HELSINKI

SHEDDING NORTHERN LIGHTS ON ENDODONTICS

6–9 SEP. 2023

ese

# Oral Presentations on Freely Chosen Subjects

21st ESE BIENNIAL CONGRESS

# OP001 - 1 / 1 INSTRUMENT FRACTURE IN ENDODONTICS. INCIDENCE, PROBABILITY OF RETRIEVAL AND IMPACT ON ENDODONTIC OUTCOMES!

Kalyva M[1], Petropoulou E[1]

[1]*European University Cyprus*

**Aim:** To review key references and clinical parameters relevant to the incidence of endodontic instrument fracture and to present clinical cases with special focus on the management of file fractures at the apical and middle third while preserving the structural integrity of the roots.

**Summary:** The incidence of endodontic instrument fracture ranges between 4,4% and 1.66% and rotary Ni Ti instruments break more than twice as often as SS instruments. The probability of fractured instrument retrieval depends on several factors including the level of the root canal (cervical, middle or apical), the length, the design and alloy of the fragment and the anatomy of the root canal at the fracture location. In case of instrument fracture in a curved root canal, the removal depends on the fragment location, as with current techniques the retrieval of visible fragments is quite predictable.
The impact of instrument fracture on the outcome of endodontic treatment is related to the preoperative diagnosis as apical periodontitis has been consistently demonstrated to be a prognostic factor and microorganisms have been an established cause of persistent apical infection. The fractured instrument may compromise apical access - thereby preventing debridement - hence the stage of treatment at incident occurrence may also influence the level of intracanal infection and affect the treatment outcome. On the contrary, in a case carried out on ideal technical standards with no evidence of apical periodontitis, the retention of a fragment is not likely to significantly affect the prognosis.

**Key learning points:**

- Incidence of instrument fracture;
- Clinical parameters affecting the probability of fragment retrieval;
- The impact of the retained fragment on treatment outcome;
- Clinical management of fractures at the apical and middle root canal third.

# OP003 - EVIDENCE FOR THE ASSOCIATION BETWEEN PRE-PROCEDURAL ANXIETY AND PAIN IN PATIENTS UNDERGOING ENDODONTIC PROCEDURES

Sadr A[1], Ashton James C[1], Gholamrezai A[1], McNeilage A[1]

[1]*University of Sydney*

**Aim:** The talk reviews the scope of research evaluating the relationship between psychological variables (anxiety) and pain before and after endodontic treatment.

**Summary:** Dental anxiety is characterized by uneasiness or fear associated with dental procedures and receiving dental care. A significant proportion of adults experience dental anxiety, which can range from mild to severe, with dental phobia affecting an estimated 3-16% of adults. Irreversible pulpitis in endodontics is a frustrating medical condition that causes sudden and unpredictable pain, often driving patients to seek emergency dental care. This procedure involves several stages with expectations of pain during or after, possibly due to fear of endodontics. This can lead to avoiding dental treatment and poor oral health.
Evidence for the efficacy and acceptability of psychological interventions for pain management has proliferated over the past 25 years. However, psychological approaches to pain management in dentistry, especially endodontics, are scarce. To identify or develop psychological interventions to modulate pain associated with endodontic procedures, we investigated the scope of evidence for related psychological factors.

**Results**: In this presentation, after a summary of psychological predictors found in the first phase of the scoping review, we focus on anxiety results as the most common predictor with the scales used in this aspect alongside a quick mention of future potential interventions. The findings of this project may help in considering psychological factors as a predictor of pain and other outcomes in endodontic treatments and increasing predictability for case selection.

**Key learning points:**

- A key reason for pain during and after endodontic therapy;
- How much anxiety and the related psychological manifestations could affect the perception of pain in endodontics;
- Clinical implication and some introduction summary of the solution.

# OP004 - CAN APICAL PERIODONTITIS AND A HIGH DMF-T PREDICT DENTAL NEGLECT IN PATIENTS HOSPITALIZED DUE TO ODONTOGENIC INFECTIONS?

Dahl S[1], Søndenbroe R[1], Storgård Jensen S[1], Boeskov Øzhayat E[1], Folker Christensen L[1,2], Markvart M[1]

*[1]Department of Odontology, University of Copenhagen, [2]Copenhagen Centre for Health Research in the Humanities (CoRe), University of Copenhagen*

**Introduction**: Severe odontogenic infections can develop from apical periodontitis, periodontitis, pericoronitis or arise postoperatively after tooth extraction and may require hospitalization. Dental neglect is defined as incapability of maintaining oral health and avoidance of seeking dental care, but the exact clinical application of the term dental neglect is missing.

**Aim**: The aim of the present study was to identify clinical criteria to detect patients with dental neglect.

**Methods**: To measure dental neglect, we applied the Dental Neglect Scale (DNS). We examined the association of high scores of dental neglect with medical, clinical, radiological and sociodemographic characteristics, in patients hospitalized with severe odontogenic infections. The hypothesis is that patients with a high DNS score have significantly higher DMF-T and more apical radiolucencies than patients with a low DNS score.

**Results:** In total, 321 patients hospitalized due to an odontogenic infection (WHO ICD-10 K12.2) at Copenhagen University Hospital, Denmark in 2012-2019, were included and received the DNS. The study obtained a response rate of 58.5%. Furthermore, 10 qualitative interviews were conducted with patients obtaining highest scores on DNS to explore the social and behavioral aspects. A high degree of dental neglect was detected in 47.6% of the cohort. Males frequently had a higher degree of dental neglect than females (p=0.001). The median DMF-T score for patients with low and high DNS score was 10.5 and 9 respectively (p=0.463), and the hypothesis was therefore rejected. However, there was a statistically significant (p=0.004) association between the number of apical radiolucencies categorized as none, one, two or more, and the DNS score.

**Key learning points:**

- Common characteristics in terms of endodontic, medical, sociodemographic and social issues for patients previously hospitalized with odontogenic infections and exhibiting dental neglect;
- How to raise awareness on dental neglect in clinical practice to improve dental attendance patterns.

# OP005 - THE MAJORITY OF PATIENTS HOSPITALIZED WITH ODONTOGENIC INFECTIONS OF ENDODONTIC ORIGIN HAVE UNTREATED MANDIBULAR MOLARS

Nesheim E[1], Søndenbroe R[1], Storgård Jensen S[1], Pigg M[2], Dawson V[2], EndoReCo, Markvart M[1]

*[1]Department of Odontology, University of Copenhagen, [2]Department of Endodontics, Faculty of Odontology, Malmö University*

**Introduction:** Apical periodontitis may develop into an oral abscess or phlegmone with the potential to spread into adjacent anatomical spaces. Predictors and risk factors for this exacerbation are largely unknown.

