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BUDAPEST

7-10 SEPTEMBER 2022

General Endodontic Posters

20TH ESE BIENNIAL CONGRESS

GE01 - SUCCESFUL HEALING OF LARGE, CYST-LIKE PERIAPICAL LESIONS OF ENDODONTIC ORIGIN, AFTER NONSURGICAL TREATMENT: CASE SERIES

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AIM: To report cases of extensive periapical cyst-like lesions of endodontic origin, that were substantially healed using non-surgical root canal treatment.

INTRODUCTION: Most periapical lesions (>90%) can be classified as granuloma, radicular cyst, or abscess and are primarily caused by root canal infection. It is a general belief that large, cyst-like periapical lesions are less likely to heal after nonsurgical endodontic therapy. Nevertheless, there is no direct evidence to support this assumption.

CASE PRESENTATION:
Nonsurgical Endodontic treatment methodology:

- Crown down technique
- Disinfection with NaOCl 5,25%, EDTA 17%, Chlorhexidine
- Digluconate 2%
- Ca (OH)2 placement as an intracanal medicament
- Single wave of warm vertical condensation of gutta percha

DISCUSSION: Active signs of healing were observed in all cases, even before obturation. The follow up of each case showed not only formation of new bone, but also complete resolution of the lesion, in most cases. This conservative method, being minimally invasive, usually requires a relatively extensive treatment period.
Nevertheless, it has the major advantage of less discomfort and trauma for the patient, compared to large surgical procedures.

CONCLUSION AND CLINICAL RELEVANCE: Non-surgical root canal treatment can be our primary treatment modality in the management of teeth with pulp necrosis and periapical lesions, regardless of the size of the lesions.

GE02 - EFFICACY OF SHOCK WAVE-ENHANCED EMISSION PHOTOACOUSTIC STREAMING (SWEEPS) IN THE RETREATMENT OF THE CARRIER-BASED ROOT CANAL FILLING AND TWO TYPES OF SEALERS

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Aim
To investigate the efficacy of shock wave enhanced emission photoacoustic streaming (SWEEPS)in the retreatment of carrier-based obturation system combined with two types of root canal sealersusing a micro-CT analysis.

Methodology
Thirty single root extracted human teeth were instrumented with a size R25 Reciproc instrument. Specimens were randomly divided into two groups (n = 15) according to the type of root canal sealer. In the first group, root canals were obturated with AH Plus sealer and Guttafusion R25 gutta-percha. In the second group, a combination of Guttafusion R25 and MTA Fillapex sealer was used. After one week, retreatment of all specimens was performed using Reciproc instruments. After retreatment, root canals were additionally irrigated using a novelEr:YAG laser modality SWEEPS, following the auto SWEEPS protocol. To analyze the differences in the filling remnants, each tooth was scanned in a micro-CT device after root canal obturation, after retreatment using Reciproc instruments and after an additional SWEEPS treatment. The analysis was conducted using Two way ANOVA by material as the independent variable and volume after revision and after SWEEPS as a repeated measure, while initial volume was used as a covariate, so its impact is excluded.

Results
Reciprocating instrument alone was more effective in the removal of MTA-based sealer than epoxy resin-based sealer ($p<0.05$).
The results show that SWEEPS significantly reduces residual volume however, the materials were not removed completely from none of the samples. The reduction is independent of the material used when corrected for the initial volume.

Conclusion
The results of this study show that SWEEPS can be used to enhance the removal of root canal filling materials, both MTA and epoxy resin-based sealer combined with carrier-based obturation system. However, the practitioner must be aware it is not able to fully remove all the remnants from the endodontic space.

Funding
This study was founded by Croatia Science Foundation: „Investigation and Development of New Micro and Nanostructure Bioactive Materials in Dental Medicine“ IP-2018-01-1719. The leader of the grant is prof. Ivana Miletić.

GE03 - MANAGEMENT OF PERIAPICAL LESION ASSOCIATED WITH SILENT TRAUMA

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Aim of the case: To shed light on Silent trauma as differential diagnosis idiopathic maxillary anterior teeth with necrotic pulp and apical radiolucency.

Case presentation: A 50-year-old male presented with asymptomatic mobility and discoloration on #21. No pain on percussion, palpation and tooth responded negatively to thermal and EPT tests. Adjacent teeth were WNL. A previous dentist has initiated a RCT with TF present in the access cavity. Apical radiolucency (about 11 x 11 mm) was visible radiographically around the apex of tooth # 21. Patient denies history of trauma to the tooth however, he reported a history of surgery that was done 5 years ago under general anesthesia. Diagnoses was established as previously initiated with asymptomatic apical periodontitis. The treatment plan was to perform NSRCT and followed by SRCT if needed with all risks and benefits and alternative option were discussed with the patient. NSRCT and composite filling were done in two visits. One year recall showed asymptomatic tooth with sinus tract and apical radiolucency still the same. Apicoectomy was indicated and executed successfully using MTA as retrograde material. One year recall after the apicoectomy, the patient was asymptomatic with no mobility and the lesion was reduce radiographically.

Discussion: Traumatic injuries to the dentition have variable outcome on the health of the pulp and periapical status. A proper medical and dental history is mandated specially in cases where the routine etiologic factors such as carious lesions and trauma are inconclusive. The frequency of dental injury during general anesthesia varies in the literature, however the majority of studies reported 1-2%.

Conclusion / clinical relevance: Patients present pulpal and periapical disease with no obvious etiologic factor and history of hospitalization; silent trauma should be considered in differential diagnosis.

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GE04 - DISSOLVING EFFICACY OF INDIVIDUAL SOLVENTS AND BINARY COMPOUND ON GUTTA PERCHA AND EPOXY RESIN-BASED SEALER

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AIM
To examine the efficacy of the binary compound, compared to individual solvents, on the dissolution of gutta-percha and epoxy resin-based sealer, together with the retreatment time.

Methodology
The solvents used in this study included orange oil, grapefruit oil, eucalyptol, tetrachloroethylene, grapefruit oil/tetrachloroethylene (1:1) and distill water (control). Gutta percha cones (FKG DENTAIRE, La Chaux-de- Fonds, Switzerland) and epoxy resin-based sealer AH Plus (Dentsply DeTrey, Konstanz, Germany) were stored in moulds (n=42) and immersed in solvents for 5 and 20 min. Every mold was weighed before and after immersion. The experiment was performed according to ISO 6876:2012 specifications. The time spent on the retreatment of mesial root canals in 35 extracted first maxillary molars with rotary files and different solvents was evaluated. To test the statistically significant differences, the t-test was used for pairwise comparisons. The Kruskal–Wallis test was used to comparatively evaluate the dissolving action and retreatment time between groups. The significance level was set at $p < 0.05$.

Results
There was a significant difference in dissolving efficacy between the control and test groups ($p<0.05$). At 5 minutes, the grapefruit oil exhibited the best sealer solubility in relation to the other solvents ($p<0.05$). For 20-minutes immersion time, tetrachloroethylene and grapefruit oil/tetrachloroethylene (1:1) showed the best solvency capacity of gutta percha with weight losses of 11.2% and 10.8%, respectively, statistically different from that of orange oil and eucalyptol, with the smallest percentage of weight loss 3,23% and 1.35%. The binary compound presented the least time-consuming retreatment procedure than the individual solvents ($p<0.05$).

Conclusions
The best solvency capacity of gutta percha was obtained with tetrachloroethylene while grapefruit oil showed a superior solvent effect of sealer. It was found that in order to reduce the retreatment time, it is necessary to use a binary solvent such as grapefruit oil/tetrachloroethylene (1:1).

GE05 - LONG TERM OUTCOME OF AVULSED MANDIBULAR INCISOR WITH PROGRESSIVE EXTERNAL ROOT RESORPTION: 9 YEARSFOLLOW-UP

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Avulsion and reimplantation of immature permanent teeth represent a major challenge in terms of treatment and long – term prognosis. The present case report describe the long time outcomes of 7 years old patient following an accident in which his mandibular left central incisor was avulsed and reimplanted in one hour of physiological storage (the tooth was kept in the mouth under the tongue). External root resorbtion of tooth #31 was diagnosed radiographically one month after dental injury. Endodontic treatment using calcium hydroxide short-term therapy and root canal obturation with mineral trioxide aggregate MTA below the crestal bone margin. Three months later root resorbtion progressed what leaded to the periodontal surgery decision. Nine years after replantation, external root resorbtion was damaged half of the root, but the tooth was still functional with favorable esthetics.

Keywords: external root resorbtion, tooth avulsion, dental trauma, tooth reimplantation, replacement root resorbtion

GE06 – RETRIEVAL OF ENDODONTIC INSTRUMENT SEPARATED IN THE APICAL THIRD OF ROOT CANAL

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Aim: To report clinical case of successful retrieval of endodontic instrument separated in the apical third of first maxillary premolar root canal.

Introduction: Separated endodontic file in root canal hinders optimal cleaning and shaping of endodontic space and interferes with favorable treatment outcome.

Case presentation: A 34-year-old male patient was presented to a general dentist for restoration of fractured maxillary left first premolar. Endodontic treatment was initiated and block was found in buccal canal CBCT radiograph showed approximately 5 mm long fragment in the apical canal third whose appearance suggested that it might be a Hedström file (Fig 1). The patient was then referred to an endodontic specialist for the removal of the separated file. Gates-Glidden burs were used to create a straight-line access and to allow visibility of the coronal aspect of the broken file. Dental microscope magnification (40 x) allowed the removal of dentin circumferentially around the fragment using endodontic ultrasonic tip. The canal was irrigated with sodium hypochlorite after each ultrasonic instrument activation in order to flush dentine debris and cool the operating field. Due to root canal curvature and angulation between the axes of the fragment and the canal, more dentine was removed from its mesial wall. Ultrasonic vibrations allowed loosening up and successful retrieval of the broken instrument (Fig 2). Afterwards a radiograph was taken to confirm the complete removal of the fragment, canals were instrumented using reciprocating NiTi files and calcium hydroxide medication was placed. In the next visit root canals were obturated with sealer and guttapercha cones (Fig 3). The tooth was restored with a fiber post and a ceramic crown After thirteen months, clinical and radiographic examination, showed satisfactory result (Fig 4).

Discussion: Separated endodontic instrument removal should be performed with minimal damage to root dentin but it is not always possible to preserve the original shape of endodontic space.

Conclusion & Clinical Relevance: Clinical experience and appropriate armamentarium enable conservative and effective retrieval of separated instruments and resolve consequent endodontic complications.

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GE07 - **ENDODONTIC RETREATMENT COMPLICATION - CANAL PERFORATION**

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Perforations are mechanical or pathological communications between the root canal system and the external environment. This possible complication during endodontic treatment and retreatment could result in failure of saving the tooth. Instead of extraction we can try to close this communication. The prognosis for a tooth with a perforation depends on the location of the perforation, negotiability of the canal, contamination and treatment.
The aim of this poster is to present a possible complication and solution for canal perforation that could arise in performing an endodontic retreatment. The presentation shows case of tooth 46 with perforation in mesiobuccal canal referred from other doctor for consultation under microscope. Procedure involved solving this problem with help of Mineral Trioxide Aggregate and performing retreatment of three canals. The endodontic retreatment became a success which is visible on x-ray pictures and resolution of symptoms. Materials like Mineral Trioxide Aggregate can increase the life span of the tooth for many years ahead.

GE08 - DECOMPRESSION: A CONSERVATIVE APPROACH OF A THROUGH-AND-THROUGH LESION

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A 38-years-old female presented for evaluation of a large periapical radiolucency apical to the right lateral incisor (tooth 1.2). The patient referred that pain and discomfort above the tooth began after the non-surgical root canal treatment 10 months before, and steadily increased from then on. There was also a reported swelling on both buccal and palatal aspects.
Clinical examination revealed a sinus tract and pain on vertical percussion and palpation, with no periodontal pockets nor increased tooth mobility.
A cone beam computed tomography (CBCT) revealed a lesion involving tooth 1.2 and both buccal and palatal cortical bone plates (through-and-through).
The diagnosis was previous treated tooth with chronic apical abscess.
Treatment options were discussed with the patient and decompression was preferred and consented upon.
In the first appointment a flap was raised under local anesthesia in order to perform an incisional biopsy and allow placement of the decompression tube.
The patient was instructed to wash the lesion through the tube with sterile saline twice a day during the entire period in which the tube was placed. After 5 months, apical microsurgery was performed.
At 1 year follow-up the patient had no symptoms and the periapical radiography showed signs of healing.
Decompression of large lesions prior to surgical approach is assuming an increasing and important role that largely contributes to maintaining the surgical procedure as minimally invasive as possible. 3
Decompression is effective in reducing lesion's volume and minimizing the surgery extension. 3,4 Large periapical lesions, and especially through-and-through lesions, tend to form scar tissue even after lesion enucleation, which is still considered successful healing. 3Patient cooperation plays a key role in the success of this treatment option.2

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Keywords: decompression; through-and-through lesion; apical surgery; cyst management

GE10 - MECHANICAL PERFORMANCE OF TEETH WITH EXTERNAL CERVICAL RESORPTION RESTORED WITH DIFFERENT MATERIALS – AN IN VITRO STUDY

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Aim: External cervical resorption (ECR) is a complex lesion that involves dental, periodontal and in more advanced cases pulpal tissues. Early diagnosis helps to achieve a successful treatment, however, the location and characteristics of ECR makes the treatment of such cases a challenging task for the clinician. While a large number of studies have investigated the nature and aetiology of ECR, there is only limited scientific evidence about the restorative therapy of ECR. Therefore, this in vitro study aimed to examine fatigue and fracture resistance of mandibular incisor teeth with artificial Patel 2Ad cavities restored with different restorative materials.

Methodology: 30 intact mandibular incisors extracted due to periodontal reasons were selected. The teeth were randomly divided into 3 experimental groups (n=10). A standardized cavity, simulating a Patel 2Ad resorption cavity was prepared to every specimen. The cavities included the mesial, buccal and distal surfaces of the roots. Their depth were determined in 40% of the mesio-distal width of the teeth, measured in the level of the cemento-enamel-junction (CEJ). The height of the cavity was determined in 3 mm, into apical direction from the CEJ. After the preparations the groups were restored with different restorative materials. Group 1 was restored with Biodentine, group 2 with glass-ionomer cement (Equia Forte) and group 3 with composite filling material (G-aenial anterior). Fatigue-survival and fracture resistance was measured for all specimens using a cyclic-loading machine and static load-bearing capacity of the teeth was tested using a universal testing machine. Kruskal-Wallis test was conducted from the results.

Results: All of the tested specimens survived the cyclic-loading. There were no statistically significant difference in fracture resistance between the tested groups.

Conclusions: According to our results, from a mechanical point of view all of the tested materials could be used to restore teeth with external cervical resorption cavities.

