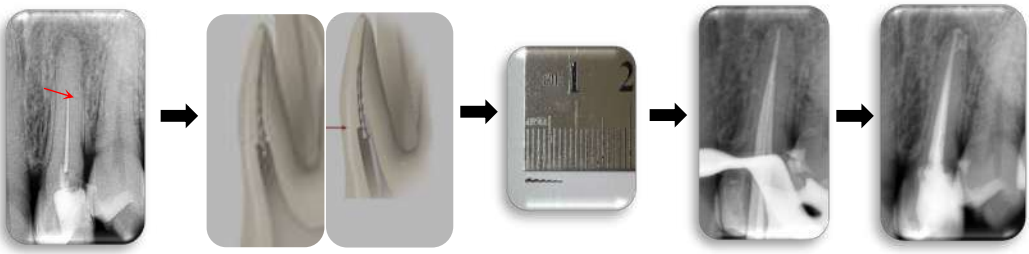
CASE PRESENTATION

Case Report 1 (bypass)



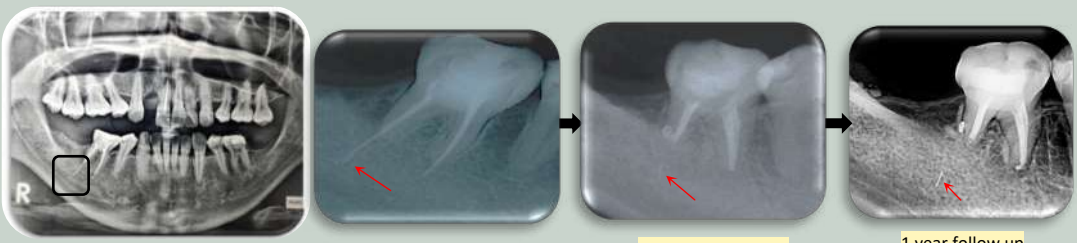
The separated instrument in mesio-lingual canal of tooth no. #36 | Canal negotiation using K-file no. 8 until working length | Master apical cone (MAC) confirmation | Obturation

Case Report 2 (retrieval)



The separated instrument in buccal canal of tooth no. #24 | Platform preparation and fragment retrieval using ultrasonics | The separated fragment | MAC confirmation | Obturation

Case Report 3 (leave in situ)



The separated instrument in the alveolar bone | Obturation and the fragment left in situ | 1 year follow up

Discussion

A Procedural error like separated instrument is sometimes inevitable in root canal treatment procedures. This procedural error could be a consequence of cyclic and torsional fatigue that could manage with several approaches (bypass, retrieval, and leave in situ). In the first case report, the separated instrument was bypassed because it was located in the curvature and in the apical third of the mesial canal. This technique was chosen because more conservative and did not need direct visibility to the separated fragment. The second case report, the fragment was retrieved because it was located in the coronal third of the buccal canal, and direct visibility was achieved. In the third case report, the fragment in the alveolar bone was left because no sign of bone pathology and the fragment was located near the mandibular canal. The surgical approach has high risk to inferior alveolar nerve damage.

Conclusion

The decision for managing the separated instrument is based on the location of the fragment. The approach should be conservative and not damage the vital anatomy structure.

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GE15

HEALING OF PERIAPICAL LESION AFTER ENDODONTIC RETREATMENT AND SEPARATED FILE RETRIEVAL

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AIM

To present a clinical case of periapical lesion healing after the retrieval of endodontic instrument fractured in lower first molar.

INTRODUCTION

Fracture of endodontic instrument during primary endodontic treatment of mandibular molar resulted in periapical lesion formation around mesial root. This therapeutic complication hindered appropriate instrumentation and disinfection of the root canal system.

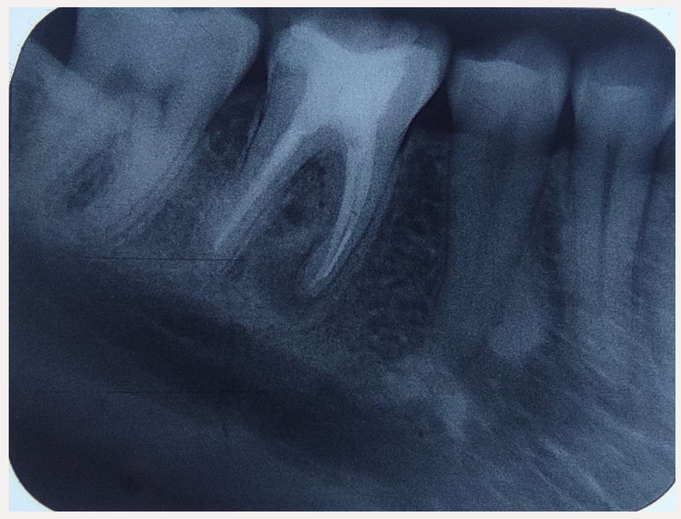


FIG 1 PRE-OPERATIVE RADIOGRAPH

CASE PRESENTATION

A 24-year-old female patient was referred to our clinic for removal of separated endodontic instrument that was presumed cause of periapical lesion around mesial root. Patient had mild bite sensitivity and radiographic imaging showed separated file segment in one of mesial canals (Fig. 1). Retreatment was planned and previous gutta-percha filling was removed from the root canals using Gates–Glidden burs and reciprocating file system. Next phase was to obtain straight-line access to the broken file and soften the curve of blocked mesial canal. This allowed good visibility and formation of a platform around the coronal aspect of the fragment using active endodontic tip. With an aid of a dental microscope magnification (40x) it was possible to transfer ultrasonic vibrations precisely to the coronal end of the broken file. These vibrations loosened up the file fragment and that allowed its removal (Fig. 2). Canal patency was achieved along its entire length and removal of the fragment was confirmed radiographically (Fig. 3). Cleaning and shaping of root canal system was done using reciprocating file system and irrigation with 1% sodium hypochlorite and 10% citric acid solutions. Calcium hydroxide paste was placed as an intracanal medicament. Due to personal reasons the patient was unable to attend the scheduled obturation and medication phase lasted for three months. Canals were obturated with gutta-percha cone and epoxy resin-based endodontic sealer and radiograph was taken to assess quality of the canal filling (Fig. 4). The radiograph revealed satisfactory healing of periapical lesion.



FIG. 2 REMOVED FRAGMENT



FIG. 3 RADIOGRAPH AFTER FRAGMENT REMOVAL



FIG. 4 POST-OBTURATION RADIOGRAPH

Discussion

Removal of separated endodontic instrument could be of crucial importance in a case of tooth with a periapical lesion and infected root canal system. Although different techniques for the removal of broken files were developed there is a risk of being overly destructive towards root dentin.