**Aim:** The aim of this retrospective cross-sectional study was to examine the course of endodontic infection and treatment before hospitalization and identify predictors for this adverse event. We hypothesized that patients hospitalized with infections of endodontic origin are characterized by untreated endodontic infections rather than ongoing or completed endodontic therapy.

**Results**: A total of 217 patients diagnosed with oral abscess or phlegmone (WHO ICD-10, K12.2) caused by an endodontic infection, were hospitalized between 2012-2019 at the Copenhagen University Hospital, Denmark and included in the study. The mean age was 43.8 years (SD 19.1). The gender distribution was even (52.1% females). Gender and endodontic status were significantly associated (p=0.015); females were more frequently hospitalized with a tooth with ongoing (11.1%) and completed (15.1%) endodontic therapy than males (8.5% and 6.5%, respectively), while males more often got hospitalized with an untreated tooth with apical periodontitis (32.7%) than females (26,1%). Most of the patients (57.9%) had no comorbidities. There were no significant associations between number of comorbidities and endodontic status (p=0.23). First and second mandibular molars were the most frequent infection foci (54.8%). Infectious foci were related to teeth with untreated apical periodontitis (58.3%), ongoing (19.4%) and completed endodontic therapy (22.3%).
To investigate the endodontic history that preceded hospitalization, 200 patients (>18 years) were asked for consent to collect dental records from their private dental practitioner. The records will be analyzed to define predictors for exacerbation of endodontic infections.

**Key learning points:**

- Characterization of patients hospitalized with odontogenic infections of endodontic origin;
- Preoperative symptoms, choice and quality of treatment in patients hospitalized with odontogenic infections of endodontic origin.

# OP006 - THE OUTCOMES OF ORTHOGRADE DECOMPRESSION OF LARGE PERIAPICAL LESIONS USING LONG-TERM APPLICATION OF CALCIUM HYDROXIDE AS AN INTRACANAL MEDICATION

Saber S[1]

*[1]The British University In Egypt*

**Aim:** To demonstrate the good potential for clinical and radiographic healing of large periapical lesions after long-term use of calcium hydroxide as an intracanal medication.

**Summary**: Inflammatory cyst-like periapical lesions are often associated with intra-radicular or extra-radicular infections. Such lesions may undergo slow asymptomatic evolution and attain remarkable radiographic dimensions. Non-surgical resolution of such lesions can be attained through orthograde lesion decompression and control of the intracanal exudation. Furthermore, long-term calcium hydroxide [$Ca(OH)_2$] therapy has been advocated because of its favorable antimicrobial and reparative properties. This presentation will present a case series of this approach while highlighting the different technique variables including case selection, optimum time for placement, vehicle selection, duration of placement, criteria for evaluating clinical and radiographic outcomes, role of CBCT, removal methods, predictors of outcomes, impact of systemic health and systemic adjuncts, impact on tooth fracture strength and management of extrusions.

**Key learning points**:

- Acknowledge the role of long-term calcium hydroxide in non-surgical resolution of cyst-like large periapical lesions;
- Learn an evidence-based clinical protocol to achieve the best outcomes;
- Analysis of outcomes to identify predictors of success or failure.

# OP007 - PARTIAL VERSUS FULL PULPOTOMY FOR MANAGEMENT OF SYMPTOMATIC IRREVERSIBLE PULPITS IN CARIOUS MATURE PERMANENT TEETH

Taha N[1], Albakri S[1]

[1]*Department of Conservative Dentistry, Jordan university of Science and Technology*

**Introduction:** Based on the histology of teeth with irreversible pulpitis, partial or full pulpotomy using calcium silicate-based materials could be performed. According to the European Society of Endodontology partial pulpotomy is defined as the removal of a small portion of coronal pulp tissue after exposure, followed by the application of a biomaterial directly over the remaining pulp tissue prior to placement of a permanent restoration. While full pulpotomy is defined as complete removal of the coronal pulp and the application of a biomaterial directly on the pulp tissue at the level of the root canal orifices, prior to placement of a permanent restoration only few studies with limited sample size are available that compare the outcome of partial and full pulpotomy in teeth with carious pulp exposure and clinical diagnosis of irreversible pulpits.

**Aim**: This presentation aims to review the biological bases of vital pulp therapy in irreversible pulpits, review the clinical procedures, prognostic factors, and available literature on the outcome. Finally, it will present the results of a randomized clinical trial of full vs partial pulpotomy in the management of mature permanent teeth with carious pulp exposure in terms of patient's centered and clinician's centered outcomes. Aiming at highlighting some guidlines for management of such cases and the selection between partial and full pulpotomy.

# OP008 - PULPOTOMY FOR THE MANAGEMENT OF IRREVERSIBLE PULPITIS IN PERMANENT POSTERIOR TEETH (PIP): A FEASIBILITY STUDY

Colloc T[1], Hamilton A[1], Tait C[1], Ricketts D[1], Clarkson J[1], On behalf of the PIP study team

[1]*University Of Dundee*

**Introduction**: Studies conducted in secondary care suggest symptomatic irreversible pulpitis in permanent posterior teeth could be managed with Full Pulpotomy (FP) rather than conventional root canal treatment (RCTx), preserving radicular vitality and promoting minimally invasive treatment. However, there is a lack of evidence in primary care settings, where the majority of dentistry is carried out.

**Aim**: The NIHR-funded PIP study aims to address this evidence gap through a pragmatic multicentre randomised control trial in primary care in the UK, with the primary objective of comparing the clinical and cost effectiveness of FP compared with RCTx. A feasibility study was undertaken to determine progression to the randomised control trial.

**Methods**: For the feasibility study, general dental practitioners (GDPs) delivered FP to patients attending with irreversible pulpitis symptoms. Progression to the main study was dependant on meeting five feasibility criteria; the number of GDPs recruited, successful training in FP, clinical fidelity of FP, participant satisfaction, and number of potentially eligible patients per month per practice. A process evaluation with qualitative interviews was also conducted.

**Results:** A total of 11 GDPs recruited 23 participants. Successful training of GDPs and participant satisfaction reached 100%. Clinical fidelity was 68%, increasing to 100% following introduction of feedback forms, and the number of eligible patients per month was 0.9. Qualitative interviews showed a positive response from GDPs and participants.

**Conclusion:** The feasibility study showed FP can be delivered successfully in a primary care setting and allowed exploration of opportunities and challenges prior to progression to the randomised control trial.

**Key learning points**:

- A feasibility study is valuable in planning a multicentre randomised control trial;
- A pragmatic approach allows for better reproducibility into primary care setting;
- The feasibility study suggests that FP can be provided successfully in primary care;
- Qualitative analysis showed patients and dentists were favourable towards FP.