GE11 - EFFECT OF INTRACANAL CRYOTHERAPY ON THE IL-1 BETA, TNF-ALPHA AND MMP-8 LEVELS IN THE PERIAPICAL EXUDATE OF TEETH WITH CHRONIC APICAL PERIODONTITIS

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Aim
To evaluate the effect of intracanal cryotherapy on the IL-1 beta, TNF-alpha and MMP-8 levels in the periapical exudate of teeth with chronic apical periodontitis.

Methodology
Mandibular premolar teeth of 60 male patients within the 20-30 years old range, diagnosed with asymptomatic apical periodontitis were root canal treated in two visits with 14-days interval. Periapical exudate was sampled with #40 sterile paper points positioned 2 mm beyond the working length for 60 s in the first and second visit. The baseline sample (the first visit) was obtained following access cavity preparation and completion of preparation of root canals. Then, the patients were assigned to either control or intracanal cryotherapy group and received a final irrigation using 20 mL of distilled water either at 2.5°C or room temperature for 5 min using EndoVac. The canals were dressed with calcium hydroxide. In the second visit, 14 days later, the calcium hydroxide was removed with passive ultrasonic irrigation and the periapical exudate were sampled again. IL-1 beta, TNF-alpha and MMP-8 levels were determined with ELISA. Data were analysed using t-test and repeated measures ANOVA with 5% significance threshold.

Results
At baseline, the levels of IL-1 beta, TNF-alpha and MMP-8 levels were similar between the control and cryotherapy groups ($p > .05$). In the intraoral cryotherapy group, the amount of IL-1 beta, TNF-alpha and MMP-8 decreased from the first visit to the second greater than the control group. However no statistically significant difference regarding the change of IL-1 beta, TNF-alpha and MMP-8 levels were found between the cryotherapy and the control group ($p > .05$).

Conclusions
Intraoral cryotherapy application did not alter the IL-1 beta, TNF-alpha and MMP-8 levels in the periapical exudate of teeth with chronic apical periodontitis.

Funding
Scientific and Technological Research Council of Turkey with the project number 119S397.

GE12 - WORKING LENGTH ACCURACY OF DUAL MOVE-DUAL PEX IN DIFFERENT FILE TYPES

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Aim: Investigate the accuracy of the Dual Move-Dual Pex (Micro-Mega, France) device in measuring the canal length when used with different heat-treated files and apical widths.

Materials and Method: Thirty-six single-rooted extracted teeth were included in the study. The actual canal length was determined under the microscope with #10 stainless steel under x2.5 magnification, by advancing the file until it was visible from the apical part. The teeth were modeled in alginate for electronic apex locator procedures. Without any preparation, 2 electronic working lengths were determined by using #10K with the apex locator, advancing up to 0.0 and 0.5 points. Firstly, electronic measurements were made at OneCurve 25,4%, 0.0 and 0.5 points, which is Micro-Mega's file. The same measurements were made with Endoart Action Gold-Action Blue Kit S1 file. After the instrumentation was completed, the same measurements were repeated with the F2 files of the sets. All electronic working lengths were compared among themselves and with the control group. Data were statistically analyzed using one-way Anova and Tukey tests.

Results: When the measurements made with the apex locator were compared with the control group, no significant difference was found both 0.0 and 0.5 points in the use of Endoart($p>0.05$).
There were significant differences between the actual and the static apex locator values at 0.0 and 0.5 points ($p<0.0001$) in the measurements made during preparation. Values read during preparation were higher.

Conclusion: It was found that simultaneous measurement and preparation using the Endoart Gold-Blue Kit in the Dual Move-Dual Pex device tended to exceed the actual working length, while OneCurve did not tend to exceed. It would be useful to firstly determine the working length in static mode and then move on to the shaping phase. More beneficial results will be obtained when the device is used with its own files.

GE13 – MINERAL TRIOXIDE AGGREGATE APICAL PLUG IN DEVITAL TEETH WITH AN OPEN APEX: CASE SERIES

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Aim: The purpose of these cases is to present the apexification using MTA and root canal treatment of maxillary and mandibular right central incisors which had an open apex.

Introduction: Mineral trioxide aggregate (MTA) has been used in dentistry especially, teeth with an open apex, such as an immature teeth. It was possible to optimize the treatment time of these cases by immediate placement of apical plug and the root canal filling.

Case Presentation: A 32 years old male patient referred to endodontic department for evaluation of tooth #11 and #31 with an open apex and periapical radiolucency. The patient had no symptom. In clinical evaluation, non-complicate crown fracture was determined for tooth #11 and #31 and they had been traumatized when he was 8 years old. The root canal treatments were done under local anesthesia and rubber-dam isolation. After shaping and irrigation, calcium hydroxide was placed as an intracanal medicament. After one week, calcium hydroxide was removed chemomechanically. MTA was mixed and carried into the canal with special MTA carrier and was condensed to apical portion of root canal with pluggers. After 24 hours, coronal parts of tooth were filled with gutta percha and resin based sealers by using cold lateral condansation technique.

Discussion: Apexification is described as a method to induce a calcified barrier of an incomplete root in teeth with necrotic pulp. This barrier that used in this case MTA is mandatory to allow the compaction of the root filling material.

Conclusion & Clinical Relevance: The using of MTA for apical plug effectively treated teeth which had an apical lesion also with an open apex. The patient was recalled after 2 years. Clinical examination showed that satisfactory healing and the radiography was showed that adequate periapical response as well.

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GE14 - REMOVAL OF SEPARATED INSTRUMENT

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The success of non-surgical endodontic treatment is high given that adequate cleaning and shaping, together with a proper hermetic seal of the root canal(s) has been done.
One of the most troublesome incidents during RCT is fracture of an endodontic instrument. According to the evaluations done in recall radiographs, the frequency of broken endodontic instruments range between 2-6% of the investigated cases.
Broken instruments usually prevent the access to the apex, thus lowering the prognosis of the root canal treatment of the related teeth. The prognosis of teeth with broken instrument depends mainly on the preoperative condition of the pulpal and/or periapical tissues, the stage of treatment as well as the level in the canal at which the instrument was separated, and wheather the instrument could be retrieved from the canal or not.
All these reasons lead to an increase in the interest of removing intracanal separated instruments
There isn't a simple method for treating such cases, but there are different techniques to manage it. These techniques include the use of endodontic forceps, ultrasonic tips, hollow tube–based extractor systems, and endodontic files. The present case report describes the removal of a large separated NiTi endodontic instrument by using the modified hollow tube–based extractor system.
Removal of broken instruments from the canals is difficult but possible in some cases with a success rate varying from 55-79%. The clinician has to bypass the instrument and clean and fill the canal in presence of broken instrument. In every attempt that the clinician makes for removing or bypassing the file, he should incorporate and adequate cleaning. Also, an ideal root canal filling material is to be used, it must have easy handling properties, radiopacity, dimensional stability, insolubility, moisture resistance, sealing ability and biocompatibility

GE16 - THE ANTIBACTERIAL EFFECT OF CALCIUM HYDROXIDE AND PROPOLIS COMBINATION AGAINST ENTEROCOCCUS FAECALIS

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Aim: To find out the difference of antibacterial effect of calcium hydroxide-propolis group and calcium hydroxide-sterile aquadest group against Enterococcus faecalis.

Methods: This research was a laboratory experimental study. Enterococcus faecalis were swabbed to Muller Hinton Agar (MHA). Calcium hydroxide-sterile aquadest group, calcium hydroxidepropolis group, and amilum tritici-propolis group as positive control group were placed in 3 wells with 5mm diameter and 3mm depth made in MHA. The diameter of the zone of inhibition around the test materials was measured after 24 hours.

Results: The widest diameter of inhibition zone was calcium hydroxide-propolis group which has mean 16.1250 mm followed by calcium hydroxide-sterile aquadest group and amilum triticipropolis group. Based on Anova testing, there is significant difference in inhibition ability between all treatment groups which has p value = 0.013 (p value < 0.05).

Conclusion: Calcium hydroxide-propolis has the highest antibacterial effect than calcium hydroxide-sterile aquadest and amilum triciti-propolis against Enterococcus faecalis.

GE18 - THE EFFECT OF PATIENT'S RACE ON THE OUTCOME OF ENDODONTIC TREATMENTS: A POOLED ANALYSIS OF 1 YEAR RECALL DATA FROM FOUR CONE BEAM CT OUTCOME STUDIES

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Objectives
The aim of this pooled data analysis was to establish if there is an association between a patient's race and the proportion of successful outcomes of endodontic treatments, and if so, what factors may determine this association.

Methodology
Data collected from four prospective clinical outcome studies were pooled. All root canal treatments (RCT) were carried out using a standardized protocol. Patients were recalled 12 months after the completion of the treatment. Treatment outcome was determined based on the clinical findings and CBCT examination. Statistical analysis included the description of categorical and continuous variables, for the total sample, Simple binary logistic regression models, Chi2 tests and Kruskal-Wallis tests were undertaken.

Results
Data from 301 patients were available, of which 43 were black (14.3%), 50 were non-black minority ethnic (NBME) (16.6%) and 208 white (69.1%). The risk of an unfavourable outcome was higher in teeth with short root canal fillings (OR=3.36; p=0.002), when a preoperative radiolucency was present (OR=2.59; p=0.019) and when an intra-operative root canal perforation was detected (OR=5.25; p=0.016).
Multiple regression models showed that black (OR=2.28; p=0.05) and NBME patients (OR=3.07; p=0.008) had a higher risk of an unfavourable result compared to white patients.

Conclusions
Black and NBME patients had a significantly higher failure rate of root canal treatments compared to white patients, all other known pre, intra and post-operative risk factors for root canal treatment failure were present in similar proportions in BME and white patients.

Clinical Significance
Clinicians need to be aware that Black and NBME patients may have less successful outcomes of root canal treatments compared to white patients. This information can create awareness, ensuring extra care is taken to follow endodontic treatment protocols thereby reducing this discrepancy.

GE19 - RADIOGRAPHIC OUTCOME OF NONSURGICAL ENDODONTIC TREATMENT DURING THE PANDEMIC. A RETROSPECTIVE STUDY OF POSTGRADUATE STUDENTS' RECORDS

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Aim: To determine retrospectively the radiographic outcome of root canal treatments and retreatments performed by endodontic postgraduate students of the Dental school of Aristotle University of Thessaloniki during the Covid-19 period.

Methodology: Dental records of patients who received root canal treatment or retreatment were retrieved from the electronic records of the Aristotle University of Thessaloniki, School of Dentistry for the period 2020-2022. Only records with complete radiographic information and a follow-up period of at least 6 months were included. Pre-operative variables including demographic characteristics of patients, tooth type, periapical lesion size, PAI score, and post operative variables including treatment outcome (healed, healing or not healed), PAI score, apical level of obturation, sealer extrusion and type of coronal restoration were recorded. All radiographs were evaluated independently by 2 endodontic residents.

Results: Among the 450 records retrieved only 89 were included. The follow up period range was between 6-24 months. The majority of the cases were posterior teeth (64%). 75% of the cases presented periapical radiolucency. The overall success rate was 90% with 48.4% healed, 41.6% healing and 10% not healed. The success rate for initial treatment was 91% and for retreatment 87%. Teeth with favorable outcome presented decreased PAI score postoperatively whereas failed teeth presented 4 and 5 score in 67% of the cases. Underextended obturation was reported in 22% of the failed cases. 23.6% of treated teeth exhibited postoperative sealer extrusion (22% of the failed cases). Regarding the type of coronal restoration 35% were restored with crown and the rest 65 % using a direct restoration.

Conclusion: The majority of the patients failed to follow the endodontic recall guidelines during the pandemic. Nevertheless, the overall success rate remained high. Patients seem to prefer less time consuming interventions as indicated by the high rate of direct coronal restorations.

GE21 - INVASIVE CERVICAL RESORPTION: A NARRATIVE REVIEW ON THE TREATMENT APPROACHES

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AIM
Invasive cervical resorption (ICR) is an aggressive form of external root resorption that shows various clinical and radiological features. ICR treatment aims to retain the affected teeth in healthy, functional, and esthetic conditions. Multiple therapeutic options have been described to manage the resorptive defect. This review aimed to investigate the treatment choices, materials, and techniques used in ICR cases and their outcomes.

METHODOLOGY
A narrative review was conducted, including all articles in English, reported from inception to January 2022, on treatment choices in ICR cases. PRISMA guidelines were used, and electronic searches were performed in PubMed Medline, Scopus, and Web of Science databases.

RESULTS
Of the 892 articles evaluated, 86 were selected; 81% of the reports were published between 2010 and 2021, and 84% of cases were performed in a university environment. The external-surgical intervention was the prevalent modality chosen to reach and treat ICR lesions, followed by the orthograde internal access and a combination of the two. Mechanical debridement of the resorptive tissue was adopted more frequently, while the inactivating agent most used was 90% trichloroacetic acid. Bioactive endodontic cement was used more often to fill ICR defects, followed by glass ionomers and composites. The surgical-external and combined external and internal therapies were mostly correlated to cases classified as Heithersay Class 2 and 3. Follow-up was available for 94% of the cases, with an average recall of 29 months; the success rate was 89%.

CONCLUSIONS
The most encouraging finding from this review is that most of the multiple materials and techniques reported have proven valuable in resolving the damage caused by this disease, as the prognosis tends to be generally optimistic despite the severity of the condition.

GE22 - **MANAGING ANKYLOSIS AFTER TRAUMATIC INJURY: LONG TERM FOLLOW UP OF DECORONATION AND ROOT SUBMERGENCE**

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Aim: Evaluation of the effectiveness of the decoronation technique in alveolar ridge preservation.

Background: Severe traumatic root injuries, such as avulsion, intrusion and lateral luxation will cause damage to the periodontal ligament (PDL) fibres, resulting in an inflammatory process. By losing the intervening root/bone barrier (PDL space), an increased mesenchymal activity will follow, which leads to progressive replacement of the root substance by bone, hence resulting in ankylosis [1,2]. Ankylosed teeth in growing patients should not be left untreated, because it can lead to an infraposition of the ankylosed tooth, an un-esthetic ridge deformity, tilting of adjacent teeth and esthetic disturbance [2,3]. Several treatment options have been described to treat ankylosed teeth in adolescents, such as composite build-up, surgical repositioning, bone distraction, autotransplantation, extraction or no intervention at all, but most of them are associated with an unpredictable prognosis [3]. Decoronation and root submergence are a more conservative combined treatment modality, firstly described by Malmgren in 1984 [4]. This technique involves a coronectomy of the ankylosed tooth beneath the cementoenamel junction, removal of the pulp and stimulation of bleeding in the root canal by triggering the periapical area [2]. The available evidence recommends a strict follow up when ankylosis is diagnosed [2]. Frequent loss of the pontic due to non-invasive adhesive technique is a potential limitation of the decoronation technique [2].