Conclusion & Clinical Relevance

Appropriate access preparation and precise clinical work during fragment retrieval can minimize damage to the dentine wall and enable elimination of infection from endodontic space. Orthograde file removal is the most conservative treatment option for these unpredictable clinical complications.

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GE16 - LEAKAGE OF THREE NEWLY DEVELOPED SEALERS AFTER ONE WEEK OR 6 MONTHS OF STORAGE

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Aim: To measure leakage of three newly developed sealers inserted with two different methods of sealer placement measured following a storage time of 1 week or 6 months.

Methodology: 128 straight single-rooted teeth were divided into four groups according to different sealers (AH Plus (AHP, comparison group), Oxford Root FILL (Oxford), BioCal Root Sealer (BioCal) and Harvard MTA – RootSeal (MTA); negative / positive control: additional 15 teeth each). Each group was divided into two subgroups (n = 16 each) regarding sealer placement (Lentulo versus Eddy). Root canals were prepared to size 40, .04 taper. Final irrigation was carried out with Citric acid 40%, NaOCl 3% and ethanol 70%. Root canals were filled with the respective sealer and an adjusted master point size 40, .04 taper. Teeth were stored for one week to allow sealer setting (1wk). Eight teeth of each subgroup were further stored within artificial saliva for 6 months (6mth). Linear dye penetration was measured following centrifugation at 30g within 5% methylene blue solution. Data was analysed using SPSS 21.0.

Results: Leakage differed significantly among sealers (Kruskal-Wallis test $P<0.05$). Leakage decreased over time for AHP (7.7 mm @ 1wk vs. 3.8 mm @ 6mth) and MTA (4.8 mm @ 1wk vs. 2.3 mm @ 6mth) (Mann-Whitney tests, $P<0.001$) and was stable for Oxford (2.0 mm vs. 2.8 mm) and BioCal (2.3 mm vs. 3.0 mm). Sealer placement had an influence on leakage of Oxford (1.4 mm for Lentulo and 3.4 mm for Eddy; Mann-Whitney test $P=0.003$) but not for the other sealers.

Conclusions: Within the limits of the study, storage led to less leakage for AHP and MTA. Sealer placement showed an impact on leakage of Oxford. The new sealers under investigation exhibited acceptable properties regarding leakage.

Funding source: This study was supported by S&C, Elmshorn, Germany.

GE17 - PUSH-OUT BOND STRENGTH TO ROOT CANAL DENTINE AND SURFACE MORPHOLOGY OF FOUR CALCIUM SILICATE-BASED SEALERS

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Aim: To assess push-out bond strength to root canal dentine and surface morphology of calcium silicate-based sealers.

Methods: Four calcium silicate-based sealers were included in the study: BioRoot (Septodont), BioRoot Flow (Septodont), Bio C (Angelus), EndoSequence BC (Brassler), and the control paste AH Plus (Dentsply). Dentin discs, obtained from the middle third of maxillary molars with fused roots were used to test the bond strength. Five holes with a diameter of 1mm were prepared on each disc. After immersing the discs in a solution of 5% NaOCl and 9% etidronic acid, rinsing with distilled water, the samples were dried and each hole of every disc was filled with a different sealer. After 7 days, the bond strength was tested on a universal testing machine. bioactivity was determined by analysing formation of hydroxyapatite on the samples' surface upon immersion in phosphate-buffered saline PBS for 24h and 28 days by using a field emission scanning electron microscope FESEM (Tescan FE-SEM Mira 3 XMU, Brno, Czech Republic) operated at 20keV.

Results: In terms of push-out bond strength calcium silicate-based sealers achieved similar values, which were statistically significantly different compared to AH Plus which showed the highest values of dislocation resistance ($p<0.05$). After 24h of immersion, FESEM analysis revealed discrete precipitate formation on the surface of all calcium silicate-based sealers. The surface of AH Plus remained unchanged. After 28 days of immersion, the surface of calcium silicate-based sealers was covered in needle-like and spherical precipitates characteristic for newly-formed hydroxyapatite indicating the bioactive properties of the sealers.

Conclusion: Calcium silicate-based sealers exhibited lower dislocation resistance compared control AH Plus sealer. All calcium silicate -based sealers showed to be bioactive in vitro in both time intervals.

Keywords: calcium silicate, push-out bond strength, scanning electron microscopy, bioactivity.

Access cavity preparation for endodontic treatment - most common difficulties observed among young dentists during postgraduate training.

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Scientific supervisor: dr. n. med. Monika Sitarz[2]
[1]Scientific Society at the Department of Conservative Dentistry and Endodontics of the Medical University of Lublin
[2]Chair and Department of Conservative Dentistry and Endodontics of the Medical University of Lublin

Aim: To present the most common difficulties in obtaining proper access for root canal treatment among the group of young dentists during post-graduate training.

Introduction: Antiseptic root canal treatment is an extremely complex, complicated and demanding procedure. It requires a large piece of knowledge and practical skills from dentist. One of the essential stages of the root canal treatment is obtaining advantageous access to the root canal - it affects further steps directly. It allows to locate all of the canals and disinfect intra - canal space.



Fig. 1-3



Fig. 4

Methodology: The research was done in the Chair and Department of Conservative Dentistry and Endodontics in the period of three months among the patients of young dentists starting root canal treatment in a magnified view using a microscope. Following features of proper access were rated: location, shape, preparation of the floor of chamber and of the walls of cavity, possibility of free insertion of first endodontic instrument, retention and resistance, preventive lowering the height of the tooth cusps in molars and premolars. Every access was rated individually by two endodontic dentists working in a magnified view, with minimum of 3 – years - long clinical experience.

Discussion: Among 85 treated patients (42 men, 43 women in the age from 19 to 74) it was found that the most common problem was to insert initial endodontic instruments to the root canals freely (55) (Fig no 5). The problem was observed both in the primary as in the secondary endodontic treatment. It mainly affected incisors in the maxilla, proximal canals of the upper molars and proximal buccal canals of the lower molars (Fig no 6).

Conclusions:

1. Straight line access for root canal treatment, although is time-consuming, makes further steps of the treatment easier to perform and allows to avoid complications – thanks to that reduces time of the procedure.
2. Treatment with the use of a microscope gives a chance to introduce amendment in a planned and safe way that allows to conserve enamel and dentine in the treated tooth, which positively affects its durability.