# OP009 - POST-OPERATIVE PAIN MONITORING IN IMMATURE TEETH WITH IRREVERSIBLE PULPITIS AFTER PARTIAL PULPOTOMY

İlgenli I[1], Açıkgöz Yakşi S[1]

[1]*Ege University, Faculty Of Dentistry, Department Of Endodontics*

**Aim**: To report the levels of post-operative pain in three cases of immature permanent teeth with symptoms of irreversible pulpitis that were treated with the two-session approach of partial pulpotomy utilizing MTA and sodium hypochlorite, which is used for haemostasis and disinfection.

**Summary**: Pulpotomy involves amputation of the affected inflamed coronal portion of pulp, which is later followed up with preservation of the remaining vital pulp tissue. If left untreated, irreversible pulpitis of juvenile teeth with open apices can also lead to pulp necrosis, which stops future root development and leaves behind short, fragile roots that are brittle. This issue persists whether we use conventional treatments for this kind of tooth, like MTA-plug or calcium hydroxide apexification therapy. Nonetheless, pulpal therapies on permanent teeth have also been reported to be painful dental procedures, and postoperative pain may follow these procedures. For adolescents, it is very crucial to reduce postoperative discomfort to prevent the development of fear and apprehension about dentistry and dental treatment in the future. We report 3 immature mandibular molars with indications of irreversible pulpitis including spontaneous pain. Electrical and cold tests were used to assess the pulp vitality before the treatments. Also, the preoperative pain levels were recorded according to a 10 cm horizontal VAS. The patients were called on the 6th, 24th, and 72nd hours after the procedure, and were asked to mark their pain levels on the VAS. The teeth were vital, asymptomatic and functional at three-month radiographic and clinical follow-ups.

**Key learning points**:

- Immature teeth with open apices pose a serious challenge to clinicians;
- In cases of irreversible pulpitis, vital treatments can be an option to eliminate the complications of conventional treatments;
- Any potential development of dental fear may be avoided by treating the symptomatic painful tooth and lessening postoperative pain, especially in adolescents.

# OP011 - INJECTABLE-PRF; A PROMISING INNOVATION IN ENDODONTICS

Mansour N[1]

[1]*Ministry of Health and Population, Egypt*

Platelet extracts, mainly represented by platelet-rich plasma (PRP) and platelet-rich fibrin (PRF), have received great attention in various endodontic topics; such as vital pulp therapy, regeneration, trauma, and endo-perio lesions. Their utilization opens up a new avenue in clinical dentistry. PRF was first described by Choukroun et al. (2006), it is a second-generation platelets concentrates, and has many advantages over PRP including easy preparation and absence of blood manipulation. PRF is a living biomaterial composed of cytokines, leukocytes, stem cells, and platelets, entrapped in tetra molecular fibrin meshwork, which act as a scaffold, supports micro vascularization, and works as a transport for carrying cells, which are important for hard and soft tissue regeneration. However, its initial formulations lacked a liquid concentrate of proteins. For this reason, significant advancements were recently made to obtain a liquid or flowable version of PRF called injectable-PRF by introducing the "low-speed concept", lowering blood centrifugation speed and time. In agreement with this hypothesis, more platelets, leukocytes, and growth factors are retained in the supernatant fluid before the coagulation cascade. This flowable, natural blood concentrate allows ease of access and flow within the root canal. Furthermore, it allows mixing with biomaterials used in endodontics, this combination promises to help achieve great soft and hard tissue repair. It is a minimally invasive technique that will raise the bar of tissue regeneration in endodontics, because of its low-cost, enhanced curative effect and can be produced immediately at the chairside.

As it is considered an autologous biomaterial, it does not elicit a foreign body reaction. Under the condition of regenerative, trauma, or inflammatory disease, it can alleviate the immune response, and favor restoration, and repair. i-PRF may be a suitable strategy to ease patients' pain and meet clinical needs.

**Keywords**: Injectable-PRF, Pulp, Regeneration, Vital Pulp Therapy.

# OP012 - CAN THE RESIDUES OF CALCIUM HYDROXIDE DRESSINGS WITH DIFFERENT VEHICLES AFFECT THE ACCURACY OF ELECTRONIC APEX LOCATORS?

Erkal D[1], Tekinarslan D[1], Koç S[1], Er K[1]

[1]*Akdeniz University*

**Aim:** The aim of this study was to evaluate the effect of the residues of the calcium hydroxide(CH) dressings with different vehicles on the accuracy of 2different electronic apex locators(EALs).

**Methods** A total of 120 single-rooted human extracted teeth were selected. Endodontic access cavities were prepared, and then occlusal reduction was done in all teeth for standardization. A size 10K-type file was advanced under a stereomicroscope at X15 magnification until the file was seen apically and the measured value was recorded as actual length(AL) using a digital caliper. All the root canals were shaped using ProTaper Next files (DentsplyMaillefer, Ballaigues, Switzerland) up to size X4 and embedded in the alginate model to measure electronic length (EL1) using 2 different EALs[Propex-Pixi(Dentsply) and EndoRadar (Woodpecker, Guilin,China)]. The teeth were divided into a control group (without CH) and 5 experimental groups according to the different CH vehicles (saline, monopropyleneglycol, methylcellulose, silicone oil and chlorhexidine), and calcium CH dressing was placed with a lentulo file. The teeth were stored at 37℃ and 100% relative humidity for 7 days. CH was removed from all teeth using 2 mL of 17% EDTA irrigation with 20 seconds EDDY activation twice. Then EL was measured with same EALs and recorded as EL2. The difference was calculated by subtracting each tooth's AL from EL both before and after the placement of CH dressing. Statistical analysis was performed using Kruskal-Wallis and Wilcoxon tests at 5% level of significance.

**Results:** There was no significant difference among the mean values (EL2-AL) of all groups measured after removing the CH dressing for both EALs ($p>.05$). Propex-Pixi and EndoRadar were more accurate in the measurements after removal of CH dressing than before. However, this accuracy was statistically significant for only EndoRadar ($P<.05$).

**Key learning points:**

- CH dressings can be prepared with different vehicles;
- When CH is removed with irrigation activation using EDDY, residues of CH don't affect the accuracy of the EALs.

# OP013 - DOES ROOT CANAL SHAPING EFFECT THE ACCURACY OF ELECTRONIC APEX LOCATORS IN CURVED AND STRAIGHT ROOT CANALS?

Tekinarslan D[1], Ercan E[1], Erkal D[1], Koç S[1], Er K[1]

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

**Aim:** The aim of this study was to evaluate the effect of root canal shaping on the accuracy of electronic apex locators (EALs) in curved and straight root canals.