Conclusion: This technique seems to be promising in terms of bone preservation until definitive implant placement or a prosthetic solution is planned [3]. Furthermore, it is a simpler and less expensive procedure than ridge augmentation, when vertical bone apposition is required [5].

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GE23 - BACTERIAL PENETRATION AND PROLIFERATION OF THE GAP IN VERTICAL ROOT FRACTURE WITH DIFFERENT SEALING MATERIALS - A CONFOCAL LASER SCANNING MICROSCOPIC STUDY

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Introduction: the main problem associated with vertical root fracture (VRF) is the colonization of the fractures by bacterial biofilms. The bacteria can be found in defects, secondary fractures, or dentinal tubules associated with the fracture. A confocal laser scanning microscopic provide a reliable quantitative information about the presence and distribution of bacteria in dentinal tubules.

Aim: to trace histologically bacterial penetration and proliferation after sealing of the simulated VRF with different intracanal sealing materials using confocal laser scanning microscopy (CLSM) and Scanning Electron Microscope (SEM).

Methods: 60 extracted human single-rooted premolars were used in this study. After root canal preparation, stimulated VRFs were created. The canals were obturated using MTA, Gutta percha & AH plus sealer or Gutta percha & BC sealer. Enterococcus Faecalis bacterial infection was done by filling the teeth with Enterococcus Faecalis suspension. Bacterial colonization was assessed the in the dentinal tubules and the simulated VRF.

Results: In the MTA group, there were significantly more dead bacteria in the dentinal tubules than live bacteria ($p=0.015$) while in the AH group there were significantly more live than dead bacteria ($P=0.048$). There were significantly more bacteria in the AH group comparing the BC and the MTA group ($p<0.001$).

Conclusions: Considering the limitations of an ex-vivo setting, the present study demonstrated that bacteria may colonize the simulated VRF of the part of the fracture all the way to the outer surface. The type root canal filling material may affect the amount and vitality of the colonized bacteria.

GE24 - EXPRESSION OF TYPE I COLLAGEN IN PULP CELLS OF RATTUS NOVERGICUS POST APPLICATION OF CALCIUM CARBONATE (CACO3) FROM BLOOD SHELLS (ANADARA GRANOSA) ON REPARATIVE DENTIN FORMATION

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Aim: To analyze the expression of type I collagen in the process of reparative dentin formation with positive type I collagen parameters after the application of CaCO3 from Anadara granosa shells.

Methodology: This laboratory experimental study carried out using Rattus novergicus in which the maxillary molars were prepared until perforated. The teeth then applied with CaCO3 extracted from Anadara granosa shells and the cavity filled with GIC. The treatment group was determined on the 3rd and 14th day. The teeth were then extracted and slide preparations were made with Masson's Trichrome staining.

Results: There was significant increase in the expression of type 1 collagen between the treatment groups on day 3 to day 14 with p value = 0.009 ($p < 0.05$). Masson's Trichrome staining showed a significant difference in collagen fibril density on day 3 and day 14, where on day 14 showed dentinogenesis for reparative dentin formation evidenced by higher density of collagen fibrils.

Conclusion: Post-application of CaCO3 from Anadara granosa shells showed a positive type I collagen density with collagen fibrils density on the fourteenth day higher than on the third day indicating the occurrence of dentinogenesis.

Acknowledgement: The authors thank the Ministry of Research, Technology, and Higher Education, Indonesia, for financing this study

Keywords: CaCO3, Anadara granosa, dentinogenesis, reparative dentin, collagen fibrils

GE25 - **TREATMENT OF TWO CHALLENGING CONSECUTIVE DENTAL TRAUMATIC INJURIES**

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Aim
To discuss ways to react to incomplete replantation after avulsion of permanent mature teeth and to highlight the importance of examination of accompanying soft tissue lesions.

Introduction
When replanting avulsed incisors after a traumatic injury, complete repositioning is not always possible. Following replantation, early root canal treatment is mandatory in mature teeth. Even traumatic dental injuries that appear to be uncomplicated at first glance can be accompanied by distinct soft tissue lesions.

Case Presentation
An 8-year-old patient avulsed his tooth by knocking his knee against the lower left central incisor. After storage for 30 minutes in the boy's own saliva, the tooth was replanted incompletely alio loco, splinted and resin bite blocks were applied in the posterior region by his orthodontist. When the patient introduced himself at the dental clinic two days later, the tooth was shortened, the bite blocks were removed, and root canal treatment was initiated. Two years later, the tooth did not exhibit any pathological findings, neither clinically nor radiologically. Two days before the appointment for root canal obturation, the boy had another accident, hitting both his upper central incisors on hard ground after stumbling. The teeth showed small enamel fractures, and lower lip bitemarks on the inside and the outside. After locating the tooth fragments with an X-ray radiograph, the fragments were removed under local anesthesia.

Discussion
The application of resin bite blocks after incomplete replantation of the lower incisor resulted in prolonged treatment time for the brave young patient. Removing scattered tooth fragments from surrounding soft tissue is essential for successful wound healing.

Conclusion and Clinical Relevance
If a mature tooth cannot be replanted completely after avulsion, the tooth should be directly shortened with a bur after splinting and root canal treatment should be initiated. Simple 2D-X-Ray pictures can help in locating tooth fragments in surrounding soft tissues.

Funding information
Work was funded by the Interdisciplinary Center for Clinical Research of the Medical Faculty of Friedrich-Alexander Universität Erlangen-Nürnberg and by the Office for Gender and Diversity of the University Hospital Erlangen ("Innovationsbündnis 4.0").

GE26 - **ENDODONTIC TREATMENT OF THE MANDIBULAR FIRST MOLAR WITH RADIX ENTOMOLARIS**

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Introduction

The removal of all vital and necrotic pulp tissue and microorganisms from the root canal system is essential for the success of endodontic treatment. Normally the permanent first molar has two roots, mesial and distal, with two mesial and one distal canal. But, mandibular molars may have an additional root located either distobucally (radix paramolaris) or distolingually (radix entomolaris-RE).

Three rooted molar traits have a high degree of genetic predisposition in the Eskimo population and in Eskimo Caucasians mixture. The presence of RE is high among Taiwanese (Chinese) population (21,1%-33,33%) and bilateral incidence is ranging from 53,65 to 68,57% in them. Low prevalence of RE is notice in African, Eurasian and Indian population (<5%). RE may also be present in the first, second and third molar; being less prevalent in second molar.

Aim

The aim of this study is to present a case of permanent mandibular first molar with an additional third root (radix entomolaris) in Serbian population.

Case presentation

A 53 year old female reported to the Department of Restorative Dentistry and Endodontics of the School of Dentistry, Belgrade, complaining of pain in the right posterior tooth region of the lower jaw. Clinical examination revealed a deep carious lesion of the right permanent first mandibular molar. The tooth showed a delayed response after electric pulp testing. A diagnosis of symptomatic irreversible pulpitis was made. Retroalveolar radiography showed carious lesion encroaching on the pulp space and the presence of an additional distal root.

The caries was removed, and access opening was performed. The access cavity was modified from triangular into a more trapezoidal shape and another orifice was located distolingually. Initial instrumentation was done with K file ISO number 10 and working lengths were determined electronically with apex locator Root ZX, (J. Morita, Kyoto USA). The chemo-mechanical instrumentation was performed with Reciproc blue file R25 (VDW, Germany) and massive irrigation of sodium hypochlorite (1%). Obturation of the root canals was performed using gutta percha points and AH plus sealer (Dentsply, Switzerland).

Conclusion

Radiographically, the third root is visible in most of cases, but occasionally it may be missed because of its slender dimension or overlapping with distal root. Visual aids such as a loupe, intraoral camera or dental microscope can also be helpful. CBCT is very useful in the diagnosis of teeth with complex anatomies. A case of RE can be easily diagnosed by a careful evaluation of preoperative radiographs (taken at different angulations) and careful examination of the floor of the pulp chamber.

GE27 - **DETECTION OF ENDODONTIC SEALER RESIDUES AT THE RESIN-DENTIN ADHESIVE INTERFACE**

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Aim

Since endodontic sealer residues in the pulp chamber can negatively affect the bond strength of adhesive systems[1], it is important to remove these residues. The aim of this study is to investigate a method to detect and quantify sealer residues in dentinal tubuli and in the pulp chamber (hybrid layer).

Methodology

Sixteen extracted human teeth (monoradicular, non-carious) were endodontically treated. The endodontic sealer AH Plus® by Dentsply® utilized to seal the canals, was tagged with immunomarker Rhodamine B (RB – concentration: 0,1%). The teeth were divided in four groups, depending on the method used to remove sealer residues in the pulp chamber[2,3]: water (1), ethanol (2), primer (3), Clearfil SE primer by Kuraray® or (4) Tubulicid by Dental Therapeutics®. Following the removal of sealer residues, the pulp chamber was restored using a bonding system tagged with immunomarker Rhodamine Green (RG – concentration: 0,2%) and composite Clearfil Majesty by Kuraray®. The teeth were horizontally sectioned and analysed by a LSM 800 Zeiss® fluorescence microscope. A statistical analysis was performed[4].

Results

This study is a starting point for further investigation to find a method to detect sealer residues. Further investigations should include a control group (positive and negative), have a greater sample size and should check the solubility of the marker and the sealer independently before starting the experiments.

Conclusion

Rhodamine B and Rhodamine Green could be detected and quantified by using a fluorescence microscope. Since the sealer and the bonding system were tagged with different fluorophores, they could be identified separately. Ineffective cleaning of the sealer residues could be seen as a correlation of both fluorophores (when both fluorophores are present, there are still residues at the resin-dentin adhesive interface).

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GE28 - EFFECT OF NEUROGENIC INFLAMMATION AND CELLULAR INFLAMMATION ON EXPERIMENTAL FLARE-UP POST DENTAL PULP TISSUE EXTIRPATION

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Aim: To analyze the correlation between expression of CGRP, NaV1.7 on nerve cells and expression of HSP70, TNF-α on macrophage cells in dental pulp tissue after LPS administration and extirpation of pulp tissue in root canals.

Methodology: The experimental laboratory research with post-test only control group design. This study was conducted using fifteen Spraque Dawley mice which were divided into three groups, each group consisted of five mice: Control group, Pulp tissue extirpation group, and LPS (Ultrapure lipopolysaccharide from Porphyromonas gingivalis – TLR4 ligand) group followed by extirpation of pulp tissue. Samples were collected from apical field of mandibular incisors. Examination using immunohistochemical methods. Statistical analysis using path analysis of linear regression was used to determine the effect of variables on other variables ($\alpha<0.05$).

Results: There were positive and significant correlation occurred in HSP70 with TNF-α ($\beta=1.061$; $p=0.013$) and between CGRP and TNF-α ($\beta=0.592$; $p=0.040$). This indicates the higher levels of HSP70 and CGRP will be followed by higher levels of TNF-α. The correlation between HSP70 and TNF-α was stronger than the correlation between CGRP and TNF-α. Positive and significant correlation occurred in CGRP with NaV1.7 ($\beta=0.724$; $p=0.01$) and between TNF-α and NaV1.7 ($\beta=0.571$; $p=0.016$). This indicates the higher levels of CGRP and TNF-α will be followed by higher levels of NaV1.7. The correlation between CGRP and NaV1.7 was stronger than the correlation between TNF-α and NaV1.7.

Conclusions: The immunohistochemical mechanism of flare-ups can occur through two pathways, the inflammatory neurogenic pathway and the inflammatory cellular pathway. Neurogenic inflammatory pathways have a greater influence than cellular inflammatory pathways on flare-ups.

GE29 - ANTIMICROBIAL EFFICACY OF SODIUM HYPOCHLORITE (NAOCL) AND HYPER-PURE CHLORINE DIOXIDE (CLO2) IN THE DEPTH OF DENTIN TUBULI

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Aims
Our goal was to determine the effectiveness and functional penetration depth of ClO2 and NaOCl in dentin tubuli in vitro. ClO2 is a volatile solution and presumably passes gas bubbles occluding the different parts of the root canal system including the tubuli; therefore, it should be able to penetrate deeper, than NaOCl.

Methodology
The distal root of extracted lower molars were prepared according to the protocol of Andrade et al. (2015). After sterilization and artificial infection by Enterococcus faecalis, the roots were irrigated with saline, NaOCl, or ClO2. Following longitudinal root splitting the bacteria were stained with live/dead fluorescent viability stain. The functional penetration depth of the irrigants along the tubuli was analyzed at the coronal third using confocal laser scanning microscope. The effectiveness of the irrigants was determined by the equation of 100xdead/live+dead at given depths.

Results
Both disinfectants were able to kill bacteria to minimum 500µm depth. NaOCl was significantly more potent at 100µm; however, ClO2 increased in efficacy with depth. It tends to be more potent in greater depths, but there was no significant difference between them. The overall effectiveness of both irrigants was not more than 38%.

Conclusions
Both tested irrigants effectively killed bacteria in the dentin tubuli; however, they were far from total elimination. The penetration depth of the irrigants is more than previously published. We suggest the application of both disinfectants in clinical practice consecutively with ClO2 applied as final irrigant.

Funding
Semmelweis University, Dental Faculty Grant 2021

GE30 - PREVALENCE OF FUSOBACTERIUM NUCLEATUM IN PERIAPICAL LESIONS OF ENDODONTICALLY TREATED TEETH

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Aim
One of the endodontic treatment failure reasons is secondary/persistent infection, being Fusobacterium nucleatum, one of the Gram-negative strict anaerobic bacteria, frequently found in these cases. Periapical lesions of endodontic origin mostly correspond to inflammatory reactions resulting from pulp necrosis and bacterial contamination of the root canal. The objective of this study was to verify the prevalence of F. nucleatum in periapical lesions and to associate them with clinical and radiographic features of the patients.

Methodology
Patients with periapical lesions in teeth with unsuccessful endodontic retreatment were indicated for endodontic microsurgery, where the periapical lesion was collected (n=13). Samples were analyzed using Nested-PCR. Fisher's exact test was used to assess the associations of F. nucleatum with the clinical and radiographic features of the patients. A significance level of 5% was adopted.

Results
F. nucleatum was present on 9 periapical lesions. No association was found between F. nucleatum and clinical and radiographic features.

Conclusion
The prevalence of F. nucleatum in periapical lesions is 69.23%.

Funding
Source FAPESP 2015/23479-5, 2017/25090-3, CNPq 303852/2019-4, and CAPES 001.

GE31 - ROOT CANAL TREATMENT OF THREE-ROOTED MAXILLARY FIRST PREMOLARS: REPORT OF TWO CASES

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Three-rooted maxillary first premolars have an incidence of 0.5-6% according to the literature, however their clinical management remains challenging. The aim of this poster is to present the management of two cases of upper first premolars with three root canals.

In Case 1, a 48-year old woman was referred for treatment of her first upper left premolar that presented signs of pulpitis. The third canal was missed in the initial radiograph and it was revealed radiographically post-treatment. The tooth was accessed again and the third canal was located three millimetres deep into the buccal root canal and treated. In Case 2, a 56-year old woman was referred for retreatment of her maxillary first premolar. A missed third canal was located mesial to the buccal canal and treated.