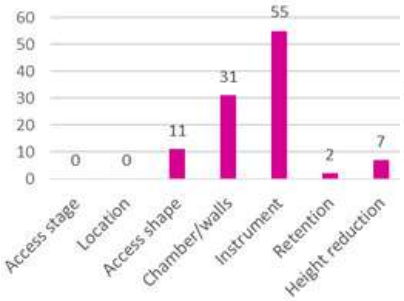


Fig. 5 Criteria for evaluating the correctness of access

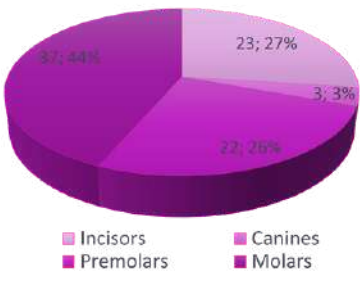


Fig 6. Ratio of the examined individual groups of teeth

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GE19 Broken instruments removal – methods of treatment and case study

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Figure 1. X-ray nr 1 – first appointment, broken file visible in mesial canal



Aim

Fracture of endodontic instrument often results from incorrect use or overuse. The aim of this poster is to present a possible complication and solution for broken instrument in canal that could arise in performing an endodontic treatment.

Introduction

Fragmentation of instruments in the root canal is a complication during endodontic treatment. [1] Dentist should assess whether removal of the instrument is possible and eliminate the separated fragment. It is important to consider the possible complications associated with the activities of instrument removal, and if the consequences involved, for instance, excessive weakening of the root structure, the broken instrument should be left in the canal. [1] There is a wide range of methods to remove an instrument from the cavity of the tooth. The treatment can be either conservative or surgical. A conservative approach contains the array of available methods: bypass of the fragment, removal of the fragment, instrumentation and obturation coronally to the fragment.[2] The use of ultrasonics and operative microscope represent the most effective and reliable method for removing a separated endodontic instrument from a root canal. [2]

Methodology

Figure 2. X-ray nr 2 – second appointment, gutta-percha removed from canals, visible broken file



Patient requested a consultation after endodontic treatment in tooth 36 finished few years ago outside of the clinic. She came with acute persistent pain escalating by biting. X-ray nr 1 was made on the first visit – broken instrument is visible in mesial canal. There is possibility that it was Lentulo Spiral because of its shape. Patient was unaware of the complication. On X-ray nr 1 periapical changes around distal and mesial canals are shown. Dentist decided to begin endodontic retreatment of tooth 36 and remove broken instrument. The tooth 36 was isolated by rubber dam. On first appointment gutta-percha was solved with help of Orange Guttane, Gates Glidden bur, Hedstrom files and Reciproc Blue files. X-ray nr 2 was performed – gutta-percha was removed completely, broken instrument was still visible. Between appointments dexamethasone was put in the canals and closed with temporary filling. On second appointment under microscope metal part was seen in MB canal. The canal system was rinsed with NaOCl 5,25% and NaCl 0,9%. Removal of broken file became possible by use of ultrasound system – yellow tip Endo Chuck. Dentist moved the file by ultrasound using circle movements around broken part. Broken instrument became loose and came out of canal by Endo Chuck movements. On the third appointment dentist came to conclusion that messiobuccal canal is obliterated. Three canals were filled for the whole Working Length in the warm Gutta-Percha Technique - BeeFill. The final X-ray nr 3 showed the homogenic root fillings.

Figure 3. X-ray nr 3 – broken file removed, obliteration in mesiobuccal canal



Discussion

If breakage of the instrument occurs in effect of dentist's movements, patient should be informed of the incident and consideration should be given whether to eliminate the fragment or not.[3] Stainless steel instruments usually fail by excessive amounts of torque and NiTi instruments break due to combined action of torsional stress and cyclic loading. [3] Elements that have an effect on fractures are instrumentation technique, use of torque controlled motor, core dimension and surface conditioning of the instrument, rotation rate, radius of canal curvature, presence of straight line access and glide path to apical portion of the canal. Smaller endodontic instruments (size 15, 20) are more prone to distortion as a result of stressing on their small cross sections. [3] The reported frequency rate for fractured instruments varies from 0.7% to 6% of cases. [4]

Figure 4. Broken file removed visible on Endo Chuck.

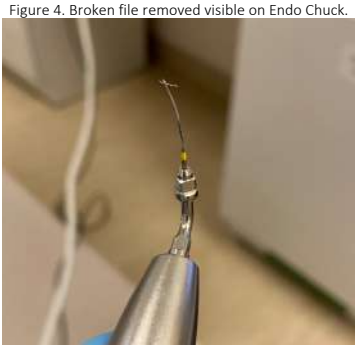
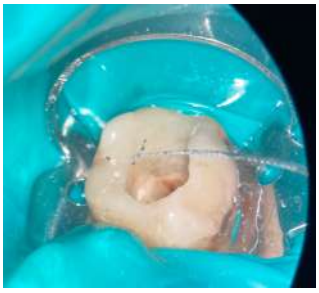


Figure 5. Broken file removed visible on Endo Chuck tip in microscope vision.



Conclusion & Clinical Relevance

Dealing with a broken instrument is difficult process. The use of operative microscope, ultrasound instruments and special broken tool removal systems help to eliminate the fractured part. The rate of successful fragment removal is high but it can not be clearly defined as endodontic treatment success. Removal of healthy dentin and especially peri-cervical dentin decreases root strength and can predispose the root to vertical root fracture.[5] A broken file by itself does not induce inflammation. It is caused by bacteria and fractured file prevents effective disinfection of canal system. When the instrument breaks at the beginning of instrumentation of an infected root canal, its presence affects therapy prognosis negatively, while if the separation occurs during the last stages of instrumentation of an infected root canal, or in an aseptic root canal, the prognosis is better. [2] Removing the instrument is more likely to succeed when the fragment is found in the coronal third, before the root canal curvature, when the root canal curvature is not severe, and when it concerns upper or anterior teeth. However, in cases where the fragment is found either in the apical third or beyond the root canal curvature, or visibility and access are impossible, removing the instrument is not recommended, since there is a high risk of perforation.[2] The clinical algorithm should be based upon the understanding of biological processes that are causing periapical lesions and tooth biomechanics. The aim of treatment is the maintenance of a long-term functional tooth. [5]

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GE20 - INFLUENCE OF CHELATING DENTIN CONDITIONERS ON DENTAL PULP STEM CELL BEHAVIOUR AND CYTOTOXICITY IN ZEBRAFISH LARVAE MODEL

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Aim: To investigate the effect of different combinations of chelating agents on dental pulp stem cells (DPSCs) behaviour and evaluate their toxicity in zebrafish larvae model.