**Methods**: A total of 42 extracted human mandibular molars with straight (0-10 degrees) distal root canals and curved mesial root canals (30-50 degrees) were selected and defined as Group 1 and 2, respectively. The working length was measured under a stereomicroscope at X15 magnification and these measurements were recorded as actual working (AWL1) before root canal preparation. Then, the electronic working length (EWL1) determined with two different EAL [Propex-Pixi (Dentsply) and EndoRadar (Woodpecker, Guilin, China)]. All measurements were performed by a single operator by repeating three consecutive measurements for each tooth using a digital caliper. Root canal preparation is done with ProTaper Ultimate F1, F2 in mesial canals and F1, F2, F3 files in distal straight root canals. Standard irrigation protocol was applied during root canal preparation and EDDY was used for activation. Then, the measurements were repeated under a stereomicroscope and recorded as AWL2. EWL measurements were also repeated and recorded as EWL2 after preparation. The difference was calculated by subtracting the AWL from the EWL for each tooth. For statistical analysis, Paired Sample t-test and Wilcoxon tests were applied.

**Results:** There was no significant difference in the accuracy of Propex-Pixi and EndoRadar before and after preparation for both Group 1 and Group 2 ($p > .05$).

**Key learning points:**
Root canal preparation has no effect on the accuracy of EALs used in this study in curved or straight root canals.

# OP014 - ROOT CANAL RETREATMENT IN 4.6: BEYOND THE PERIAPICAL LESION

Morales Cuellar A[1]

[1]*Universidad Rey Juan Carlos Madrid*

**Aim**: Evaluate what signs and symptoms may be caused by a periapical lesion, and to analyze the potential to solve them by non-surgical endodontic retreatment.

**Summary**: A patient is received referred from the neurologist. The patient had headaches for about a year, paresthesia in the area of the right chin, and areas of alopecia on the scalp and beard. In 4.6 a periapical lesion is observed, with a cystic appearance, in the CBCT it is noted that the lesion is invading the area of the inferior dental nerve, disappearing it the lesion. It was decided to perform orthograde retreatment of tooth 4.6. Endodontic retreatment was performed:
In the first session, intracanal drainage was performed with the Endovac to aspirate the lesion´s content. In the second session, with no drainage, root canals were filled with the vertical condensation technique, after the protocol irrigation. Controls were carried out at 1, 3, 6 and 12 months, observing that the symptoms (paresthesia, headache) disappeared during the first month. After 3 months, the alopecia areas disappeared.
At 2 years follow-up it is observed the asymptomatic and functional tooth, hair growth was observed in the areas of the bald spots. In the CBCT after two years, a healing process of the lesion is observed, and once again observing the integrity of the inferior dental nerve.
All case is documented with clinical videos with microscope, intraoral pics and extraoral pic of bald spots.

**Key learning points:**

- A periapical lesion can be the cause of different pathologies in the general health of the patient;
- Regardless of the appearance or size of the lesion, surgical retreatment should be considered;
- Even more in cases in which structures such as the dental nerve are involved, taking into account the possible complications of injuring it in a surgical procedure.

# OP015 - OUTCOME OF MAXILLARY SINUS INFLAMMATORY CHANGES OF DENTAL ORIGIN AFTER ENDODONTIC TREATMENT

Nistor C[1], Perlea P[1]

*[1]UMF Carol Davila*

**Aim:** The evaluation of changes in sinus structures following chronic apical periodontitis, after orthograde endodontic treatment of maxillary molars is of great importance, considering that this aspect is frequently ignored, the focus being mainly on periapical bone recovery.

**Summary:** Our presentation shows a series of clinical cases of orthograde endodontic treatment in the maxillary molars with chronic apical periodontitis, but also with maxillary sinus changes, resorption of the sinus floor or inflammation of the sinus mucosa, all these aspects being identified on a preoperative cbct with a small field of view. The endodontic treatment was sometimes addressed only to the mesio-vestibular roots, namely the omitted mesio-vestibular canal 2. Following the treatment, the dynamics of the evolution of these pathological changes was evaluated at various points in time, also with the help of small field of view cbct, observing the same sections for each root.
The favorable evolution was observed early on the cbct scan both for the periapical changes, with bone recovery, but also the restoration of the sinus floor and the remission of mucosal inflammation, which is of great importance in the case of these teeth that are difficult or impossible to undergo apical resection. It also leads to a faster definitive prosthesis, with restored functionality of these teeth.
For the maxillary molars it is better to have them scanned preoperatively, in order to assess not only the anatomy, but also the relationship with the maxillary sinus and then the follow up cbct is useful to determine if the sinus changes have resolved, these aspects not being visible on the periapical radiograph.

**Keywords**: Maxillary sinus, endodontic treatment, evolution.

# OP016 - ENDODONTIC TREATMENT IN A 4 ROOTED MANDIBULAR SECOND MOLAR: A CASE REPORT

Liapis E[1], Georgiadou A[1], Tomas Aliberas J[1]

[1]*Universitat International De Catalunya UIC*

**Introduction**: Endo-Perio lesions are challenging situations for clinicians, in terms of diagnosis and treatment. An accurate identification of the etiologic factors is crucial for the prognosis and management of these lesions.

**Aim**: In this clinical case a second lower molar with uncommon root canal anatomy and apical radiolucency communicating with a periodontal pocket is presented.

**Methods**: A 38 year old female was referred to the Endodontic department of Universitat International de Catalunya for endodontic treatment of tooth 4.7. Tenderness to percussion and no response to cold test was noticed. According to the medical history patient was identified as ASA type I. During clinical examination a carious lesion affecting the mesial contact point was observed, and deep pocket of 10mm in the buccal side with associated sinus tract. No mobility nor swelling was observed. Pulpal necrosis with chronic apical abscess was diagnosed. After periapical radiograph, bitewing and small field of view CBCT 4 roots two mesially and two distally were detected. Apical radioluscency extending to the furcation area also detected. The treatment plan was to perform the root canal treatment with a direct restoration. The whole process was done under an operative microscope. Deep Margin Elevation was performed and root canals were instrumented with Reciproc Blue 25 and ProFile 30/0.4 and 35/0.4. Two visits were performed with calcium hydroxide paste between appointments. After endodontic treatment, direct restoration of composite filling material was performed.

**Results**: At 6 months follow up healing of the sinus tract and periapical lesion was observed, probing depth reduced to 4mm and patient was completely asymptomatic.

**Conclusion**: Differential diagnosis is challenging in cases when sinus tract originated from the endodontic lesion drain along the periodontal ligament, giving the appearance of a periodontal disease or vertical root fracture. Proper treatment can heal sinus tract resulting in good prognosis.