Radiographic and clinical examination as well as the use of an operating microscope play a key role in the management of teeth with such anatomic configurations.

GE32 - INFLUENCE OF METHODOLOGIC VARIABLES IN THE EXECUTION OF FRACTURE STRENGTH TEST IN PREMOLARS: A SYSTEMATIC REVIEW WITH META-ANALYSIS

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Aim: The aim of the current meta-analysis was to assess the impact of methodological variables in performing fracture strength tests of upper premolars.

Methodology: Medline (Pubmed), Embase and Google Scholar were screened for studies performing ex vivo fracture strength tests of intact upper premolars or premolars with 0, 1 or 2 walls lost. The outcome variable for each study was the maximum breaking load expressed in Newton (kgxm/s2). Methodological variables (i.e. simulation of the periodontal ligament, load inclination, tip position, tip diameter and thermocycling) were registered to perform subgroup analyses and meta-regression.

Results: Overall, 25 studies and 78 study groups were included in the meta-analysis. Intact premolars (17 study groups) were not significantly influenced by any of the methodological variables considered. Subgroup analysis for load inclination (30°/45° vs 90°) was significant for premolars with 0 (10 study groups), 1 (6 study groups) and 2 (45 study groups) walls lost; thermocycling was significant for premolars with 1 and 2 walls lost.

Conclusion: A strong methodological heterogeneity across studies evaluating the fracture strength of upper premolars was highlighted, especially when 0, 1 or 2 walls were lost. Further studies are needed to standardize the methodology used in order to allow for across-studies comparisons.

GE33 - **GAINING APICAL PATENCY IN THE ROOT CANAL WITH APICAL RAMIFICATION**

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Aim: To present the importance of apical patency on endodontic preparation and treatment outcome of the first mandibular molar with severe apical ramifications.

Case Presentation: A mail patient was admitted with mild sensitivity when biting hard food at the left lower side. Extensive occluso-distal defect was diagnosed on tooth 36, proven by PA radiograph revealing confined radiolucency around mesial root, and mild diffuse radiolucency at the distal and mesial aspect of the distal root with canal contours not clearly defined in the apical third of both roots. Following straight line access cavity preparation and orifices preflaring, canals were negotiated with K-file size 08 or 10. Working length was achieved 0.5 mm short of the 0.0 mark on the apex locator Romiapex A-15 in both mesial canals, but not for the distal one. Additional PA radiograph showed K-file size 08 reached only 2/3 of the distal root canal. EDTA 17% solution was used alternatively with K-files 08 and 10 finally reaching the 0.0 point. Presence of distinctive apical ramification to the mesial, distal, and the most severe „S“ shaped curve to the lingual aspect were discovered at the tips of all scouting files. Glide path was gained with PathFiles size 13 and 16, two mesial canals were prepared using Mtwo rotary files with size 20/06 and 25/06, while distal root canal was instrumented up to size 30/05, all to the working length with copious irrigation. Apical patency was established after each file used either for glide path or shaping the canals with K-file 10. Following medication with $Ca(OH)_2$ for two weeks canals were obturated by lateral cold gutta-percha condensation and Acroseal.

Conclusion & Clinical Relevance: Post-operative radiograph showed obturation of central, several lateral canals, and apical ramifications, while at six months control radiolucences almost disappeared. Apical patency could be useful procedure to achieve better irrigation, debris removal, 3D obturation, and successful healing.

GE34 - OPHTHALMIC FEATURES ASSOCIATED WITH ZYGOMATICO-MAXILLARY COMPLEX FRACTURES IN PATIENTS

Nawaz M[1]

INTRODUCTION

Zygomatico-maxillary complex (ZMC) plays a vital role in the structure, function and appearance of facial skeleton and is a major buttress. ZMC fractures are the second common facial fractures. Failure of recognition and treatment of these injuries may result in increase morbidity

AIMS

To determine the frequency of ophthalmic features associated with Zygomatico-maxillary complex fractures presented to department of Oral and Maxillo Facial Surgery at Khyber College of Dentistry, Peshawar.

METHODS

In this study all the patients having ophthalmic injuries along with clinically and radio graphically confirmed Zygomatico-maxillary complex fractures, Both genders and age between 12 to 60 years were included. A detailed history followed by thorough clinical and radiographic examination was carried out to confirm any ophthalmic injury that is associated with zygomatico-maxillary complex fracture. The data was collected using a proforma which was containing the biographic data of the patient in addition to the study variables i.e subconjunctival haemorrhage, hyphema, diplopia, decreased visual activity and enophthalmos.

RESULTS

Our study shows that mean age was 35 years with SD ± 10.32. Seventy percent patients were male and 28% patients were female. Moreover 92% patients had sub conjunctival haemorrhage, 5% patients had hyphema, 22% patients had diplopia, 14% patients had decreased visual activity, 18% patients had Enophthalmos.

CONCLUSION

Our study concludes that the frequency of ophthalmic features associated with Zygomatico-maxillary complex fractures were sub conjunctival haemorrhage 92%, hyphema 5%, diplopia 22%, decreased visual activity 14%, Enophthalmos 18% at Khyber College of Dentistry, Peshawar.

GE35 - STUDIES ON PATHOGENIC MECHANISMS OF NON-ALBICANS CANDIDA DERIVED FROM ORAL CANCER PATIENTS

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INTRODUCTION

Mouth is primary source of infections and Candida infections are associated with mortality. Oral Candida infections can be life threatening in medically compromised patients, particularly non-albicans Candida (NAC) strains are virulent.

AIMS

The present study aims were to investigate differences in proteolytic activity of Candida strains and examine the prevalence of Candida strains in oral cancer patients of the Helsinki University Hospital.

METHODS

One hundred patients with squamous cell carcinoma of oral cavity were recruited to the study. Saliva samples were collected and cultivated on CHROMagar Candida medium. The API ID 32C yeast identification kit and Bichro-Dubli Fumouze latex agglutination test were used for Candida species identification. Candida proteinase activity was analyzed using MDPF-gelatin zymography, fluorometric assays and degradation assays were performed using claudin-4 and human plasma fibronectin. The effect of pH and fermented lingonberry juice (FLJ) on intracellular protein expression of C. glabrata was assessed using the 2D-DIGE method. The levels of IL-1β, IL-10, and TNF-α were measured using ELISA.

RESULTS

These studies showed that Candida albicans (C. albicans) was the most common species in oral cavity of oral carcinoma patients. Differences existed in the proteolytic activity of non-albicans Candida (NAC) and C. albicans strains. The Candida strains degraded fibronectin and CLDN-4 and the degradation ability varied among the strains. C. tropicalis showed higher proteolytic activity compared with the other strains. FLJ caused down regulation of C. glabrata T-1639 adenylate kinase expression leading to diminished adenosine diphosphate (ADP) availability involved in the oxidative phosphorylation. The results showed a significant increase in IL-1β levels in subjects with NAC compared to Candida-negative saliva samples.

CONCLUSION

NAC may play a role in tissue inflammatory response by inducing cytokine response. The preoperative analysis of Candida infections may play a role in early diagnosis together with respective analyses of the risks in population.

GE36 - ENDODONTIC SPACERS: LITERATURE REVIEW

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Aim: To display different spacers mentioned in the literature used during temporization of endodontic access cavity and find the best possible endodontic spacer to be used from the literature point of view.

Methodology: An electronic search strategy of PubMed, PMC, EBSCO, and ScienceDirect using appropriate keywords was conducted following PRISMA guidelines, executed to identify the available studies on endodontic spacers. Reference lists of articles were also checked to find further studies. The search included articles published in the English language without a time limit. A total number of (263) articles were identified in the previously mentioned electronic databases. A total number of (204) articles were left after the removal of duplicates. A screening process was performed and (186) articles were found to be irrelevant and were excluded leaving a total number of (18) full-text articles. Finally, an eligibility assessment was conducted and a total number of (8) articles were excluded based on specific keywords.

Results: A total number of (10) articles were included in this literature review. Cotton pellet seems to be the most used spacer under temporary restorations, even though cotton spacer can reduce the sealing quality due to the wicking action of cotton fibers. In addition to cotton pellets, various materials have been proposed including polytetrafluoroethylene tape (PTFE), cellulose sponge, and foam pellets. The performance of PTFE tape in comparison with cotton pellets was evaluated by a number of studies, in contrast only one study included cellulose sponge. A higher contamination rate was found within the cotton pellet group. The performance of PTFE tape in comparison with cotton pellets and cellulose sponge was found to be higher.

Conclusion: Polytetrafluoroethylene tape (PTFE) seems to be the ideal spacer material. It is inert, inorganic, cost effective, autoclavable, visible, available, and finally easy to manipulate and remove.

GE37 - PERIAPICAL BONE HEALING AFTER CONSERVATIVE ENDODONTIC THERAPY WITH CALCIUM HYDROXIDE/IODOFORM AND OBTURATION WITH BIOCERAMIC SEALER

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Aim: To report a clinical case of periapical healing and production of cortical bone which was lost due to traumatic radicular lesion after using calcium hydroxide/iodoform as intracanal medication and obturation with bioceramic sealer

Introduction: Trauma can cause development of severe periapical lesions whose growth can lead to cortical bone loss and therefore represent a treatment challenge.

Case Presentation: A 31-year old male patient was referred by oral surgeon to try conservative endodontic treatment of traumatic periapical lesion of the tooth 41 which had previously received RCT. Tooth was tender to percussion, displayed significant mobility and fluctuant swelling with suppuration in the labial area. Cone-beam tomography (CBCT) (FIG 1 A;B;C) revealed extreme periapical bone loss, inadequate canal obturation and partial disruption of labial bone ridge.
At first, suppuration was obtained through the transcanal drainage. Tooth remained open for 3 days. Chemomechanical instrumentation was completed with Mtwo #40.04, 2% NaOCl irrigation and calcium hydroxide mixed with iodoform as intracanal medication, which lasted for 5 months. The intracanal dressing was renewed every two weeks for the first 3 months and every 4 weeks henceforth, until it was possible to dry the canal for the obturation with bioceramic sealer.(Figure 2) Tooth was restored with glasionomer cement and composite resin filling.
One year follow up showed clinically asymptomatic functional tooth and CBCT showed periapical bone healing and formation of cortical bone.

Discussion: Endodontic treatment with calcium hydroxide/iodoform for intracanal medication and tridimensional obturation with bioceramic sealer stimulates bone healing and represents a better treatment option then surgical intervention which could lead to extraction of the tooth.

Conclusion & Clinical Relevance- Conservative endodontic treatment using calcium hydroxide/iodoform as an intracanal medication and tridimensional obturation with bioceramic sealer could be an efficient treatment option for severe traumatic periapical lesions.

Keywords: periapical lesion, cortical bone loss, calcium hydroxide/iodoform medication, bioceramic sealer

GE38 - **UNINTENTIONAL EXTRUSION OF CALCIUM SILICATE CEMENTS ON TEETH ASSOCIATED WITH LARGE PERIAPICAL LESION: TWO CASE REPORTS WITH 12 MONTHS FOLLOW-UP**

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Aim: This case report aims to present the periapical healing of an unintentional extrusion of calcium silicate cement on the open apex of the maxillary central incisor associated with a large periapical lesion.

Methodology: Traumatic dental injuries can result in pulp necrosis and apical periodontitis, impairing root development**.** When this condition is left untreated, it causes inflammation in the tissues at the apex, which may lead to significant damage of the periapical alveolar bone. Maxillary central incisors are the most frequently affected teeth by traumatic dental injuries. Radiographic presentation with large like cystic-like periapical radiolucency can be the fate if these teeth are left untreated. Non-surgical root canal treatment with apexification using tricalcium silicate-based materials as an apical barrier is a widely accepted treatment option. However, the precise control of these material during the placement of an apical plug is challenging and may lead to unintentional extrusion.

Result: This two case report findings demonstrated remarkable healing of a large periapical lesion after apexification in a pulp necrosis of the maxillary central incisor with calcium silicate cement. In the present case, the bioceramic iRoot BP Plus and Biodentine was accidently extruded into the periapical area during placement. It may be due to the these material being pushed actively beyond apical due to the wide apical foramen. At 12 months follow-up , the periapical region remained healthy, with no pathology seen on radiography or clinical examinations, and the tooth remained asymptomatic.

Conclusion: Extrusion of calcium silicate cements (Biodentine & iRoot BP Plus) into periapical lesion is not advocated in any clinical circumstance but it does not negatively affect the osseous healing of the periradicular lesion, as evidenced by 12 months follow-up observations.

GE39 - **NONSURGICAL ENDODONTIC TREATMENT OF LARGE PERIAPICAL LESION: A CASE REPORT**

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Aim: The aim of this study is to present clinical and radiographic periapical healing of permanent lower left first molar following root canal treatment.

Introduction: Therapy of a large periapical lesion often includes a surgical procedure in adition to endodontic treatment.

Case presentation: A 34-years old female patient was referred to our clinic considering discomfort in lower left first molar region. Clinical examination showed an opened cavity without swelling and exudate. The radiological examination (orthopantomographic image) revealed a large periapical lesion involving mesial root of 36 and periapical region of the second lower left premolar. Following cone beam computed tomography (CBCT) showed a large periapical lesion 10.85 mm in lenght with small distance from the roof of mandibular canal. Non-surgical root canal treatment was performed using Ni-Ti instruments (Protaper Next, Dentsply Sirona, USA). NaOCl (2%) was used for root canal irrigation. Intracanal medication (calcium hydroxide paste) was applied and than changed once per month during 6-months period. Control X-ray showed periapical healing. Opturation of root canals was performed using AH plus sealer and gutta-percha (Dentsply Sirona, USA). Definitive restoration was done by composite resin filling materials.

Discussion: The size of periapical lesion is not a major determing factor in treatment modality selection. Long term calcium hydroxide medication achieved positive effects on periapical bone healing, providing adequate microenvironment.

Conclusion & Clinical Relevance: Conservative endodontic treatment could be successfully performed even for extensive periapical lesions and should be the first treatment option.

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GE40 - **DIRECT PULP CAPPING USING DENTIN REPLACEMENT CALCIUM SILICATE MATERIAL IN AN "OPEN SANDWICH" TECHNIQUE: 5-YEAR FOLLOW-UP**

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Aim: To report a clinical case of direct pulp capping using calcium silicate-based dentin replacement material in an "open sandwich" technique with 5-years follow-up.

Introduction: Calcium silicate-based cements that are formulated as dentin substitutes are recommended to be completely covered by the overlaying definitive restorative material. It is suggested that these materials have dentin-like mechanical properties but it is not recommended for them to be exposed to the oral environment for prolonged period of time.