Methods: The dentin disks of freshly extracted human upper incisor teeth were prepared with standardized diameter and disinfection protocol. The dentin disks were pre-treated with 17% EDTA, sodium gluconate, glutamic acid and spirulina indifferent concentrations and combinations. The proliferation and adhesion of DPSCs on conditioned dentin is assessed under scanning electron microscope and indirectly using the MTT assay. The developmental toxicity assay was performed to evaluate the malformation condition after the treatment with the agents. Also, the different parameters such as survival, heart, and hatching rate were investigated in the zebrafish larvae after the exposure to the chelating agents.

Results: The DPSCs attachment and proliferation was observed under optical microscope. The MTT assay at 24hr and 72hr interval demonstrated increased cell viability with the combination of all the chelating agents compared to 17% EDTA. The developmental toxicity assay showed higher malformations with 17% EDTA compared to other combination. The maximum survival rate after 72hrs post fertilization was observed with combination of chelating agents.

Conclusions: The current in-vitro study has proved that combination of EDTA with other chelating agents have shown to have higher viability compared to 17% EDTA agent. The in-vivo toxicity assessment shows that the combination of chelating agents have the least toxicity in terms of developmental malformation and survival rate.

GE21 - DIGITAL QUANTITATIVE EVALUATION OF THE SEALING ABILITY FOR DIFFERENT TYPES OF ENDODONTIC SEALERS

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Aim: To digitally evaluate the sealing ability of organic/inorganic endodontic sealers in vitro.

Methods: Roots of extracted bovine incisors were subjected in this study. The root canal was endodontically shaped and filled with one of the four types of sealers tested; Canals (GC-Showa Yakuhin) or Canal Sealer BG Multi (NISHIKA) for inorganic material, and AH plus jet (Dentsply Sirona) or Meta SEAL soft (Sun Medical) for organic material, 6 roots for each material. The apex area of the root was immersed into 1% of toluidine blue aqueous solution for 3 days at 37°C. The root, then, was perpendicularly sliced to its axis from the apex in every 1.0 mm of thickness. Four disk-shaped specimens were obtained in each root. Top and bottom surfaces of each specimen were digitally photographed with a digital microscope (ViTiny UM12, Microlinks Technologies) and the images were analyzed by Image J(NIH). In each surface, we set two regions of interest, ROIs; the area composed from (i) the sealer and (ii) 20μm width of dentin outer from the sealer, respectively. The staining rate of each ROI was calculated as the rate of pixels stained in the ROI. The data was statistically analyzed by Mann-Whitney U test, $p<0.05$.

Results: The staining rates were (i)14.5(1.5-39.0) and (ii) 42.4(5.9-56.5) in the inorganic sealers and (i)0.0(0.0-0.0) and (ii)0.0(0.0-0.0) in the organic sealers. The data were shown as a median and the interquartile range. For (i) and (ii), the staining rates of the organic sealers were significantly lower than the rate of the inorganic sealers. The staining rate of the organic sealers had a tendency to be decreased along with the distance from the root apex.

Conclusions: The result of the present research suggested that organic endodontic sealers had the better sealing ability to aqueous solution than inorganic sealers.

GE22 - MECHANICAL EVALUATION OF A NEWLY INTRODUCED RECIPROCATING FILE

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[1]Sapienza University of Rome, [2]Boston University Henry M. Goldman School of Dental Medicine

Aim: The aim of the study is to evaluate a rotary file recently introduced on the market, the Direct R Gold (Direct Endodontics S.A.S, Paris, France), since there are no data available. This study want to assess its mechanical properties comparing them with the following widespread reciprocating instruments: Reciproc (VDW, Munich, Germany), Reciproc Blue (VDW, Munich, Germany) and WaveOne Gold (Dentsply Maillefer, Ballaigues, Switzerland).

Methods: A total of 120 nickel-titanium files, 30 each from 4 different reciprocating systems, (DirectR, Reciproc, Reciproc Blue, EdgeOne Fire, and WaveOne Gold) were evaluated through mechanical tests. The performances of above-mentioned file were tested by subjecting each specimen to torsional resistance tests at 3 mm from the tip, cyclic fatigue resistance tests with a 90° degree and 2 mm radius of curvature and bending resistance tests at 3 mm from the tip. One-way analysis of variance and the post hoc Tukey test were performed with the significance level set to a 95% confidence level.

Results: Direct R showed the best mechanical performances in terms of torsional resistance (1.84±0.12 Ncm) with statistically significant difference for this test, while in terms of flexibility and cyclic fatigue resitance no statistically relevant difference has been found between the three thermally treated instruments, Direct R Gold, Reciproc Blue and WaveOne Gold. The Reciproc files showed the worst flexibility and cyclic fatigue resistance (157.2 6 8.3 g and 9.27 6 1.18 seconds, respectively).

Conclusions: Within the limitations of this study, the recently introduced Direct R Gold file showed mechanical performance that could encourage its clinical use, with a higher resistante to torsional stresses without losing flexural performances, in comparison to the worldwide spread tested instruments.

GE23 - ANALYSIS OF EFFECTIVENESS OF LATERAL CANAL FILLING WITH DIFFERENT ENDODONTIC SEALERS

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Introduction: The goal of endodontic therapy is the three-dimensional filling of the root canal system after its cleaning and shaping. The role of the sealer consists in hermetically sealing of the root canal, including the apical deltas, accessory and lateral canals and creating an intimate adaptation between the root canal and the gutta-percha.

Aim: Evaluation of the filling effectiveness of artificial lateral canals after obturation with different calcium silicate based sealers.

Methods: The research used 40 extracted human lower premolars that were mechanically prepared (Reciproc blue R40) to working length. Artificial lateral canals were made from the vestibular surface of the roots in the apical, middle and the cervical third at 3, 6, 9 mm from the apex of the root. Communication with the main canal was checked using a K file #10 hand instrument. After copious irrigation with 0.5% NaOCl, obturation was performed with sealer and gutta-percha. The teeth were divided into 4 groups (n=10): Group 1: BIO-ROOT; Group 2: MTA FILLAPEX, Group 3: WELL ROOT; Group 4: AH Plus (control group). Digital retroalveolar radiographs were made from the mesiodistal direction, and the obturation analysis of the lateral canals was computer evaluated (Scopeimage 9.0).

Results: There was no statistically significant difference between the tested sealers, although the smallest area of empty space in the lateral canals was recorded in the AH Plus group, and the largest in the BIO ROOT group. The analysis showed the best obturation results in the apical, then the middle third, and the worst in the cervical third, whereby a statistically significant difference was observed only in the MTA FILLAPEX group.