# OP017 - EXPLORING A PARADIGM SHIFT IN PRIMARY TEETH ROOT CANAL PREPARATION

Elbahary S[1]

[1]*Tel Aviv University, Endodontics department*

**Aim**: Primary teeth root canal treatment is a complex procedure that requires the right approach and techniques to ensure a successful outcome. Traditional methods of root canal preparation have been used for many years but may not always achieve optimal results. This presentation will explore a paradigm shift in primary teeth root canal preparation and provide an overview of new techniques and materials that are being used to improve outcomes. This presentation aims to introduce the audience to the benefits of the new approach and provide practical insights for implementing the paradigm shift in their practice.

**Summary:** This presentation will start by discussing the current challenges in primary teeth root canal treatment and the limitations of traditional methods of root canal preparation. We will then introduce the paradigm shift and new techniques and materials to achieve better outcomes. This includes the use of bioceramic materials, non-invasive methods of cleaning, and the importance of preserving the tooth structure. We will also discuss the benefits of the new approach, including improved success rates, reduced risk of complications, and better preservation of the tooth structure. During the keynote, I will also present my recently published micro CT study on the same subject. The study adds to the growing body of research supporting the paradigm shift in primary teeth root canal preparation. The presentation will provide an opportunity to discuss the study's practical implications for clinical practice.

**Key learning points:**

- Understanding the limitations of traditional root canal preparation in primary teeth;
- Exploring the new paradigm shift in primary teeth root canal treatment;
- Identifying the new techniques and materials used in the new approach;
- Understanding the benefits of the new approach, including improved outcomes and reduced complications;
- Practical insights for implementing the new paradigm shift in your own practice.

# OP018 - HOW THREE-DIMENSIONAL IS A ROOT CANAL TREATMENT?

Hamdan R[1]

[1]*Private practice*

**Introduction:** The more our knowledge about root-canal-anatomy advances, the more the difficulty of three-dimensional treatment appears. The outcome of our daily practice doesn't always reflect the complexity of the root-canal-system and differs from photos shown in numerous in-vitro CT-studies.
To understand this gap; two questions can be taken into consideration:
- How trustworthy is the use of conventional radiographs to assess the outcome?
- How three-dimensional are shaping, irrigation, and filling procedures?

Despite their limitations: anatomical noise, the two-dimensional nature of the images, and various degrees of geometric distortion, conventional radiographs are used in daily endodontics practice. A CBCT-examination should only be considered if the obtained images are likely to aid diagnosis and treatment (6). Micro-CT scans are not adequate for in-vivo use. It seems that there is nowadays no alternative to conventional radiographs.
Mechanical shaping-methods result in 30-50% of untouched canal-walls. Activated-irrigation approaches are proven to be efficient with removing debris therefore compensating the deficit of mechanical instrumentation.

**Aim:** Introducing high-fluid sealers like calcium-silicate-based should improve the ability of three-dimensional filling.

**Methods**: Four extracted maxillary-teeth with complex anatomy were chosen to undergo an extreme cleaning and filling protocol. After shaping with Ni-Ti files (0.25, 6%) with copious irrigation with NaOCl-3%, samples were left in NaOCl-3% for one week then in EDTA-17% for 24-hours. Irrigation was activated using US-tips and laser. Samples were dried using paper-points and then let to dry for 72-hours. Two teeth were filled with gutta-percha-points and an epoxy-resin sealer using warm-vertical-condensation and two teeth were filled with gutta-percha-points and calcium silicate-based sealer using hydraulic-condensation. Assessments were done using radiographs from two different angles.

**Results:** Few details of three-dimensional anatomy were observed but the results are not satisfying from a three-dimensional point of view.

**Key learning points:**
- A three-dimensional treatment is still of high complexity;
- Only activated irrigation seems to fulfill the three-dimensional criteria.

# OP019 - ANATOMICAL VARIATION IN ENDODONTIC THERAPY

Alani A[1]

*[1]Nova Medical Center*

**Summary**: The hard tissue repository of the human dental pulp takes on numerous configurations and shapes; the variations of anatomical and morphological characteristics of the teeth are very important for any practitioner. These differences in root morphology determine the success of the endodontic therapy and the long-term prognosis of the tooth, especially when it is an abutment for a prosthetic restoration. Before beginning an endodontic treatment, the clinician must take into account the morphological variations of the root anatomy. A thorough knowledge of tooth morphology, careful interpretation of angled radiographs, proper access preparation and a detailed exploration of the interior of the tooth are essential prerequisites for a successful treatment outcome; magnification and illumination are aids that must be utilized to achieve this goal.
This presentation describes:
1. How the lack of knowledge in root and pulp anatomy permits errors in diagnosing and treatment planning.
2. A thorough understanding of the complexity of the root canal system is essential for understanding the principles and problems of shaping and cleaning, for determining the apical limits and dimensions of canal preparations.
3. Unfilled canals, left like this by omission, can compromise both the endodontic and prosthetic treatment.
4. Describes and illustrates tooth morphology and discusses its relationship to endodontic procedures.

# OP020 - C-SHAPED ROOT CANALS. DIAGNOSING, INSTRUMENTATION, OBTURATION AND POST ENDODONTIC RECONSTRUCTION

Kubatska M[1]

[1]*Tannlege Mariya Kubatska*

**Summary**: C-shaped are one of the most demanding root canals. Unfortunately, that tricky anatomy can cause a lot of iatrogenic complications, which can appear in every stage of root canal treatment. From diagnosing, instrumentation, irrigation, obturation, and post endodontic reconstruction. Presentations include precise information about possible complications related to treatment of C shaped root canals and explain how we can prevent them. Studies regarding the appearance of C-shaped root canals show that C shapes appear in only 3% of European population till 50% in Asian population. Which means some clinicians have to deal more often with them. Strip perforations are one of the most frequent complications regarding instrumentation of C-shaped root canals. Reason for that is the occurrence of a danger zone. Danger zones occur in 99% of C-shaped root canals. In 80% cases it is situated lingually. Lack of consideration to the danger zone in planning of instrumentation of root canals can result in strip perforation and future failure of root canal treatment. That's why radiological diagnostics, especially CBCT, are so important for localizing of danger zones and treatment planning. Choice of minimal invasive instruments and correct instrumentation technique have a significant role in management of that kind of cases. The most popular classifications of C shaped root canals are Fan and Melton classifications. Some types of C shaped root canal can contain danger zones of critical values. Danger zones in C1 and C3 type according to Fan can be 0.2 mm.