Case presentation: A 30-year-old male reported to our department for comprehensive dental care. Patient's chief complaint was the history of mild pain on cold beverages intake, in right maxillary region. Intraoral examination revealed MOD filling with secondary caries on the distal aspect of right upper molar. The tooth was with no symptoms, no tenderness on percussion and with positive electric test response similar to control tooth. Treatment was performed after administration of local infiltrative anesthesia with vasoconstrictor (articaine plus 1:100 000 epinephrine). Following old filling removal and carious dentin excavation using slow speed hand piece it was visible that carious lesion approached very close to pulp cavity. In final stages of the preparation pulp tissue was exposed but vital and without any major bleeding (Fig 1). Having in mind clinically visible status of the pulp tissue, its responses to diagnostic testing and exposure diameter it was concluded that maintenance of tooth vitality and direct pulp capping could be suitable. After toilet of the cavity with cotton pellet damped in 1% sodium hypochlorite, tricalcium silicate cement Biodentine (Septodont St Maur des Fosses, France) was applied to the exposed site and rest of the cavity up to occlusal 2 mm, approximately (Fig 2). When the material had set, the occlusal surface was restored with resin-based composite (Fig 3). This resulted with Biodentine exposed approximally, in an "open sandwich" technique. Since the patient did not show up for control examinations in five years, Biodentine was exposed to the oral environment for that period of time. During clinical evaluation, five years later, exposed Biodentine surface showed moderate wear out but the tooth had positive responses to electric testing and was symptom free (Fig 4). Periapical radiograph revealed no signs of periapical pathology (Fig 5).

Discussion: Beside bioactive properties, stimulative effect on pulp cells and tertiary dentin formation, Biodentine as a pulp capping material should also provide protection of pulp tissue against leakage and microbial contamination. Adequate and long-lasting sealing of permanent restoration is crucial for clinical success of the direct pulp capping procedure.

Conclusion & Clinical Relevance: The present case confirms that Biodentine, in addition to preserving the capacity of pulp tissue for self-repair and healing, provides a durable seal. Despite the moderate wear out observed on surface of Biodentine exposed to oral environment, this material showed reliable sealing ability for at least five years.

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GE41 - **ROOT CANAL RETREATMENT OF MANDIBULAR SECOND PREMOLAR WITH THREE ROOT CANALS**

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Aim: To report rare case and successful endodontic retreatment of second mandibular premolar with three canals and three separate foramina.

Introduction: Knowledge of root canal morphology as well as its variation is important in achieving successful endodontic treatment. Mandibular second premolar can have highly complex root canal morphology and requires careful assessment. Anatomic studies showed that the occurrence of three canals with separate foramina in mandibular premolars is very rare.

Case presentation: A 23-year-old male presented to our department for restoration of fractured left mandibular second premolar. Medical history was noncontributory and clinical examination revealed damaged composite filling and gutta percha cone in the pulp chamber. Patient was symptom free and without percussion and palpation sensitivity. Periapical radiograph showed inadequately obturated one of root canals and complex morphology with possibility of at least two canals but did not provide definitive conclusion regarding internal morphology of pulp chamber (Fig. 1). There was no evidence of periapical radiolucency. Without administration of the local anesthetic the tooth was accessed and previous gutta-percha filling was removed from the root canal with the aid of hand K-files. Pulp chamber was then tactile explored to locate additional canal orifices. Size 10 K-file followed three different directions on repeated introduction and patient felt pain sensation when it was introduced to length greater than previous gutta-percha filling. Diagnosis of partially necrotic pulp was made and tooth subjected to Cone Beam Computed Tomography (CBCT) examination for better evaluation of the three-dimensional morphology. CBCT revealed that the premolar had three separate root canals (mesiobuccal, distobuccal and lingual) with distinct apical foramina (Fig. 2). After inferior alveolar nerve block was established, all three canals were initially carefully negotiated to full length using hand size 10 K-file. Working lengths were established with the use of an apex locator (DpexIII, Woodpecker, Guilin, China). The canals were cleaned and shaped with BioRacefiles (FKG DentaireSA, La Chaux-de-Fonds, Switzerland). Canals were copiously irrigated with a 1% sodium hypochlorite solution and smear layer removed with 10% citric acid. Canals obturation was performed using single-cone technique with gutta percha that match the geometry of final apical file (25/.04) and AH Plus sealer (De Trey, Dentsply, Konstanz, Germany). The access cavity was temporarily restored with Citodur (Doriodent, Wien, Austria) and radiograph was taken to assess the quality of obturation (Fig. 3). The tooth was restored with glass ionomer cement base and composite filling. At the 6 months recall, patient was asymptomatic and control radiograph showed healthy periodontal ligament (Fig. 4).

Discussion: The conventional radiograph indicated the aberrant anatomy but did not conveniently reveal variations in root canal anatomy. Further tactile examination of pulpal chamber floor and walls with a small K-file tip suggested presence of tree canal orifices. CBCT precisely revealed and confirmed complex chamber morphology with tree root canals.

Conclusion & Clinical Relevance: Careful clinical examination of the pulp chamber, vigilant radiographs inspection and knowledge of root canal anatomy variations should help the clinician to locate additional canals and increase the success rate of endodontic treatment.

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GE42 - **EVALUATION OF BONE REGENERATION AFTER APICAL SURGERY USING PLATLET-RICH-FIBRIN**

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AIM

This study aims to evaluate and report the potential of bone regeneration and healing in periapical tissues using platelet-rich fibrin (PRF) after apical surgery.

METHODS

Case reports are presented in which conventional endodontic therapy failed and periapical root-end surgery was required. Patients were distributed into two groups by randomization principle: Group I - bone defect was filled with autologous platelet-rich fibrin membrane (PRF) to stimulate bone regeneration and Group II – Control group without PRF application. Patients were clinically, radiologically and ultrasonographycally examinated before apical surgery procedure and at recall visits. Radiological images were analyzed using i-Dixel, Moritta, Japan.

RESULTS

A higher rate of healing and bone regeneration was observed after 6 months in Group where PRF was used. Ultrasound imaging investigation was performed using a high frequency hockey stick linear transducer with a 20 mm width scan (frequency 15-18 MHz, Apolio a550, Canon).

CONCLUSION

Apical surgery with PRF may provide good healing rates and therefore the use of PRF in the study continues.

GE43 - THERMAL EFFECT OF ULTRASONIC ENDODONTIC DEVICES DURING THE REMOVAL OF A SEPARATED ENDODONTIC INSTRUMENT

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Aim: The aim of our study was to observe the temperature change on the outer surface of the root as a result of the ultrasonic preparation applied in different ways during the removal of broken endodontic instruments.

Methods: In the ex vivo study, maxillary central incisors were decoronated and an R25-sized nickel-titanium ReciprocBlue instruments were fractured into each root canal. 7 study groups were created. The temperature of the outer root surface was measured at the height of the fragment using a K-type thermocouple. In groups 1-6, the teeth were fixed in a ProTrain tube containing ProTrain gel and in the 7th group without heat conducting gel. Gates-Glidden drills were used to approach the broken instruments and to construct the preparation platform. The temperature rise was recorded. Ultrasonic preparation was performed with a # 25 stainless steel U-file fixed to the endochuck. The preparation mode of the device (E5 and P3) and the preparation time (30, 45 and 60 s) varied in each group. Four ultrasonic preparation phases were performed on one tooth. Between the preparations the root canal was rinsed with 1 ml of room temperature water and dried with paper points for 30 seconds. Root surface temperature was also recorded after preparations and rinsing.

Results: The temperature measured at the end of the preparation was higher than the initial temperature in all groups. The largest mean temperature rise occured in group 6 reaching 8°C. The temperature measured after rinsing was in all cases significantly lower than that measured at the beginning of rinsing. The temperature of the root surface is influenced by the surrounding medium.

Conclusion: Based on the results of our study, high-energy preparation in excess of 60 seconds may can damage the periodontium.

GE44 - RADIOPACITY OF PREMIXED AND TWO-COMPONENT CALCIUM SILICATE-BASED ROOT CANAL SEALERS

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The aim of our study was to evaluate radiopacity of different calcium silicate-based sealers and to compare them with control, epoxy resin–based sealer.

Methods: Four premixed (TotalFill BC Sealer, EndoSequence BC Sealer, Ceraseal, Bio-C Sealer) and four two-component calcium silicate-based sealers (BioRoot RCS, MTA Fillapex, Bioceramic Root Canal Sealer, GuttaFlow Bioseal) were used. AH Plus, an epoxy-based sealer, was used as a control. Specimens were radiographed alongside an aluminum stepwedge using a Radiovisiography (RVG-4) and CCD-based digital sensor. An X-ray generator (Trophy Radiology), operating at 70 kV and 7 mA for 0.07 s with a source-to-object distance of 30 cm was used. Data were compared using one-way ANOVA with Bonferroni post-hoc test (α=.05).

Results: Ceraseal had the highest radiopacity value, while Bioceramic Root Canal Sealer had the lowest radiopacity value. Bioceramic Root Canal Sealer and MTA Fillapex had radiopacity levels significantly lower than all other sealers. Radiopacity of AH Plus, was similar to radiopacity of all premixed calcium silicate-based sealers and showed to be significantly higher than radiopacities of all two-component endodontic sealers.

Conclusion: Calcium silicate-based sealers presented wide radiopacity range. Values went from slightly above minimal required value (3mm), to a value higher than the control sealer. Premixed endodontic sealers showed similar level of radiopacity as AH Plus which suggests that their clinical performance, in terms of visibility on dental radiograms, should be similar.

Keywords: radiopacity, calcium silicate, root canal sealer

GE45 - INFLUENCE OF DIFFERENT IRRIGATING SOLUTIONS ON THE PUSH-OUT BOND STRENGTH OF CALCIUM SILICATE-BASED SEALERS

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Aim: To evaluate the influence of different irrigation solutions on the push-out bond strength of BioRoot RCS (Septodont, France), MTA Fillapex (Angelus, Brasil), EndoSequence BC (Brassler, USA) and AH Plus (Dentsply, Germany) root canal sealer.

Material and Methods: Sixteen dentin discs were obtained from the middle thirds of extracted third maxillary molars with fused roots. Four, 1 mm large, holes were drilled in each dentin disc. Discs were divided into two groups (n=8). In group 1, discs were for 60s immersed in 2% NaOCl and 17 % EDTA, successively. Discs from the second group were immersed in a combined 2% NaOCl + 9% HEDP solution for 60s. All slices were rinsed with deionised water and dried with absorbent paper. Then, every hole of each dentin slice was filled with a different sealer. The specimens were incubated in simulated body fluid at 37°C and 100 % humidity for 7 days. Following setting, the push-out test was performed using a universal testing machine at a cross-head speed of 1mm/min. Bond strength values (MPa) were calculated as force (N) divided by area (mm2). Data were compared using one-way ANOVA with Turkey's post-hoc test (α=.05).

Results: Comparing the two irrigation protocols, no statistically significant difference was observed in adhesion of the sealers ($p > .05$). AH Plus showed the highest values of push-out bond strength ($p<.05$), whereas MTA Fillapex presented significantly lower adhesion to root canal dentin ($p<.05$).

Conclusion: Displacement of investigated sealers wasn't affected by the irrigation protocol. In both protocols, AH Plus demonstrated higher push-out bond strength compared to calcium silicate-based sealers.

Keywords: EDTA; HEDP; push-out bond strength; calcium-silicate sealers; smear layer

GE46 - PUSH-OUT BOND STRENGTH OF THREE DIFFERENT ROOT CANAL SEALERS

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Aim: The aim of this study was to evaluate the push-out bond strengths of epoxy based Adseal (Meta Biomed, South Korea), calcium silicate-based Ceraseal (Meta Biomed, South Korea) and control AH Plus (Dentsply, Germany) root canal sealer.

Material and method: Nine dentin discs were obtained from the middle thirds of extracted third maxillary molars with fused roots. Three, 1.2 mm large holes, were drilled in each dentin disc using a carbide bur. Discs were for 60s immersed in 2% NaOCl and 17 % EDTA, successively. Dentin discs were rinsed with deionised water and dried with absorbent paper. Afterwards, every hole of each dentine slice was filled with a different sealer. Specimens were placed in simulated body fluid at 37°C, in 100% humidity for7 days, allowing the sealers to set. Following setting, the push-out test was performed using a universal testing machine at a cross-head speed of 1mm/min. Bond strength values (MPa) were calculated as force (N) divided by area (mm2). Data were compared using one-way ANOVA with Turkey's post-hoc test (α=.05).

Results: Mean± standard deviation values of push-out bond strength were 5.21±0.87 MPa (Adseal), 0.06±0.02 MPa (Ceraseal), and 3.13±0.38 MPa (AH Plus). All sealers showed statistically significant difference in push-out bond strength ($p < 0.05$). The highest bond strength was achieved by Adseal, while the calcium silicate-based Ceraseal showed significantly lower values. The values of the push-out bond strength of the control AH Plus sealer fell between the afore mentioned sealers.

Conclusion: The newly presented epoxy based sealer Adseal showed significantly higher bond strength compared to control AH Plus and to calcium silicate-based sealer Cearaseal, which, expectedly showed the weakest dislocation resistance.

Keywords: push-out, root canal sealer, epoxy, calcium silicate

GE47 - PUSH-OUT BOND STRENGTH OF CALCIUM SILICATE-BASED SEALERS

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Material and method: Push-out bond strength measurement included 24 extracted single rooted teeth, randomly allocated to 3 groups. From each root, three 1mm-thick-slices were obtained at different section levels (coronal, middle, apical). The root canal of each specimen was enlarged with a carbide bur to 1.5mm in diameter. Disks of the same tooth were filled with the same sealer. Specimens were placed in simulated body fluid at 37°C, in 100% humidity for 28 days. Following setting, the push-out bond strength test was performed using a universal testing machine at a cross-head speed of 1mm/min. Bond strength values (MPa) were calculated as force (N) divided by area (mm2). Data were analysed using ANOVA and Tuckey's post-hoc test (α=0.05).

Results: Mean± standard deviation values of push-out bond strength were 8.23±2.72 MPa (AH Plus), 4.69±1.1 MPa (EndoSequence BC) and 3.72±1.67 MPa (BioRoot RCS). AH Plus showed significantly higher values than calcium silicate-based root canal sealers ($p < 0.05$). There were no significant differences in bond strength values between BioRoot RCS and EndoSequence BC sealer ($p > 0.05$). Regarding the root third, AH Plus showed highest push-out bond strength values in the middle third, while BioRoot RCS and EndoSequence BC sealer showed similar results in all three root thirds.

Conclusion: AH Plus presented higher dislocation resistance than calcium silicate-based sealers. Root canal region had no impact on bond strength values of both calcium silicate-based sealers, while AH Plus had significantly higher values in the middle third.