Conclusion: None of the tested sealers was able to completely fill all artificial lateral canals. The biggest problem is obturation of the lateral canals in the cervical third of the root.

FAU
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GE24

Uniklinikum Erlangen

Treatment of an Apical Lesion of an Uncertain Origin; a Case Report



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Aim

To demonstrate the complexity of achieving a clinical diagnosis for an apical radiolucency of unknown origin and to consecutively determine the adequate treatment option.

Introduction

Oral fistulas and periapical translucencies are common clinical finding with various etiologies. A thorough anamnestic, radiographic and clinical diagnosis is necessary to determine the appropriate treatment plan.

Case Presentation

The patient presented with a buccal fistula in the region of tooth 37 after experiencing pain in the area a few weeks prior. Teeth 36 and 37 were non-tender to percussion and showed positive responses to sensitivity (cold) testing. There was no increased mobility, pocket depth or apical pain on palpation. Tooth 36 showed a slight discoloration (Fig.1) Radiographically, a large radiolucency was observed in the apical regions between 36 and 37 (Fig.2). The filling in tooth 36 was removed without local anesthesia. The tooth showed no vital response, and upon accessing the pulp chamber, the pulp tissue was found to be completely necrotic (Fig.3). No cracks were observed under the operating microscope. Root canal treatment was performed on tooth 36 (Fig. 4), and a fiber-reinforced composite was used for restauration. The fistula disappeared completely after the first visit, and the patient was asymptomatic.



Figure 1



Figure 2

Initial situation before treatment, guttapercha point in fistula tract



Figure 3
Removal of the old filling, necrotic pulp

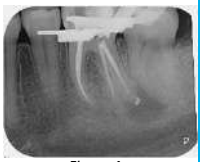


Figure 4
Completed root canal treatment

A clinical and radiographic follow-up was conducted after 3 months, at which time the radiolucency was still visible, teeth 35 and 37 reacted positive to sensitivity testing, were non-tender to percussion, and showed no fistula (Fig. 5)

However, after nearly 6 months, the fistula and symptoms reappeared. 37 was tender to percussion, and the reaction to sensibility was decreased. A root canal treatment was initiated, after which the fistula disappeared again, and the patient became asymptomatic. Depending on further findings, additional treatment, such as surgery, may be necessary.



Figure 5
Control after 3 months

Discussion



Figure 6
Previous situation with impacted wisdom tooth 38

Periradicular lesions can be a result of both odontogenic and non-odontogenic causes. For instance, tumors and cysts may also appear as periapical translucent lesions[1]. Furthermore, the etiology of an infected root canal varies. Besides caries or trauma also cracks in the tooth or restorations can lead to an infection of the pulp[2]. The involvement of the pulp can also be secondary. In the case of tooth 37 a retrograde infection via the periapical lesion could be plausible. A periapical disease could also be connected to a wisdom tooth removal. A possible complication caused by an invasive removal of wisdom teeth is the damage of the 2nd molar [3]. In this case, the removal of the impacted wisdom tooth had taken place a few years prior (Fig. 6).

Conclusion & Clinical Relevance

The presented case emphasizes the importance of careful diagnosis and phased treatment plans. While treating periapical lesions, both differential diagnoses as well as evaluating the possible etiology are of an importance.

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GE25 - DISINFECTION PROTOCOLS IN ENDODONTIC TEXTBOOKS – AN ANALYSIS OF 70 ENGLISH AND GERMAN TEXTBOOKS FROM 1960 TO 2022

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Aim: To evaluate the protocols for disinfection of root canals described in English and German endodontic textbooks published from 1960 to 2021.

Methods: A literature research was performed in catalogues from several German universities and national libraries. Additionally, a private library was searched. Included were textbooks on Endodontology and textbooks with separate chapters on root canal treatment published between 1960 and 2022. Only books in English or German language were evaluated. The books had to be accessible for complete reading. A list of 19 items addressing several aspects of root canal disinfection was developed for standardized evaluation of the books and chapters.

Results: A total of 196 textbooks were identified via the literature research. Finally 70 textbooks were accessible for evaluation, 42 in German and 28 in English. The evaluation revealed a large variety in the methods, materials and techniques for root canal disinfection. In the majority of textbooks and chapters detailed quantitative recommendations are missing. Only a few textbooks present a more or less complete disinfection protocol.

Conclusion: There still is no consensus on many details of root canal disinfection in endodontic textbooks. Nevertheless, amount and quality of information and data on root canal disinfection have clearly improved over the last two decades.

Crash, Bang, Wallop: Endodontic and Restorative management of traumatised teeth - a case report

GE26

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Introduction:
Traumatic dental injuries (TDIs) occur most frequently in children and young adults, comprising 5% of all injuries. Twenty-five percent of all school children experience dental trauma and 33% of adults have experienced trauma to the permanent dentition, with most of the injuries occurring before age 19[1]. Working in a secondary care centre provides us the opportunity to assess and treat cases that would otherwise be beyond the remit of general dental care, as well as working with general dentists in an advisory and planning role

Aim:
This case report discusses the journey of a 26-year patient who sustained dental trauma to the anterior region of the mouth which resulted in enamel-dentine-pulp fracture of the UL1 and Enamel-Dentine fracture of the UR1 tooth. This case reports also highlights some of the challenges an endodontist is presented with regarding treatment planning, formulating an ideal sequence and delivering predictable outcomes in tandem with patient expectations.

Treatment/ Methodology
Treatment included Re root canal treatment of the UL1, given the large apical area and resorption as a result of trauma, this required an apical barrier with Mineral Trioxide Aggregate (MTA). Once root canal treatment was complete, non-vital internal-external tooth whitening was carried out to address the extensive discolouration. Upon completion of whitening, existing restorations from the UR1, UL1 were removed and refurbished using direct composite. This case provides an overview of treatment that led to not only a significant improvement in function and aesthetics but also restored the patient's self-esteem and confidence. The sequence of treatment is presented in a series of photographs illustrating the phases of treatment.

Conclusion & Clinical Relevance:
1. Careful consideration of patient and treatment factors is mandatory whilst considering any form of restorative or endodontic treatment.
2. Every treatment has a survival time, and this must be clearly conveyed to the patient as part of the consent process to enable them in making an informed decision regarding their treatment options.
3. MTA apical barriers have a high success rate especially in teeth which have suffered dental trauma[2], teeth with incomplete root apices and apical resorption.
4. Internal external tooth whitening is a conservative method to improve the discolouration however patient compliance is required. This can be used as first line management for discoloured teeth before more indirect options are considered, e.g. veneers/crowns[3]
5. Decision-making around endodontic treatment vs extraction depends on a number of factors, to name a few, patient motivation and age, their ability to maintain a reasonable level of oral hygiene, operator skill, the expected longevity of the treatment and the use of the best available materials/ technique to improve treatment outcomes.