**Key learning points:**

- Cbct diagnosing is very important to identify position and degree of danger zones;
- Minimal invasive instrumentation play key role in prevention of strip perforation in C-shaped root canals;
- Instruments with small taper should be preferred in C-shaped cases;
- Irrigation with high volume of concentrated NaClO with Pui is recommended.

# OP021 - A NEW METHOD FOR ASSESSING ROOT CANAL CLEANLINESS USING LIGHT MICROSCOPIC FOCUS STACKING AS AN ALTERNATIVE TO THE USE OF THE SCANNING ELECTRON MICROSCOPE (SEM) - A PRELIMINARY REPORT

Suter B[1]

[1]*Private Practice*

**Aim**: To demonstrate a new method for assessing root canal cleanliness after chemo-mechanical debridement.

**Summary:** First, in most ex vivo studies of extracted teeth root canal cleanliness is measured in using the scanning electron microscope (SEM).
This has the following disadvantages:
- High cost due to equipment, time and use of personnel.
- Slow process due to sputtering, installation in the SEM microscope, etc. (2-4 samples per half day in the author's experience).
- No easy distinction between organic and inorganic tissue (B/W image).
And the following advantages:
- High to very high magnification power
- 3-D image

Second, conventional light microscopy (CLM) is not an alternative to SEM because a flat, transparent specimen is needed.
Nonetheless CLM would have the following advantages:
- Ease of use
- Possibility of staining the preparation
- Coloured image
And the following disadvantages:
- The maximum optical magnification possible is about 1000x
- 2D image

A third possibility now exists using the relatively new technology of focus stacking light microscopy (FSLM). This allows us to take 3-Dimensional light microscopic images.
Examining publications on this subject shows that most of the SEM images presented are indeed not of a higher magnification than 1000x. Thus it would have been possible to do the same assessment with the more efficient 3-D FSLM technique based on colour images.

**Key learning points:**

- Magnification required to assess root canal cleanliness;
- Limitations of light microscopy imaging;
- Limitations of SEM imaging;
- Learn how to perform 3-D light microscopic imaging;
- Advantages and disadvantages of SEM versus 3-D light microscopic imaging;
- See how differently the dentin surface is represented in the images taken with the 3D-FSLM compared to the SEM images.

# OP022 - DIAGNOSIS AND ENDODONTIC TREATMENT OF ODONTOGENIC CUTANEOUS SINUS TRACTS

Jemaa M[1], Neifar Y[1], Lahmari A[1], Tlili M[1], Bellasoued A[1], Khattech M[1]

*[1]Service Of Dental Medicine, Military Principal Hospital Of Instruction, Tunis, Tunisia*

**Aim:** To describe two cases of cutaneous lesions of dental origin that were initially misdiagnosed as being dermatological in origin.

**Introduction**: The sinus tract is defined as the channel surrounded by epithelium due to a chronic inflammation of an epithelial surface, mainly from a closed area. Cutaneous sinus tracts can be odontogenic or non-odontogenic. Clinicians should be aware that lesions with a dental origin can be misdiagnosed as dermatological lesions. The sinus tract with odontogenic origin is described as a pathological channel formation because of pulp necrosis.

**Observations:**
Case 1:
Female patient aged 36, was referred for a chin lesion that had appeared 1 month ago. Clinical examination revealed a cutaneous erythematous draining fistula inferior to the chin. Teeth 41 and 31 were asymptomatic and dyschromic. Periapical radiograph showed periapical lesion associated with 41 and 31, incomplete endodontic filling in tooth 41 and absence of endodontic obturation in tooth 31. Root canal treatment for 41 and 31 was done. 1 month recall showed good improvement of the fistula.
Case 2:
Male patient aged 23, consulted for a spontaneous pain in the chin area initially diagnosed as skin infection. Tooth 31 was asymptomatic and tender to percussion. Periapical radiograph showed periapical lesion associated with the tooth 31 (incomplete endodontic filling). A CBCT was performed and showed a periapical lesion and the presence of 2 canals. Retreatment of 31 was done and complete healing of the fistula was obtained at 6 months.

**Key learning points:**

- Dental aetiology, as part of a differential diagnosis, must be considered in such oro-facial lesions;
- Correct diagnosis and treatment of the dental cause of a cutaneous sinus tract can prevent unnecessary and multiple antibiotic and surgical interventions.

# OP023 - ENDO-PERIO CONCOMITANT LESION AT SECOND MOLAR MANDIBULAR: A CASE REPORT

Nyoman Putri Artiningsih D[1], Elizabeth E[2]

*[1]Lecturer, Department Of Conservative Dentistry, Faculty Of Dentistry, Universitas Indonesia, [2]Student, Department of Conservative Dentistry, Faculty of Dentistry, Universitas Indonesia*

**Aim**: to present the etiology, development of imunopathogenesis and management of endo-perio concomitant lesion.

**Summary**: Concurrent endodontic and periodontal disease without communication has unique and different pathway of pathogenesis. Initiated by different causes from pulp and periodontal infection at one tooth simultaneously. This kind of lesion has multifactorial causes such as persistency of infection zone and traumatic occlusion, yet are not self-limiting. The immune system also took part of the lesion enhancement. The management might need multidisciplinary approach to achieve a healthy periodontal and functional teeth in the stomatognatic system.

**Key learning points:** complexity of pulp-periodontal pathway.

# OP024 - SURVIVAL AND MANAGEMENT OF TEETH WITH ENDODONTIC-PERIODONTIC LESIONS: A LITERATURE REVIEW

Al-Sibassi A[1], Moawad E, Jarad F, Hill R, Edwards K, Longridge N, Adeyemi J

[1]*University of Liverpool*

**Aim**: Present the prevalence, aetiology, microbiology, diagnostic and management strategies as well as prognosis for teeth with endodontic-periodontic lesions (EPL's).

**Summary**: EPL's are "lesions with apicomarginal or intra-bony periradicular bone loss of pulpal and/or periodontal origin that communicates with the oral cavity via a periodontal probing defect". The range of prevalence for EPL's is between 4% to 17.78% and mandibular molars and patients with stage II periodontitis and worse are most affected. EPL's are caused by biofilm establishment of the pulpal and periodontal tissues via communicative pathways between the two tissues which can be anatomical, developmental, pathological, or iatrogenic. There is no clear microbial profile linked to EPL's. Non-vital teeth with deep periodontal pockets are pathognomonic for EPL. Negative prognostic factors include:

- Increased periodontal destruction;
- Reduced levels of cemental root coverage;
- Presence of an infected root canal system;
- Perforations at the alveolar crest level, over 3mm in diameter and associated with a probing depth over 4mm and a pre-operative lesion;
- root fractures;
- Cemental tears in the apical third of the root and;
- Severe developmental defects.