Keywords: push-out, calcium silicate, root canal sealer

GE48 - PERIAPICAL BONE HEALING AFTER CONSERVATIVE ENDODONTIC THERAPY WITH CALCIUM HYDROXIDE/IODOFORM AND OBTURATION WITH BIOCERAMIC SEALER

GE49 - COMPARISON OF CYCLIC FATIGUE RESISTANCE OF DIFFERENT NITI ALLOY ROTARY INSTRUMENTS IN SINGLE AND DOUBLE CURVED CANALS

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Aim
To compare the influence of the temperature, sodium hypochlorite (NaOCl) immersion, and sterilization on the cyclic fatigue resistance of the Protaper Next (PTN), Hyflex CM (HCM), EdgeFile-X7 (EFX7), and XP-endoShaper (XPS) in single and double canal curvatures.

Methodology
PTN (30/0.07), HCM (30/0.04), EFX7 (30/0.04), and XPS (30/0.01) files were divided into 4 groups (n=20/each group; 10/subgroup) for the cyclic fatigue test to be used in four different medium conditions. A stainless steel block with two artificial canals was used with 90º angle of curvature for the single curve and, a coronal curve with 45º, and the apical curve with 60º angle of curvature for the double curve. The number of cycles to fracture (NCF) was calculated, the fractured lengths were recorded and the fracture surfaces were assessed via SEM.

Results
Statistical analysis was performed using the three-way ANOVA and Bonferroni's post hoc test at significance level $p < 0.05$. The NCF of EFX7 and XPS were higher than HCM and PTN ($p < 0.05$) in all tested groups. The NCF was significantly influenced by the file types ($p < 0.05$) in all groups, angle and curvature locations ($p < 0.05$) in all files except PTN ($p > 0.05$), and surrounding medium conditions ($p < 0.05$) in all files except PTN and HCM ($p > 0.05$). No statistical difference in the length of the separated part in all groups ($p > 0.05$) except at angle and curvature locations ($p < 0.05$).

Conclusion
EFX7 significantly outperforms other brands in terms of cyclic fatigue resistance, followed by XPS. All files except PTN showed a significant decrease in NCF in more challenging canals. The NCF of both EFX7 and XPS was reduced by body temperature and NaOCl immersion, whereas sterilization has a favourable effect on EFX7's NCF but a detrimental one on XPS's.

GE50 - APICAL SURGERY ON MAXILLARY LATERAL INCISOR IN RETREATMENT FAILURE: A CASE REPORT

GE51 - PROOF-OF-CONCEPT STUDY TO DETERMINE CHANGES IN DENTIN MINERAL DENSITY USING QUANTITATIVE BACKSCATTERED ELECTRON IMAGING TECHNIQUE AFTER DIFFERENT IRRIGATION SOLUTIONS IN SITU

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Sodium hypochlorite (NaOCl) is the most commonly used irrigation solution during root canal treatment. NaOCl has well known proteolytic effect on dentin microstructure. This study uses quantitative backscattered electron imaging (qBEI) to assess changes in dentinal mineral density at increasing distances from the pulp in sliced samples treated with 6%NaOCl as compared with untreated samples (an ex-vivo model).

Methodology
10 bovine incisors were randomly assigned to 2 groups (n=5): one batch served as a negative control group (no treatment) and another treated with 6% NaOCl. All teeth were decoronated and the first 1mm of the root below the CEJ was sectioned to be used as a standard to identify changes in mineral density for the rest of the root. 6% NaOCl treated group was prepared using rotary ProTaper-Next® files (Dentsply Sirona Endodontics, Ballaigues, Switzerland) in brushing motion, to an apical size 50 and 6% taper (X5) at full working length and irrigated with 6% NaOCl using endodontic needles (28G, VMK ENDONEEDLE, Osaka, Japan) while the control group left without treatment or irrigation. Sections before and after treatment were assessed for changes in dentin mineral density measured at x1000 using PhenomXL backscatter microscope (Thermofisher Scientific, Netherlands) from the canal walls to the external cementum and outer root surface. The data were analyzed using one-way ANOVA test with 5% significance level.

Results
Mineral density increased significantly following treatment with 6% NaOCl compared to the control group ($P<0.05$). The increase in mineral density extends up to 2500 µm from the canal wall. The change in density decreases with increasing distance from the canal.

Conclusion
qBEI appears to be a suitable method to quantitatively determine changes in mineral density in cross-sections of treated roots. 6% NaOCl depletes the organic component of the root with effects extending up to 2500 µm from the pulp.

GE52 - DIFFERENTIAL DIAGNOSIS OF INTRA-CORONAL RADIOLUCENCY AND MANAGEMENT: A CASE REPORT

GE54 - THE REINFORCEMENT OF PORTLAND CEMENT WITH GRAPHENE OXIDE NANOMATERIAL: POTENTIAL FOR USE IN VITAL PULP THERAPY

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Recently, there has been an increase in interest in the use of biocompatible dental materials in vital pulp therapy within the dental field. As a result, there is a high and growing demand for novel Portland cement-based formulations due to their beneficial effects on cell viability and proliferation, which promote healing, repair, and, ultimately, treatment success.

The goal of this study was to see how adding graphene nanoplatelets affected the biocompatibility and mechanical properties of three lab-prepared Portland cement-based prototypes. The new material is envisaged as an alternative vital pulp therapy agent.

Material specimens in the shape of discs with an inner diameter of 10mm and a thickness of 2mm were created. Mechanical testing was performed on each material prototype using an Instron Universal Testing Machine and a Through-Indenter-Viewing hardness tester. Mechanical tests included compressive and flexural strength, diametral compressive fatigue limit and surface hardness. Human dental pulp stem cells were cultured with material discs, and the biocompatibility of the materials was determined using a mitochondrial metabolic activity assay.

In response to material discs, the addition of 1:99 w/w graphene nanoplatelets had a significant proliferative effect on cells after 72 hours compared to the control ($P<0.0001$). The addition of 3:97 w/w of graphene nanoplatelets resulted in a significant increase in physical properties, but it was initially cytotoxic. The findings in this study led to the conclusion that although the addition of both 1:99 and 3:97 w/w of graphene nanoplatelets to Portland cement improved the mechanical properties, the 1:99 w/w formulation exhibited better bioactivity compared to other formulations.

This study, we believe, can serve as a preliminary foundation for more rigorous investigations, giving other researchers a head start in future evaluations of this prototype material. Based on the findings of this study, additional work is required and is being planned.

GE55 - IN VITRO INVESTIGATION OF THE EFFICACY OF ZINC OXIDE NANOPARTICLES AND PHOTODISINFECTION WITH BLUE LIGHT AGAINST ENTEROCOCCUS FAECALIS

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Aim: In vitro investigation of the efficacy of zinc oxide nanoparticles, along with photodisinfection with blue light, both in combination and alone against Enterococcus faecalis compared to 1% sodium hypochlorite in planktonic solutions.

Methodology: The study was divided into eight different groups including the control group. E.faecalis was cultured and exposed to 1% sodium hypochlorite, zinc oxide nanoparticles and blue light alone and in combination respectively under similar controlled conditions. Colony forming units (CFU) from each group were counted using Staurt® colony counter and calibrated to Don Whitley colony counting scale. All recorded data was transferred to MS EXCEL spreadsheet (Microsoft Corporation, Seattle, WA, USA) where average counts of all groups were calculated. Comparisons among groups was done by plotting an error bar graph using MS EXCEL. Statistical analysis was done using SPSS V20 (Chicago, Ill, USA). Control group was compared to experimental groups using the Mann Whitney test.

Result: 1% sodium hypochlorite, Zinc oxide nanoparticles and blue light alone and in combination were able to produce antimicrobial effects against E.faecalis. Combination groups, which included 1% sodium hypochlorite, in general were more efficient against E.faecalis. Blue light alone was not associated with a significant reduction in bacterial counts, however it was more effective when used in combination with 1% sodium hypochlorite and Zinc oxide nanoparticles. Efficacy of blue light was directly dependent on the time and distance of light irradiation. Combination of 1% sodium hypochlorite, zinc oxide nanoparticles and blue light was most effective against E.faecalis, resulting in significant reduction in CFU.

Conclusion: The utilization of zinc oxide nanoparticles and blue light, alone or in combination with 1% sodium hypochlorite may be a promising adjunct in antimicrobial endodontic treatment.

GE56 - **PERFORATION MANAGEMENT USING BIOCERAMICS MATERIAL**

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This case presentation aimed to describe the management of a lateral cervical perforation in a lateral upper incisor using bioceramic material (Biodentine) for obturation.
The inspection of the tooth revealed a perforation at the level of the vestibular gum. After radiographic evaluation access cavity preparation was obtained with the aid of dental operating microscope. Perforation was identified, granulation tissue was removed and the perforation was disinfected using sodium hypochlorite. The correct canal has been identified. Perforation was sealed using Biodentine and in the second appointment after the preparation and disinfection of the root canal, epoxy resin (AH-plus) and gutapercha (CWC) was used for sealing. A fiber post and core material was used to restore the tooth.
After one month we have healing of the gingiva without any probing defect.

GE57 - MANAGEMENT OF DISCOLORED TOOTH POST TRAUMATIC INJURY WITH MINIMAL INVASION: A CASE REPORT

GE58 - THE EFFECT OF ADMINISTRATION CACO3 FROM BLOOD SHELLS (ANADARA GRANOSA) TO THE EXPRESSION OF ALKALINE PHOSPHATASE (ALP) RAT CELLS ON REPARATIVE DENTIN FORMATION

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Aim
To determine expression of alkaline phosphatase on reparative dentin formation after CACO3 administration from blood shells (Anadara Granosa).

Methodology
The experimental laboratory research with post-test only control group design.
The samples of this study were 42 strain wistar rats divided into 6 groups of rats consist of 7 random samples each. Cavity preparation around 1 mm is performed in the occlusal side of the right upper molar of rats. Group 1-3, the control group, was treated with Ca(OH)2 and sealed with cention. Group 4-6, the experimental group, were treated with blood clam shells derived calcium carbonate suspension and sealed with cention. The teeth in each group were extracted after 3, 7 and 14 days accordingly then preparat slide was made. The immunohistochemical stained using anti ALP antibodi monoclonal. The slides were counterstained, mounted and sealed using cover glass and observed under a light microscope.

Results
The number of ALP expressions were significantly different in each group in which control group was lower compared to the treatment group. The mean value of cells expressing ALP in odontoblasts after application of calcium carbonate showed an increase with increasing exposure. The smallest mean ALP expression was the control group on day 3, while the largest mean ALP expression was in the treatment group with calcium carbonate application on day 14.

Conclusions
Application of calcium carbonat from blood cockle (Anadara Granosa) shells induced healing process and generate dentinogenesis formation by increasing the expression of the ALP.

GE59 - EVALUATION OF THE DENTAL OPERATING MICROSCOPE EFFECTIVENESS IN PERFORATION REPAIR: AN IN-VITRO STUDY

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Aim: To evaluate the effectiveness of using the dental operating microscope in furcal perforation repair of extracted molars.

Methodology: After the approval of the institutional review board, forty-seven upper molar teeth (N=47) with well-developed roots were selected and cleaned. Access cavities were done for all teeth and perforations were performed in the furcation area, under magnification, with a high-speed round bur iso012. Teeth were divided into 4 groups: Two test groups repaired with Mineral Trioxide Aggregate (MTA); *Group 1 (n=20): repaired under magnification (x16) *Group 2 (n=20): repaired without magnification, and two control groups; * Negative group (n=5): perforations done without repair * Positive group (n=2): no perforations done. All teeth were restored with composite, then teeth surfaces were all covered by nail polish coating except 1 mm all around the perforation area, before they were immersed in methylene blue for 48 hours. Finally, teeth were sectioned and assessed under stereomicroscope in buccolingual and coronal sections; For the coronal section, the assessment was done according to the presence or absence of dye leakage. While for the buccolingual section, dye penetration was measured and evaluated on four-level scoring system: 0: No leakage; 1: Leakage extending less than half of the repair material; 2: Leakage extending more than half of the repair material; 3: Leakage extending the entire length of the repair material. Results were statistically analyzed using the statistical package for social science (SPSS) and represented on suitable tables and graphs. Mann-Whitney test was used to assess the results.

Results: No significant difference was observed between the two test groups. A significant difference was observed between the test and the control groups.

Conclusion: Perforation could be equally repaired with or without magnification. However, further studies with larger sample size are recommended.

Keywords: Perforation repair, Dental operating microscope, MTA, leakage assessment, stereomicroscope

GE60 - EVALUATION OF SMEAR LAYER AND DEBRIS REMOVAL OF NEW ALL-IN-ONE DUAL-ACTION IRRIGATING SOLUTIONS FOR CONTINUOUS CHELATION: A SCANNING ELECTRON MICROSCOPE STUDY

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Introduction: The aim of this in vitro study was to compare the smear layer and debris removal of two all-in-one dual-action irrigating solutions for continuous chelation (Triton and Dual Rinse HEDP) with the traditional dual-step NaOCl and EDTA sequential chelation irrigation.

Methods: 30 single-rooted single-canal teeth were shaped and divided into three groups (n=10). The teeth were irrigated with Triton (Brasseler; Savannah, US), Dual Rinse HEDP (Medcem GmbH; Weinfelden, Switzerland) mixed with 6% NaOCl and 6% NaOCl/17% EDTA (Vista Apex, Racine, WI). The teeth were then split and observed under scanning electron microscope (SEM) to evaluate the canal wall cleanliness in the coronal, middle and apical third. The area with the greatest amounts of smear layer and debris was photographed for each third of the canal at 1000x magnification. The presence of smear layer and debris was evaluated using Gutmann grading score system. The debris and smear layer score data was analyzed using the Shapiro-Wilk test, the Kruskal-Wallis test and the Dunnett test with Benjamin Hochberg correction. The statistical significance level was set at 0.05.

Results: Triton was statistically more effective than Dual Rinse HEDP and NaOCl/EDTA in removing smear layer and debris from all root canal thirds ($P < 0.05$), with the exception in removing smear layer from coronal and middle thirds with NaOCl/EDTA ($P > 0.05$). There was a significant difference between Dual Rinse HEDP and NaOCl/EDTA only in removing smear layer from the coronal and middle third ($P < 0.05$).

Conclusions: Despite the limitations of this in vitro study, Triton was statistically more effective in removing debris from all root canal thirds and showed the same efficacy of NaOCL/EDTA in removing smear layer from coronal and middle thirds.

GE61 - GUIDED ENDODONTIC VERSUS CONVENTIONAL ACCESS CAVITY PREPARATION: AN EX VIVO COMPARATIVE STUDY ON SUBSTANCE LOSS

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Aim
To compare preparation of endodontic access cavities in teeth with calcified root canals with the conventional technique and Guided Endodontics regarding the detection of root canals, substance loss, and treatment duration.