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GE29 - THE EFFECT OF DIFFERENT CANAL GEOMETRIES ON ENTEROCOCCUS FAECALIS RETENTION DURING ENDODONTIC IRRIGATION

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Aim: To assess the reduction of the microbial load in different root canal geometries prepared in 3D printed teeth using conventional needle irrigation.

Methods: 288 standardized 3D printed lower central incisors with single straight canals were prepared using K3 XF rotary files to create 9 different geometries with standard taper: (20. 4%, 20. 6%, 20. 8%,25. 4%, 25. 6%, 25. 8%, 30. 4%, 30. 6%, 30. 8%). All teeth were infected with E.faecalis NCTC775 inoculum standardized by spectrophotometer to match 0.5 McFarland standard. All samples were incubated for 7 days, and fresh BHI broth was added every 24 hours. Control groups including non-infected teeth were irrigated with phosphate-buffered saline, whilst test groups' canals were irrigated with 5.25% Sodium Hypochlorite. All samples were irrigated with conventional needle irrigation using side-vented, 30-gauge needles. All parameters were standardized, including needle penetration depth, irrigation volume, and irrigation time. The outcome was assessed by enumeration of E.faecalis from canal samples, which were serially diluted and assessed for colony-forming units (CFU). Statistical analyses were conducted using GraphPad software (San Diego, USA) and a P value of <0.05 was considered statistically significant.

Results: The results show statistically significant reductions in the E. faecalis load between pre-irrigation and post-irrigation samples in all groups ($p<0.01$). Treatment groups that were irrigated with 5.25% Sodium hypochlorite had significantly less bacteria compared with control groups irrigated with PBS ($p<0.01$). However, the change in the root canal geometry did not have a statistically significant impact on bacterial load reduction in either the treatment group or the control group.

Conclusion: Root canal geometry doesn't affect E. faecalis retention in 3D-printed tooth model when irrigated using conventional needle irrigation.

Nonsurgical Pulpal Floor Perforation Management with Biodentine In Maxillary Right Second Premolar : A Case Report

GE30

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Aim

To discuss the effectiveness of biodentine as a reparative agent in the management of pulpal floor perforation

Introduction

The artificial communication between pulp chamber and periodontium may compromise the success of endodontic treatment and even lead to treatment failure. Surgical and nonsurgical approaches have been successfully used to repair such defects depending on several factors such as size, location and shape of the defect. Bioactive material have been used to repair this kind of defect and indicated to enhance the treatment prognosis. This case report illustrates the successful nonsurgical management of iatrogenic pulpal floor perforation in maxillary right second premolar.

Case Presentation

A 39-year-old female patient came with persistent discomfort in upper right second premolar which has previously undergone endodontic treatment (fig.1). Clinical examination showed temporary filling in distal-occlusal area. Upon its removal, dental cotton pellet was found inside the cavity, base material was absent and light bleeding can be seen coming from an iatrogenic pulpal floor perforation (fig.2). Taking the location and size of perforation into consideration, a nonsurgical approach was selected. All the granulation tissue around perforation site was removed and irrigated with saline and 2% Chlorhexidine. After the perforation area was clear, biodentine powder and liquid were mixed, then placed into the perforation area (fig.3). The tooth was retreated afterwards (fig.4). All procedures were performed with the use of dental microscope and rubber-dam isolation. The twelve months follow up showed no clinical symptoms and radiographic examination demonstrating no obvious radicular lesion (fig.5)



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5

Discussion

Biodentine has dentine-like mechanical properties. It also induces mineralization, has good biocompatibility, short setting time, and better handling. Its high alkalinity has anti-bacterial effects and causes micromechanical adhesion during the setting reaction, forming a stable marginal adaptation with superior sealing ability. Patient complaint fully resolved upon treatment completion.

Conclusion

Iatrogenic pulpal floor perforation repair with biodentine has the potential to prolong the survivability of the tooth. Nonsurgical approach for perforation located at the pulp chamber floor has a favourable prognosis with the use of dental microscope.

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GE31 - EFFECTIVENESS OF EDDY SONIC ACTIVATION IN ELIMINATING DENTINAL DEBRIS: AN IN-VITRO STUDY

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Aim: To evaluate the cleaning efficiency of EDDY sonic activation in removing dentine debris in comparison to passive ultrasonic activation and needle irrigation.

Methods: Thirty roots from extracted human single rooted teeth with minimal curvature were used. The roots were cleaned and shaped, then were split into the bucco-lingual direction. Using a scaler, a longitudinal groove was performed into the inner root surface of one root halve of each tooth. The grooves were filled with dentin debris mixed with sodium hypochlorite in order to simulate an unprepared canal irregularity. The root halves were then re-assembled and were randomly divided into three groups according to the irrigant activation technique used (n=10): G1 needle irrigation, G2 passive ultrasonic activation (Acteon Satelec, Merignac, France), G3 EDDY sonic activation (VDW, Munich, Germany). After performing the irrigation protocol using 10 ml of sodium hypochlorite and 5 ml of EDTA solution for each group, the samples were disassembled. Using a stereomicroscope (Olympus, Japan) with an attached digital camera, digital images of the groove were taken. The amount of the remaining dentine debris after irrigant activation was assessed using a scoring system. The differences in dentine debris scores between different groups were evaluated by means of Kruskal Wallis tests followed by multiple comparisons using the SPSS software (SPSS, Inc, Chicago, USA). The level of significance was set at P= 0.05.

Results: No statistically significant difference was found between sonic activation and ultrasonic activation in removing dentine debris. Both activation techniques performed significantly better than needle irrigation.

Conclusions: Under the condition of this study, the removal of dentin debris from artificial apical groove was best achieved by sonic activation using EDDY as well as by passive ultrasonic activation.

GE32 - ANTIFUNGAL AND GENOTOXIC EFFECTS OF MATRICARIA CHAMOMILLA AS A ROOT CANAL IRRIGANT

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Aim: The aim of this study was assessment of efficiency of the ethyl acetate (EthOAc) extract of Matricaria Chamomilla against Candida albicans and to compare it with sodium hypochlorite and chlorhexidine, as well as their genotoxic effect.