The literature broadly suggests that non-surgical root canal treatment should be the first line treatment option with or without professional mechanical plaque removal. Adjunctive surgical options include combinations of open flap debridement, resection, hemisection, guided tissue regeneration (GTR) and endodontic microsurgery. Failing these, extraction is indicated.

**Key learning points:**

- Treatment of EPL's using GTR has showed promising results, with survival rates up to 95% at 5 years in teeth with bone loss to or past the apex, however there is minimal long term survival data. Where longer follow ups are available, attrition bias is high, skewing survival rates;
- EPL's should not automatically be assumed to be of hopeless or poor prognosis.

# OP025 - Endodontic Retreatment: Decision Making for Optimal Outcomes

Mandorah A[1]

[1]*Faculty Of Dentistry, Taif University*

**Summary:** The optimal goal of endodontics is to treat apical pathology and prevent recurrence of infection to root canal systems. Periapical lesions may fail to heal after primary root canal treatment due to different mechanical or biological causes, However, the correct decision regarding retreatment options are challenging issue impacting endodontic clinical outcomes.

**Key learning points:**

- Identify causes of post treatment diseases;
- Evaluate of the clinical outcomes of surgical and non surgical retreatment;
- Understand alternative retreatment options approaches and techniques.

# OP026 - RESTORATIVE-MATERIAL-RELATED ARTEFACTS IN DENTAL-DEDICATED MRI (DDMRI) WITH RELEVANCE IN ENDODONTICS

Johannsen K[1], Christensen J[1], Fuglsig J[1], Matzen L[1], Rendbæk H[1], Spin-Neto R[1]

[1]*Aarhus University, Section for Oral Radiology and Endodontics*

**Aim:** To explore how some common metallic materials used in dentistry may affect dental-dedicated magnetic resonance imaging (ddMRI) used in the diagnosis of endodontic pathology.

**Summary:** ddMRI is a non-invasive diagnostic modality that provides visualization of the hard and soft tissues of the dentomaxillofacial region without using ionizing radiation. This diagnostic modality may pose as an alternative to the current imaging modalities used in dentistry. However, ddMRI can be affected by the presence of metal and other metal-containing restorative materials, (e.g., gutta-percha (GP)), which may interfere with the outcome of image quality and impair the diagnostic yield. The present approach relies on a 0.55T MRI unit using a dental-dedicated 7-channel surface coil and dentistry-optimized imaging protocols. To illustrate the impact of restorative materials on ddMRI quality, 3 cases displaying different endodontic problems are presented. Each case had been treated using different dental materials.

**Results**: Case 1 presents a lower left molar, previously diagnosed with persisting AP at the distal root, now successfully root-filled in 4 canals and rehabilitated with an Emax crown. No visible artefacts were generated in the images. Case 2 presents an upper left molar with persistent pain root-filled in 4 canals and rehabilitated with a metallic post and PMF-crown. The artefact formation was localized to the restorative materials and appeared as white hyper-intense signals/voids around the crown of the tooth. Case 3 presented a Zirconia-bridge in the upper left premolar-molar region with spontaneous, undefined, and recurring pulpal symptoms. No visible artefacts were generated in the images.

**Key learning points:**

- ddMRI is a non-ionizing diagnostic modality for dental imaging, promising added diagnostic value in endodontics, even when restorative materials are present;
- ddMRI is susceptible to dental-material-related artefacts, however knowledge of the remaining limitations at low field strength and possible methods to reduce artefact formation is crucial.

# OP027 - DENTAL-DEDICATED MRI (DDMRI) FOR DIAGNOSIS IN ENDODONTICS

Christensen J[1], Kruse C[1], Johannsen K[1], Fuglsig J[1], Matzen L[1], Rendbæk H[1], Spin-Neto R[1]

*[1]Aarhus University, Section for Oral Radiology and Endodontics*

**Aim**: To demonstrate the endodontic diagnosis possibilities of images acquired with ddMRI.

**Summary**: Ionizing-radiation-based modalities (CBCT and intra-oral radiographs) are used for imaging periapical disease. However, these modalities only show mineral content in the bone. It is not possible to visualize pulp vitality, or to distinguish between active inflammation and ongoing healing/scar tissue. Though not established in dentistry, magnetic resonance imaging (MRI) allows soft-tissue visualization, promising complementary diagnostic information in dentistry, besides the advantage of eliminating radiation-related risks to patients.

**Results**: To illustrate the diagnostic potential of ddMRI, two patient cases are presented. The images were acquired on a 0.55T MRI unit equipped with a dedicated surface coil. Case 1 showed tooth 36 root-filled in 4 canals. The tooth had previously been diagnosed with persisting AP at the distal root, which was successfully treated. CBCT was acquired and showed apical radiolucency around the mesial root. ddMRI showed an area suggestive of periapical inflammation around the mesial root (hyperintense in T1, highlighted with fat-saturation). An area suggestive of scar tissue/healed bone was seen around the distal root (intermediate intensity in T1 and proton-density (PD)). Case 2 presented with discomfort in tooth 21. Evidence of root resorption and pulp obliteration was seen in CBCT that also showed an apical radiolucency. However, sensibility test was positive. ddMRI showed an apical area suggestive of scar tissue/healed bone (intermediate intensity in PD and T1). No signal was obtained from the pulp, suggesting (partial) pulp necrosis.
The results support the notion that ddMRI looks promising as a complementary diagnostic modality for endodontics, as distinction between vital/necrotic tissue and active inflammation/scar tissue is possible.

**Key learning points:**

- ddMRI is a new diagnostic modality for dentistry;
- ddMRI offers added diagnostic value in endodontic imaging, making it possible to distinguish between vital/non-vital pulp and active apical periodontitis/scar tissue.

# OP029 - 3D ENDODONTICS- ADVANCES AND NEW TECHNOLOGY

Isufi A[1], Hsu T[1], Chogle S[1]

*[1]Boston University GSDM*

**Aim:** The aim of this presentation is to discuss new 3D rendering software and technologies being implemented in Endodontics, for diagnosis, treatment planning, during treatment of clinical cases and for education of students and residents.

**Summary**

With the scientific and technological advances in diagnostic and therapeutic methods in the biomedical field there has been an increase in the predictability and longevity of the outcomes of dental procedures. The development of software programs and the use of these technologies for endodontic treatment can help in the diagnosis, preoperative treatment planning, makes it easier for patients to understand proposed procedures, increases the predictability of treatment and may reduce treatment failures, making the endodontic treatment safer and less invasive. Image analysis and visualization techniques are essential problems in the successful application of CBCT data. Different software platforms such as MeVisLab, 3D Endo, Amira, 3D Slicer, Sicat Endo, Blue Sky plan, guided endodontics through static guides, dynamic navigation and haptic guide and assistance with the Yomi robot will be presented. These preoperative procedures can increase predictability of the chosen technique, improve applicability of the treatment plan, shorten operative time and improve the communication with patients.