Methodology
Thirty-six human extracted sound teeth (12 canini, 24 incisivi) with calcified root canals were matched by the following criteria in pairs: tooth type, crown and root length, existing restorations, and radiographic degree of calcification. The pairs were divided in two groups (n=18) and supplemented with premolars and molars to produce six study models. Three models were prepared by an independent, experienced endodontic specialist (SB, 18 years professional experience, 13 years as endodontic specialists) by conventional means. For the second group, guides were used by a general dentist with four years professional experience. All access cavities were prepared in a dental dummy to simulate clinical conditions. The time needed to access the calcified root canal was recorded. Substance loss was measured using postoperative cone-beam computed tomography. Statistical significance was tested by examining the overlap of 95% confidence intervals (CIs).

Results
All root canals were successfully accessed. GE showed significantly less substance loss than the CONV group in creating the access cavities (CI= 8.30-14.91 vs. 14.98-18.77mm³). Time required for both methods, showed no significant difference (CI= 158-365s for GE vs. 139-297s for CONV).

Conclusion
Access cavity preparation in calcified teeth by a specialist or by means of Guided Endodontics shows good results, although the loss of substance is lower with GE.

GE62 - LONG - TERM EVALUATION OF TWO DIFFERENT METHODS OF DIRECT PULP CAPPING

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Direct pulp capping is coverage of exposed pulp by a biocompatible material after traumatic or carious exposure.

Aim: The purpose of the present study was to evaluate and compare the long-term clinical outcomes of direct pulp capping using two different methods.

Methodology: The study was conducted at the School of Dentistry in Pancevo (Serbia). In this clinical investigation the pulp was covered on 44 teeth in patients of both sexes, aged 25 to 45 years. Pulp was accidentally open during tutorials. The teeth were divided into two groups of twenty two, depending on the method of direct pulp capping. In the group I the exposed pulp was covered with calcium hydroxide. In group II, the pulp was treated with Er: YAG laser (200 mJ, 3 Hz, 15 s). The teeth were restored in the same visit with composite filling. Clinical and radiographic evaluation was performed 4 week, 1 year, 2 years and 4 years after the treatment. Teeth with no response to pulp vitality test were considered to be failure. The data were analyzed by Chi-square test using SPSS software.

Results: The success rate was significantly different between conventional (67 %) and laser-assisted (92 %) groups after two year ($P < 0.05$). After 4 years there were still significant differences ($P < 0.05$) between the groups (60% and 89%).

Conclusion: The laser-assisted procedure proved to be more effective than the conventional technique in enhancing the outcomes of pulp-capping therapy.

GE63 - STORAGE OF NATURAL EXTRACTED TEETH FOR RESEARCH PURPOSES: A LITERATURE REVIEW

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Aim
To discuss different storage media and techniques to preserve human extracted teeth for research purposes, and their related effects on dental pulp tissue and tooth structure composition.

Methods
In-vitro studies on human extracted teeth (HET) were included through screening conducted in the duration of (August 2021 – February 2022). filter applied Including studies in 1990-2021, English language, studies on human extracted tooth, and full-text articles. Data were collected using PubMed, EBSCO, SCOPUS, and Google Scholar. The key terms were [extracted human teeth OR natural extracted teeth] AND [storage condition OR storage media]. The initial search yielded (n=523) articles. Records after duplicates removed (n=450) articles. Included articles due to eligibility were (n=60).

Results
A range of storage solutions and their effects are concluded in this review, including formalin, sodium hypochlorite, sodium azide, thymol, and ethanol, among many others discussed. According to the study experiment, studies showed that in contrast to sodium hypochlorite, formalin preserves the pulp of teeth also the mechanical properties, including dentin hardness, dentine removal, and apical microleakage, with no significant effect on dentin bond strength. As for pulp tissue fixation and to prevent degradation, a 4% formaldehyde was used at room temperature (20 °C). Like thymol, sodium azide increases dentine moisture, but it cannot preserve the enamel microhardness achieved in formalin. Ethanol enhances dentine permeability but affects the microleakage of composite restorations. Other storage techniques such as cryopreservation and freezing showed a favorable effect on dentine shear bond strength with no effect on dentine permeability or microleakage. Also, it is advised to use 5% Dimethyl sulfoxide cryoprotectant to maintain the pulp stem cells viable.

Conclusion
(HET) are essential for in-vitro research. They should be properly stored according to the purpose of the study to be conducted.
Keywords:
Storage media, Extracted human teeth, Formalin, Cryopreservation, In-vitro dental research

GE64 - EFFECT OF NATURAL EXTRACTS ON STEM CELL REGENERATION: A LITERATURE REVIEW

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Aim: To identify the natural extracts affecting differentiation and proliferation of dental pulp stem cells DPSCs

Methodology: An electronic search through PubMed, EBSCO, ScienceDirect, PMC, and google scholar was conducted. English was the only language. A total number of 4,688 articles were collected. Articles related to natural extracts and their efficacy in stem cell regeneration in different illnesses and oral diseases were assembled. After the removal of duplication, a total number of 3,399 articles were left. Then screening was done, and 2,128 articles were excluded due to their irrelevance to the effect of herbs on human dental stem cells (HDSCs) regeneration. 1,217 full-text studies remained. After eligibility assessment, a total number of 1,093 articles were excluded and 124 articles were left.

Results: Sapindus Mukorossi seed oil with DMSO (dimethyl sulfoxide) concentration (0.02-1%) stimulates differentiation and increases vesicle secretion of DPSCs. Crocin, an active compound of the saffron plant used in lower concentrations promotes the differentiation and stemness of DPSCc. (0.17-0.08mg/ml) of Salvadora Persica cause proliferation and maintain the viability of DPSCc. The Baicalein derivate from the root of Scutellaria Baicalensis, Baicalein concentrated (1–10µm) provides dental pulp repair and endodontic regeneration. Psidium Guavjava with concentration (0.05-50 µg/ml) increases the viability of dental pulp stem cells. The Hypericum Perforatum ethanol extracts in concentration (0.05-50 µg/ml) are considered an osteoinductive agent for DPSCc. The hydroalcoholic extract of Elaeagnus Angustifolia concentrated (0.05-50 µg/ml) maintains the viability of DPSCs.

Conclusion: Studies concerning the effect of herbs in dental pulp stem cells regeneration are still in progress due to their bioactive components. Concentration is a critical point to maintain the effect of differentiation and proliferation on stem cells.

Keywords: stem cell regeneration, herbs, natural extracts, human dental stem cells, dental pulp stem cells DPSCs

GE65 - EVALUATION ACCESS CAVITY PREPARATION PERFORMANCE BY USING VR SIMODONT SELF-LEARNING SYSTEM AND PHANTOM HEAD IN 4-YEAR-GRADE DENTAL STUDENTS

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Aim
To compare the access cavity preparation performance of a VR Simodont with a phantom head simulation system in 4-year-grade dental students.

Methodology
Four-year-grade dental students of China Medical University (Taichung, Taiwan) were divided into 2 groups, group A (21 students)- practicing access cavity preparation of maxillary center incisor by using VR Simodont (Virtual Reality Dental Self-Learning System) before their operating phantom head in their endodontic laboratory class; group B (29 students)- no experience in practicing access cavity preparation by using Simodont before mid-term laboratory examination. All students worked on phantom head doing access cavity preparation of maxillary center incisor as their mid-term laboratory examination. The prepared access cavities from the phantom head of both groups were scanned by 3 Shape and evaluated for scoring. After group B students practicing VR Simodont, all the uploading prepared access cavities were evaluated by using Simodont software in teacher's computer. Wilcoxon's rank-sum test and Wilcoxon's signed-rank test were used for statistical analysis.

Results
There was no statistical difference in the access cavity preparation scores of the two groups of AB students (group A:3.58 VS group B:3.54) in their mid-term examination (p=0.5893). There was no significant different of their access cavity preparation performance between Simodont and phantom head in both groups, group A(p=0.2044) /Group B(p=0.2216).

Conclusions
Limitation of this study is the sample number is too small. Virtual reality simulators are being explored as an adjunct to dental education, they can play an important role in boosting student confidence and improving their psychomotor skills. Computer-assisted instruction learning systems have great potential in the field of dental education and are required for further use and investigation.

Acknowledgements
This research was supported by Ministry of Education, Taiwan (MOE-PMN1090470, 2019)

GE66 - PUSH-OUT BOND STRENGTH OF MINERAL TRIOXIDE AGGREGATE AND NEW NANOSTRUCTURAL CALCIUM ALUMINATE CEMENT EXPOSED TO ACIDIC AND ALKALINE ENVIRONMENT

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Aim: To evaluate the effect of acidic and alkaline environment on the push-out strength of mineral trioxide aggregate (MTA Angelus, Londrina, Brazil) and experimental nanostructural cement based on calcium aluminate (ALBO-HA, Vinca, Serbia)

Methodology: Forty-five dentinal slices (1 mm ± 0.1) were obtained from the middle third of extracted 15 human maxillary incisors and canines. Two 1-mm canal-like holes were drilled on the axial surface of each root slice. After standardized irrigation, the holes were filled with one of the two test materials. The slices were randomly divided into three groups (n = 15) according to storage media: butyric acid buffered at pH values of 5.4 (group A), synthetic tissue fluid (STF) (pH, 7.4) (group B) and STF buffered in potassium hydroxide at pH values of 9.4 (group C). The slices were incubated for 4 days at 37˚C and after that, were fixed on a universal testing machine to test the push-out bond strength. Failure modes were examined under a light microscope at x40 magnification. Data were analyzed using one-way analysis of variance with LSD post hoc test and independent sample t test.

Results: The greatest and lowest mean push-out bond strength values for both MTA and ALBO HA were observed in group B and group A respectively. There were significant differences between the all MTA groups ($p < 0.01$), while for ALBO-HA a significant difference was observed between the slices in group A and B ($p<0.05$). ALBO-HA showed significant higher push-out bond strength than MTA ($p < 0.01$) in group A. The bond failure was predominantly of adhesive type.

Conclusion: Acidic environment adversely affected the push-out bond strength of MTA and ALBO-HA, while alkaline pH value influenced only MTA push-out bond strength.

Keywords: mineral trioxide aggregate, calcium aluminate cement, pH, push-out.

GE67 - MANAGEMENT OF IMMATURE DENS EVAGINATUS WITH APEXIFICATION: A CASE REPORT

GE68 - ENDODONTIC MICROSURGERY OF ANTERIOR MAXILLARY TOOTH WITH LARGE RADICULAR CYST: A CASE REPORT

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Aim: To present endodontic microsurgery approach for anterior maxillary tooth with large radicular cyst case

Introduction: Persistent chronic infection can lead to formation of a radicular cyst. Root canal treatment often fails to treat radicular cyst case, therefore endodontic microsurgery approach is important treatment modality for success of such cases.

Case Presentation: A 20 year old female patient was reffered to Universitas Indonesia Dental Hospital with chief complain of tenderness on palpation of the upper right central maxillary incisor. The tooth has trauma history and had been treated with root canal therapy, apical plug using MTA, and restore with fiberpost and direct resin composite 3 years ago. Cone-beam computed tomographic (CBCT) examination showed large through and through periapical lesion on tooth 11 extend to tooth 12, radicular cyst was suspected. Endodontic Microsurgery approach was planned and performed under Dental Operating Microscope (Carl Zeiss) after collecting the informed consent.Local anesthesia was administered, a mucoperiosteal (trapezoidal type) flap wass opened, enucleation of cyst was performed with hand instruments and sent for histopathology examination, root end resection was performed using Linderman burr with 0^0 bevel. Retrograde preparation 3mm depth was performed with AS3D tips (Acteon Group), and filled with Bio-C Repair (Angelus). Bone graft (GAMACHA®) was applied and the surgical wound was sutured with resorbable 4-0 Vicryl Plus (Ethicon, J&J Medical, Somerville, NJ). One month followed up showed healing of the soft tissue and no symptoms.

Discussion: Radicular cyst was confirmed by histopathology examination. Root canal treatment often inadequate to treat radicular cyst. Endodontic Microsurgery approach was performed to eliminate the persistence infection and seal the apical portion of tooth with bioactive material.

Conclusion: Failure of previously treated teeth with large radicular cyst in this case was successfully managed by Endodontic Microsurgery approach.

GE69 - MANAGEMENT OF COMPROMISED MANDIBULAR SECOND MOLAR WITH HEMISECTION: A CASE REPORT

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Aim: To present the hemisection procedure as the management of compromised mandibular second molar with furcation involvement.

Introduction: Hemisection procedure is one of conservative treatment modality of preserving tooth with more than 90% successful rate. Indication of hemisection are loss of supporting bone, broad subgingival root caries, and endodontic complication involving only one root of multi-rooted teeth. Successful hemisection procedure depends on diagnosis, case selection, prognosis, endodontic-periodontic-prosthodontic consideration, and periodic evaluations.

Case Presentation: A 40-year-old female patient complained of frequent swelling on severely decayed mandibular molar. Clinical examination showed loss of tooth structure subgingivally on mesial portion of tooth 47, positive on percussion and furcation involvement grade II. The radiograph revealed obstruction on mesial root canals and radiolucencies on apical and furcation aspect.

Case Management: Endodontic treatment was performed and prefabricated fiber post was inserted on distal root canal tooth 47. Hemisection procedure was performed on the mesial root followed by bone graft (Gamacha) application. Key and key way bridge porcelain fused to metal was inserted after two months followed up.

Discussion: Successful treatment after 2 months follow-up after hemisection procedure on mesial root of 47 presented asymptomatic tooth, negative on palpation and percussion, also significant healing of bone defect was presented radiographically. Application of carbonate apatite (Gamacha, Yogyakarta, Indonesia) as bone substitute material supported bone healing. Age, no history of systemic disease, no active periodontal disease, ideal occlusion, final restoration selection and good oral hygiene play important role in the successful healing.

Conclusion & Clinical Relevance: Hemisection with key and key way bridge restoration is one of the effective treatment on compromised mandibular molar with furcation involvement.

GE70 - CLINICAL SIGNIFICANCE IN PENETRATION THE GAS AND REDISSOLVED PHASES OF ENDODONTIC IRRIGANTS

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Aims: Endodontic infections are not possible to eliminate mechanically due to anatomical complexity, therefore, chemical disinfection reaching the entire canal system has important role. However, gas bubbles can block the penetration of disinfectants, leaving the areas distally to the bubbles unreachable.
To investigate the antibacterial effects of both the gas and recondensed phases of 2.5% sodium hypochlorite (NaOCl) at pH 3-12, 2% chlorhexidine (CHX), 10% potassium iodide (PI-), 0.12% hyper-pure chlorine dioxide (ClO_2) irrigants and distilled water (DW). To examine whether these irrigants are able to penetrate through the gas bubbles by evaporating in and condensing into liquid on the other side.