Methods: The antifungal effectiveness of the EthOAc extract of Matricaria Chamomilla was determined using the agar disk diffusion method. The inhibition zones induced by the EthOAc extract were compared after 5 minutes, 60 minutes, and 24 hours to those induced by standard solutions (2% chlorhexidine and 2% sodium hypochlorite).
An in vitro genotoxicity assay was performed in cultured lymphocytes from blood of human volunteers in order to observe micronuclei formation. Statistical analysis of the results was performed using the Kruskal-Wallis test and one-way ANOVA.

Results: The inhibition zone of combination of chlorhexidine with EthOAc extract of Matricaria Chamomilla against C. albicans was 32.3mm after 5 min, 31.7 mm after 60 min and 29.7 mm after 24 hours. The inhibition zone of sodium hypochlorite in combination with EthOAc extract of Matricaria Chamomilla against C. albicans was 0 mm. The EthOAc extract of Matricaria Chamomilla did not show a genotoxic effect on lymphocyte cells.

Conclusions: The EthOAc extract of Matricaria Chamomilla in combination with chlorhexidine may be a useful irrigant in endodontic therapy.

Endodontic Treatment of The Teeth with Internal Root resorption: A Case Report

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Aim

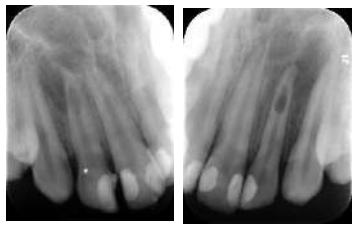
The aim of this case report was present the treatment protocol and six-years follow up of two maxillary lateral incisor with internal root resorption and periapical lesion.

Introduction

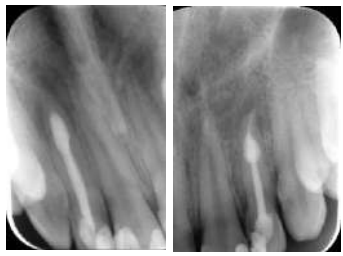
Internal root resorption (IRR) is a pathological process that starts inner side of the root canal space and results in dentin loss and potential cementum invasion (1). The success of endodontic treatment relies on effective instrumentation, disinfection and obturation technique (2).

Case Presentation

15-years old male patient was referred to Department of endodontics because for the evaluation of tooth 12 and 22 with IRR and periapical radiolucency. The lesions were confirmed with both periapical radiography and cone-beam computer tomography (CBCT) images. The teeth were asyptomatic and non-vital. The root canals were prepared, irrigated and calcium hydroxide was placed for two weeks at first apointment. The root canals were obturated using warm guta-percha technique (Calamus, (Dentsply Maillefer, Holland). In the six-year follow-up, almost complete healing of the lesions was observed and there were no symptoms in the teeth.



Pre-operative periapical radiographs



Periapical radiographs in fifth years follow-up.

Discussion

IRR poses an endodontics treatment challenge for various reasons such as the irregular nature of the resorptive lesion (3) . The warm guta percha techniques should be used to obtain adequate obturation of resorption area. Furthermore, the accuracy of the diagnostic capacity of CBCT's provides improved management of these complicated cases (4).

Conclusion & Clinical Relevance

IRR is an one of the particular category of pulp disease, which can be diagnosed by clinical and radiographic examination of teeth in daily practice. The diagnosis and the long-term successful prognosis of IRR is significantly improved CBCT imaging.

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HEALING OF PERIAPICAL LESION AFTER REMOVAL OF ENDODONTIC INSTRUMENT FRACTURED IN MAXILLARY PREMOLAR

GE35

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Aim

To present successful healing of a periapical lesion after removal of an endodontic instrument fractured in a maxillary premolar

Introduction

Removal of fractured endodontic instrument could be challenging procedure that is a prerequisite for appropriate root canal system cleaning and disinfection. In a case of tooth with a periapical lesion, adequate access to endodontic space could be the most important factor for periapical healing.

Case presentation

A 44-year-old male was referred to our department for retrieval of an endodontic file fractured during retreatment in previous endodontic procedure. Patient was symptom free, without sensitivity to percussion or palpation. Dental radiograph showed a 4 mm long file fragment in the middle portion of the root canal with periapical lesion (Fig. 1). After improving the straight-line access to the broken fragment, adequate visibility was achieved even without additional magnification. This allowed preparation of a platform at the coronal end of the fragment and transfer of vibrations from ultrasonic endodontic tip. Broken file was loosened up, removed and canal patency confirmed along its entire length. Fragment removal was radiographically confirmed (Fig. 2). Root canal was cleaned and shaped using rotary file system and irrigation with 1% sodium hypochlorite and 10% citric acid solutions for smear layer removal. Following chemical-mechanical instrumentation, calcium hydroxide was placed for a week. In the next visit medication paste was removed and root canals were obturated with epoxy resin-based sealer and gutta-percha using single cone technique. Post-obturation radiograph was taken to confirm the quality of obturation (Fig. 3). The patient was referred to prosthodontic department for the final restoration with cast post and metal-ceramic crown. Control clinical examination, fifteen months later, showed favorable outcome and healing of the periapical lesion confirmed by periapical radiograph (Fig. 4).



Fig 1 Pre-operative radiograph

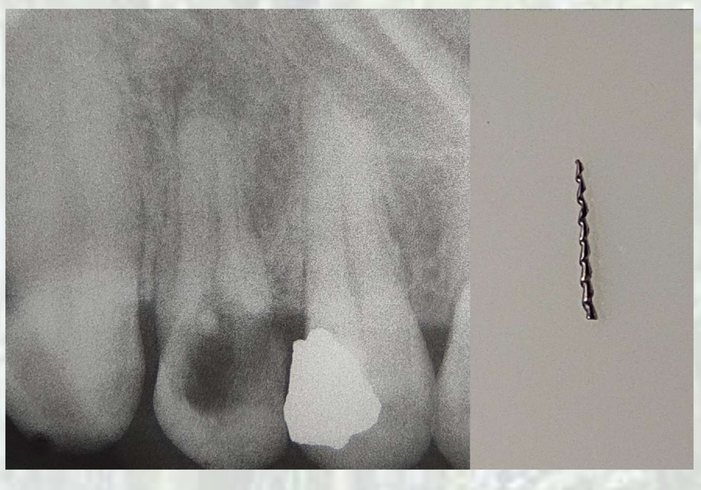


Fig. 2 Radiograph after fragment removal



Fig. 3 Post-obturation radiograph



Fig. 4 Control radiograph after fifteen months

Discussion

Different types of devices and techniques were developed for removal of separated instruments in order to minimize damage to the dentine wall and maintain the original shape of root canal as much as possible. Fractured endodontic file retrieval is a conservative therapeutic approach that enables retention of the tooth, minimizing the loss of root structure and patient´s discomfort. This is not always a predictable therapeutic procedure but allows elimination of microorganisms from root canal system as a prerequisite for the periapical healing.