Methodology: For the investigation of the gas phase inoculation loops with 1 µL 10^8 colony forming units (CFU)/mL of Enterococcus faecalis suspension were placed above the investigated irrigants in airtight tubes. For the evaluation of the redissolved phase Eppendorfs were filled with the investigated agents and Durham glass tubes (longer than the level of the agents) containing bacterial suspension were placed inside each sealed Eppendorf. In both cases the test tubes were placed in 37°C and after 1 and 10 minutes the surviving bacterial samples were plated onto agar plates for CFUs count on the next day. Wilcoxon/Mann-Whitney-test was used for statistical analysis.

Results: DW as control and CHX showed no antibacterial results in either phases. NaOCl gas phase was found to be working on a pH dependent manner. Acidification of NaOCl increased its gas phase efficiency. PI- and ClO_2 were effective in both phases, but ClO_2 was more powerful than PI-.

Conclusions: NaOCl has to be acidified before its application. PI- has to be mixed to $Ca(OH)_2$ paste in hardly healing cases. We suggest to use ClO_2, the most effective antibacterial agent in both phases as a final root canal irrigant instead of the widely used CHX.

GE71 - RETREATMENT OF LOWER LEFT FIRST MOLAR WITH SEPARATED INSTRUMENT AND PERFORATION

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Introduction

The patient was referred by the dermatologist with diffuse hair loss, atopic dermatitis. A dental focal infection was suspected by the referring doctor. Although controversial, „focal infection theory" states that localized infection, often asymptomatic, may disseminate microorganisms or their toxins to distant sites within the body and thereby cause disease (atherosclerosis, preterm birth, diabetus mellitus)(1).

Aim

Retreatment of tooth number 36, separated instrument retrieval and perforation closure, final restoration.

Case Presentation

Clinical examination (percussion, palpation) of the middle-aged, female patient showed an asymptomatic tooth 36 with an insufficiently sealed OD filling and buccal abfraction. Discoloration and secondary caries were also noticed. Tooth had normal mobility. Methodology After removing the old composite filling, a composite pre-endo build up was made in rubber dam isolation. The tooth was taken out of occlusion. Following the cleaning of the pulp chamber a perforation was detected communicating with the furcation area. MTA plug, covered with GIC cement was used to close the perforation. The broken instrument was located in ML canal and accessedby creating a staging platform with modified GG burs number 3, 4. Ultrasonic instrument with Miller broach in endo-chuck were used to loosen and retrieve the instrument. Old root canal filling was removed with Reciproc Blue file 25 (VDW Germany), and after working length determination, further chemo-mechanical desinfection, which included rigorous irrigation following the Schäfer protocol (NaOCl 2.5%, d.w, EDTA 18%. d.w., CHX 2%,), and further enlargement of the canal to Reciproc Blue size 40, new root canal filling was done with lateral condensation and warm vertical technique. Root canal filling was covered with flowable composite and long term temporary filling was placed in the cavity.

Discussion

With the help of operating microscope and ultrasonic instruments, the separated instrument was successfully removed. The perforation was closed with MTA plug and covered with GI cement.

Conclusion & Clinical Relevance

After short term follow up, the patient was asymptomatic and noticed less hair loss occurring. Follow up X-rays are intended at 6, 12 months. After signs of healing an indirect composite overlay will be fabricated for final restoration. Even in technically challenging cases with poor prognosis, retreatment done with the operating microscope andspecial instruments can improve the outcome of the treatment.

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GE72 - ALAD GEL AND RED LED IN ENDODONTIC PHOTODYNAMIC THERAPY

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Aim: Photodynamic therapy (PDT) represented one method of treatment of microbial infection in endodontics. Current research has investigated PDT in terms of reduction of bacterial load in vitro and in ex vivo, there are few in vivo studies.
This research evaluated the in vitro and in vivo effects of the association of a new ALAD gel containing 5% 5-aminolevulinic acid with a red LED irradiation against Enterococcus faecalis.

Methodology: Test 1: ALAD gel (Aladent, Alphastrumenti, Italy) was added to E. faecalis broth culture at the final concentration of 50% and 10% v/v, and suspensions were dark incubated at 37 °C for 45min. 10% ALAD were irradiated with 7 and 20min LED device; 50% ALAD irradiated for 7min. Test 2: E. faecalis broth culture was incubated for 25 min with ALAD 10%, 25%, 50%v/v and irradiated for 5min. Exposed and unexposed samples were tested for CFU (cell count) and by LIVE/DEAD (cell viability) analysis. Test3:in vivo, the samples, taken before the therapy, after application of gel for 45 min and after irradiation with red LED, were tested for CFU. ALAD gel, introduced into the canal, was activated by an endodontic tip.

Results: 10% ALAD and 45min of incubation promoted a significant reduction of CFUs, but 50% ALAD + LED 7min produced a total inactivation and an evident killing effect on E. faecalis (95% dead cells). The application in vivo of ALAD + LED 7 min exerted a significant reduction of cell count.

Conclusions: ALAD gel with LED irradiation exerts a potent antibacterial activity against E. faecalis both in vitro and in vivo.

GE73 - FRACTURE RESISTANCE OF FLARED CANALS IN ENDODONTICALLY TREATED TEETH RESTORED WITH PRE-IMPREGNATED CUSTOM FIBER REINFORCED COMPOSITE POSTS: A COMPARATIVE STUDY

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Aim: the aim of this study was to evaluate the effect of using pre-impregnated custom fiber reinforced composite posts compared to conventional treatment modalities on fracture resistance of endodontically treated single rooted teeth with flared root canals.

Materials and methods: endodontic treatment was performed on single rooted 45 intact premolars. Control group (C) without coronal flaring, in which a prefabricated fiber post with a diameter compatible with the post cavity was cemented. Experimental groups with coronal flared up root canals were as follows: FP: prefabricated fiber post; CP: cast post and core; ES: pre-impregnated custom fiber reinforced composite post (EverStickPOST); RB: composite resin build-up. Standardized cores and metal crowns were fabricated and cemented. All specimens were loaded along the long axis of the teeth until fracture occurred. Mean fracture loads and fracture modes were determined. One-way analysis of variance (ANOVA) and Tukey HSD for multiple comparisons of the means between groups were used for statistical analysis. P-values of < 0.05 were considered significant.

Results: the mean fracture load of group FP was significantly lower than all other groups except group RB, and that for group ES was significantly higher than group FP and group RB (ANOVA, $p < 0.05$). The highest percentage of unfavorable fractures was observed in group CP (78%).

Conclusions: restoring flared canals in endodontically treated teeth with custom fiber posts, associated with higher fracture loads and less unfavorable failures, which clinically means more restorable failures in case of flared canal.

Acknowledgement: This research was funded by the Deanship of Research at Jordan University of Science and Technology, under grant No. (20170172)

GE74 - AN IN VITRO COMPARISON OF MARGINAL ADAPTATION OF FOUR ROOT-END FILLING MATERIALS

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Aim
The purpose of this investigation was to evaluate and compare the marginal adaptation by dye microleakage and stereomicroscope of four root-end filling materials: MTA Flow (Ultradent), Biodentine (Septodont), Pro Root MTA (Dentsply) e Aureoseal (OGNA).

Methodology
Forty, extracted, human teeth with single root canals were selected for this study. The root canals were instrumented and filled with gutta-percha and sealer. Root-ends were resected and 3 mm deep cavities were prepared. Root-end cavities were filled, each with a type of material and the teeth were divided into four study groups. Methylene blue dye was used for determination of dye microleakage. The apical portions of the roots were then sectioned to obtain transversal sections at 1 and 2 mm. Afterwards, stereomicroscope was used to determine dye microleakage and area of gaps and adaptation of the root-end filling materials with the dentin.

Results
Statistical analysis ($P<0.05$) showed lowest internal voids and good marginal adaptation with Biodentine and Aureoseal followed by ProRoot MTA and highest marginal gaps with MTA Flow which were statistically significant. Biodentine and Aureoseal showed better marginal adaptation and lowest internal voids than ProRoot MTA and MTA Flow.

Conclusions
Within the limits of this in-vitro study, the evaluation and analysis of the apical sealing ability of Biodentine and Aureoseal proved superior to MTA Flow and ProRoot MTA when used as root-end filling materials in micro-surgical endodontics.

GE75 - EVALUATION OF TEMPERATURE DURING THE CONTINUOUS WAVE OF CONDENSATION TECHNIQUE WITH BIOCERAMIC SEALER USING THERMOCOUPLES

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Aim: Evaluate temperature variations on the external root surface during the vertical continuous wave of condensation technique with the use of bioceramic sealer, Ceraseal (Meta Biomed,Cheongju,Korea).

Methodology: 30 extracted human teeth, 15 upper central and 15 lower central incisors, were treated with Mtwo NiTi simultaneous preparation technique to size 30/05 (Sweden Martina-VDW,Padova,Italy). Two thermocouples (National Instruments,Austin,US) were connected at 1mm and 5mm coronally from the radicular apex; the warm vertical compaction with a heat plugger was applied at 5 mm from the apex for 4 seconds at 230 °C with EQV Pack (Meta-Biomed, Cheongju, Korea). Temperature (T) measurements were recorded at 0(T0),10(T1),70(T2),74(T3),84(T4),86(T5), 480(T6),490(T7) and 600(T8) seconds. All the samples were stored in an incubator at 37 °C, wrapped in moist gauzes.

Results: The recorded average temperature variations were 12.05°C, with values between 4.3°C and 33.1°C. The highest temperatures were recorded at the end of the compression ΔT4 (T4-T3) and at the "tap" for the heat plugger separation ΔT5 (T5-T4) in 10 out of 30 samples, specifically in 8 lower incisors and in 2 upper incisors, over 47 °C and never more than 15 seconds. Lower incisors samples show statistically greater temperature variations than upper incisors samples both at 5 mm ($p < 0.01$) and 1 mm ($p < 0.01$).The temperature variations of the 5mm-thermocouple were significantly greater ($p < 0.01$) than the 1 mm-thermocouple records in all samples ($p < 0.01$). A perfect hardening of the bioceramic sealer in all the samples happened.

Conclusions: The data obtained are in agreement with literature data. Have been registered higher temperature variations on the external root surface of lower incisors samples than in the upper ones. Higher temperatures critical for similar bioceramic sealer as reported in literature wasn't reached in the present study.

GE76 - SURGICAL REMOVAL OF FRACTURED ENDODONTIC INSTRUMENT PERFORATED THE MESIOBUCCAL ROOT OF A MAXILLARY FIRST MOLAR

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Aim

To present the surgical removal of a broken endodontic file, which had perforated the apical third of the mesiobuccal root of a maxillary first molar.

Introduction

The occurrence of perforations range from 0.6% to 17.6%. The most common factors associated with perforations included experience of the practitioner and type and morphology of the tooth. Root canal transposition, formation of via falsa and perforation in the apical third of the canals are severe iatrogenic lesions, more common in pronounced curvatures. Fracture of the endodontic file will then occur as a matter of course. There are cases where even magnification is not enough to treat the problem orthogradically. In these cases, surgical treatment is essential.

Case Presentation

A 50-year-old man came to our clinic complaining of constant pain and sensitivity to bite after a failed treatment on a 16th tooth. His medical history was unremarkable. Periapical X-ray and CBCT confirmed a fractured instrument and perforation in the mesiobuccal 1 (MB_1) canal, mesiobuccal 2 (MB_2) canal was also confirmed.

Methodology

After removing the remaining carious dentin and probing the canals, bleeding from MB_1 was detected. Working length was determined in the palatal and distobuccal (DB) canals. In MB_2 canal the glide path was reached with #6,#8, #10 C-files. Due to the perforation and massive bleeding in the MB_1 canal, the broken instrument was not visible under the microscope and could not be bypassed. It was decided to surgically remove the broken endodontic device. In canal MB_1, chemo-mechanical preparation and root filling of the canal was performed only up to the fractured file. Meanwhile in the other 3 canals a proper root canal filling was performed. Schäfer-protocol was used as final irrigation. Instrumentation was done with a Reciproc Blue 25 file (VDW). Obturation was performed with AH Plus sealer (Dentsply) and lateral condensation technique.

Following surgical exploration, the DB root was found uncovered by the alveolar bone, so apicoectomy removing the apical 4 mm of the root and retrograde root canal filling with biocompatible material was performed in both roots.

The surgery was performed within one week. MTA cement (Cerkamed) was used as a retrograde filling material.

Follow-up: the patient was recalled after 3 months. He was clinically asymptomatic, intraoral radiographs showed a decrease in periapical radiolucency.

Discussion

Surgical intervention is necessary in endodontic therapy, when orthograde treatment is not successful. If bypassing a separated instrument is not possible and the canal cannot be drained because of the presence of perforation of the apical region, an apicectomy should be considered. Precise location of the perforation and fractured segment can be predicted with CBCT, and microsurgical approaches produce predictable outcomes in the healing of lesions of endodontic origin.

Conclusion

Preserving natural tooth remains the best treatment decision. The tooth was successfully treated with a combination of orthograde revision and surgical root resection without any complications.

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GE77 - ENDODONTIC TREATMENT AND PERIAPICAL SURGERY OF AN UPPER LATERAL INCISOR WITH A LARGE INFLAMMATORY CYST

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Aim(s) of the case: To describe the management (endodontic treatment and apical surgery) of a large radicular inflammatory cyst in the anterior maxilla.

Case Presentation: A 17-year-old male patient came to our service of Dental Medicine with the chief complaint of continuous swelling and pus drainage from the anterior maxilla. After clinical, radiographic and Cone Beam Computed Tomography examinations, the treatment plan consisted of endodontic treatment of tooth #22 followed by periapical surgery. Histopathological analysis revealed that the lesion was an inflammatory radicular cyst. Clinical and radiographic re-evaluations at 6 and 12 months revealed progressing bone healing.

Discussion: Various reports showed that endodontic treatment should be done at initially and that 42 to 74 % of theses periapical inflammatory lesions healed after root canal treatment. [1, 2] However, when the apical lesions are extensive, endodontic treatment alone is not efficient and should be associated to decompression or marsupialization or even to enucleation. [2] Combined with conservative endodontic treatment, we opted for periapical surgery due to the lesion size and extent. Complete enucleation of cyst was achieved followed by root-end resection (3mm), ultrasonic root-end preparation and obturation of the retro-cavity with MTA. In our clinical case, calcium hydroxide-based paste dressing was placed in the tooth #22. The use of calcium hydroxide is recommended as an endodontic medication to improve periapical healing and eliminate residual microorganisms. [1]

Conclusion & Clinical Relevance: Endodontic treatment combined with periapical surgery shown to be an effective method to manage periradicular extensive inflammatory cysts.

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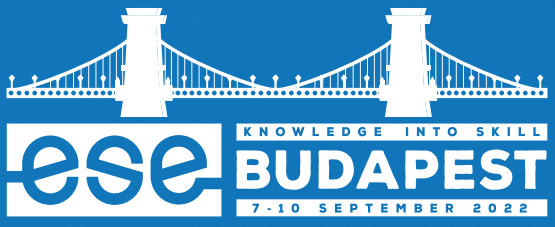

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