Conclusion & Clinical Relevance

Careful planning and adequate clinical experience with relatively simple armamentarium may be sufficient to manage successfully this endodontic complication. Appropriate access to infected endodontic space beyond fractured fragment is of utmost importance for desirable outcome and healing of the existing periapical lesion.

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GE36 - COMPARISON OF IN VITRO EXTRUSION OF IRRIGATING SOLUTIONS WITH LASER ACTIVATION USING A NOVEL PROTOCOL AND TWO DIFFERENT TIPS

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Aim: To compare the amount of extruded irrigant in final root canal irrigation achieved with laser activation using a new clinical protocol versus manual syringe irrigation and evaluate two different laser tips.

Methods: Twenty-one freshly extracted intact and mature molars were selected, instrumented up to size F2 using Edge Taper Platinum, and then inserted into a plastic tube (with a tap at the end) which allowed for the collection, measurement, and removal of irrigating solution extruded from the apex and repetitive tests for each specimen.
The samples were divided into three groups. Group A, as the control, received a manual syringe (inserting at mid-root) irrigation with 5 ml of NaOCl. Group B was irrigated with laser activation using a conical tip, and Group C was irrigated with a straight tip. Groups B and C utilized the Edge Pro Laser (Edge Endo, Albuquerque, USA) hybrid protocol, which combined water and NaOCl in various steps according to the manufacturer's instructions for laser parameters, tip, depth of insertion, time, and volumes. Each tube was weighed and the extruded irrigant was measured after each step. Data collected and analyzed (Shapiro-Wilk test, one-way ANOVA post hoc Tukey tests, $p<0.05$) with SPSS v.21.0.

Results: The hybrid protocol delivered 2 times more irrigating solution and resulted in greater irrigant extrusion overall (26% vs 8.4%), although mostly water. Extruded NaOCl was significantly lower with both tips than with manual irrigation ($p<0.005$). The straight tip caused slightly more extrusion than the conical tip when inserted in the mid-canal, but there was no significant difference when the tips were positioned in the pulp chamber.

Conclusion: Within the limitation of the present study, we may conclude that the proposed hybrid protocol with both laser tips has advantages over final syringe irrigation, increasing irrigant volume and reducing the risk of NaOCl extrusion.

GE37 - RETREATMENT TIME AND EFFICIENCY OF DIFFERENT ENDODONTIC INSTRUMENTS USED FOR ROOT CANAL RETREATMENT

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Introduction: The key phase in root canal retreatment is removal of the obturation material, which facilitates reinstrumentation, disinfection and refilling of the root canal system. Different techniques have been proposed for endodontic retreatment, such as: using hand instruments, nickel-titanium rotary files, ultrasonics, and lasers.

Aim: To compare retreatment time and efficiency of different endodontic instruments used for root canal retreatment.

Methods: Thirty extracted maxillary incisors were instrumented to working length (ProTaper X2 #25.06) and obturated. The samples were randomly divided into three groups (n=10) according to the retreatment instruments. Group 1: hand files; Group 2: ProTaper R (D1-D3); Group 3: Reciproc Blue R50. During retreatment the time needed to obtain the working length was measured. The teeth were then split axially into halves and the residual material from the canal walls was evaluated using a stereomicroscope (x40) and graded from 1 (clean canal walls) to 5 (completely covered walls).

Results: The shortest time for the removal of filling material from the canals was found for Reciproc Blue system (110 sec.), followed by ProTaper R (125.5 sec.) but without statistically significant difference. Retreatment by hand instruments needed 229.3 sec., which was significantly longer in comparison to Groups 2 and 3. The least amount of residual material was found for Reciproc Blue group, followed by hand files group ($p>0.05$). ProTaper group had the most residual filling material on canal walls, which was significantly more in comparison to other two groups ($p<0.05$).

Conclusion: None of the techniques were able the fully remove the obturation material from the root canal walls. The fastest and most successful technique was using the Reciproc blue instruments.

Keywords: Root canal retreatment, Protaper R, Reciproc, Hedström files.

GE38 - NATURAL ANTIMICROBIAL COMPOUNDS PROPOLIS AND COPAIBA: FIBROBLASTS CYTOTOXICITY, GENOTOXICITY, CYTOKINE DETECTION, AND AN IN VIVO TOXICITY EVALUATION IN GALLERIA MELLONELLA MODEL

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Aim: To investigate natural antimicrobial compounds, propolis (PRO) and copaiba oil-resin (COR) associated to hydrocortisone (H) and compared to Otosporin® (corticosteroid + antibiotic) regarding cytotoxic and genotoxic activity, and cytokines detection. Moreover, biocompatibility of PRO and COR were tested in Galleria mellonella model, aiming the development of an alternative drug in endodontics.

Methods: Dental pulp fibroblasts were submitted to no treatment or to several drug concentrations in cell culture medium conditioned with the drugs. After 24 hours, the MTT essay was performed to evaluate the cytotoxicity of the stimuli against the cells. Drug associations were also performed with concentrations that did not compromise cell viability, checked by MTT. Alpha MEM alone or with DMSO were used as controls. New cultures were submitted to the treatments and the micronucleus count was performed to evaluate the genotoxicity and ELISA essay was performed to detect the cytokines in the cell supernatant for TNF-α, IL-6, and TGF-β1. Then, increasing injected doses of PRO and COR were tested for acute toxicity in Galleria mellonella model to check the larvae survival up to 120 hours. PBS, DMSO, and no injection groups were used as controls. Kruskal-Wallis followed by Dunn tests analyzed the cell assays, while the Log-rank (Mantel-Cox) test, larvae survivals ($\alpha = 0.05$).

Results: The association of the drugs promoted higher percentages of cell density compared to controls ($P < 0.05$). Only controls treated with hydrogen peroxide showed micronucleus formation. Stimulation with different substances resulted in similar levels for the release of cytokines TGF-β1 and IL-6 ($P < 0.05$). TNF-α was not detected. PRO and COR doses showed negligible larvae toxicity.

Conclusion: The natural antimicrobial compounds PRO and COR showed absence of toxicity in different tests, warranting further investigations as endodontic drugs and open new perspectives concerning therapeutics application in the health field.

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