**Key learning points:**

- New software for 3D visualization, rendering, manipulation can help with diagnosis, treatment planning and during clinical procedures;
- New 3D technologies can help in education for students and residents, for better understanding in 3D the root canal system, preplan clinical cases, understand better and simulate diagnosis, treatment planning and clinical procedures;
- Endodontic treatment with the assistance of different 3D technologies is advancing to new and higher levels of accuracy, including software development, use of static guides, dynamic navigation and haptic guide and assistance with the Yomi robot.

# OP030 - FUSOBACTERIUM NUCLEATUM EXACERBATES PULPITIS VIA THE STING-DEPENDENT PATHWAY

Zhou L[1], Mao H[1], Li J[1], Zhang L[1,2], Chen Z[1,2]

*[1]School & Hospital of Stomatology, Wuhan University, [2]Department of Cariology & Endodontics, School and Hospital of Stomatology, Wuhan University*

**Aim:** Bacterial infection is the main cause of pulpitis. The aim of this study was to identify the alteration of the microbiota from healthy pulp to irreversible pulpitis and to explore a dominant bacteria which can promote the progression of pulpitis and its underlying mechanism.

**Methods**: We provided a comprehensive assessment of the microbiota alteration of irreversible pulpitis using 16S rRNA sequencing. Fusobacterium (F.) nucleatum was found the most enriched in tissue samples and this was validated by qPCR and FISH assay. Adult male SD rats were subjected to pulp exposure of the mandibular first molars and injected with F. nucleatum suspension, which accelerated pulpitis progression.

**Results**: Compared with the control group, F. nucleatum-infected group showed a severely disordered odontoblast layer, tissue destruction range, and extreme inflammatory cell infiltration after 24 hours operation. Micro-CT showed that periapical bone loss area in the F. nucleatum-infected rats was approximately 2 times larger than that in the control group after 28 days operation. Odontoblast-like cell was co-cultured with F. nucleatum and performed RNA sequencing. STING pathway and autophagy were activation after F. nucleatum infection. There is an interesting float of STING expression during F. nucleatum infection, which was degraded by autophagy at the early stage and strikingly increased by mitochondrial dysfunction and mtDNA escape at the late stage. mtDNA, which escaped into cytosol, caused more cytosolic mtDNA binding to cGAS. The release of IFN-β was dramatically reduced when mtDNA-cGAS-STING pathway inhibited. STING-/- mice showed milder periapical bone loss and lower serum IFN-β levels compared with wildtype mice after 28 days F. nucleatum-infected pulpitis model establishment.

**Key learning points:**
These studies highlight the interplay of F. nucleatum and host immune response in irreversible pulpitis and reveal an important role for F. nucleatum to exacerbate the progression of pulpitis, which is mediated by the STING-dependent pathway.

# OP031 - HYPERCITRULLINATION AND ANTI-CITRULLINATED PROTEIN ANTIBODIES IN CHRONIC APICAL PERIODONTITIS, A LABORATORY INVESTIGATION. DOES AUTOIMMUNITY CONTRIBUTE TO THE PATHOGENESIS?

Dremákné T[1], Martos R[2], Nagy A[3], Csősz É[4], Kiss C[5], Márton I[6,7]

*[1]Department of Oral Medicine, Faculty Of Dentistry, University Of Debrecen, [2]Department of Operative Dentistry and Endodontics, Faculty of Dentistry, University of Debrecen,, [3]Department of Health Informatics, Faculty of Health Sciences, University of Debrecen, [4]Proteomics Core Facility, Department of Biochemistry and Molecular Biology, Faculty of Medicine, University of Debrecen, [5]Division of Pediatric Hematology-Oncology, Department of Pediatrics, Faculty of Medicine, University of Debrecen, [6]Department of Biochemistry, Faculty of Medicine, University of Debrecen, [7]Faculty of Health Sciences, University of Debrecen*

**Aim**: Citrullination of proteins may lead to the formation of anti-citrullinated autoantibodies (ACPA-s) initiating the formation of an autoimmune loop which may contribute to the perpetuation of inflammatory reactions and tissue damage in chronic apical periodontitis. The objective of this study was to demonstrate the formation of citrullinated proteins and ACPA in chronic apical periodontitis.

**Methods:** Twenty-five periapical granulomas (n = 25) were investigated in the study. Healthy periodontal tissue samples served as normal control tissue (n = 6). The peptidyl-citrulline level was determined with the dot blot method. Differences between periapical granuloma and control samples were assessed using Mann-Whitney U tests. p Values <.05 were considered as statistically significant.

**Results:** Protein concentrations, peptidyl-citrulline levels and anti-CCP ratios were compared between periapical granuloma and healthy control groups. Multiple linear regression analysis revealed significant (p = .042) hypercitrullination in periapical granuloma samples. Moreover, there was a significant difference in the ACPA ratios between periapical granuloma (2.03 ± 0.30) and healthy control (0.63 ± 0.17) groups (p = .01). Seventeen of 25 periapical granuloma samples (17/25; 68%), whereas one out of six control samples (1/6; 17%) were shown to be positive for the presence of ACPA.

**Conclusion**: This is the first study detecting the presence of citrullinated peptides and APCA in periapical granuloma, suggesting the contribution of autoimmune reactions in the pathogenesis and perpetuation of chronic apical periodontitis.

**Key learning points:**

- In chronic apical periodontitis citrullination occur that can lead to antibody formation, frequently;
- Chronic apical periodontitis can also be a risk factor for rheumatoid arthritis.

Renáta Martos and Ildikó Tar contributed equally to this work.
Ildikó Márton and Csongor Kiss contributed equally to this work.

# OP032 - EFFECTS OF N-ACETYL-L-CYSTEINE AGAINST APICAL PERIODONTITIS IN RATS WITH ADRIAMYCIN-INDUCED CARDIOMYOPATHY AND NEPHROPATHY

Sebai A[1], Şehirli A[2], Sayıner S[3], Orhan K[4], Aksoy U[1]

*[1]Near East University, Faculty of Dentistry, Department of Endodontics, [2]Near East University, Faculty of Dentistry, Departments of Pharmacology, [3]Near East University, Faculty of Veterinary Medicine, Department of Biochemistry, [4]Ankara University, Faculty of Dentistry Department of DentoMaxillofacial Radiology*

**Aim:** The aim of this study is to investigate the potential protective effects of N-acetyl-L-cysteine (NAC) against apical periodontitis (AP) in rats with adriamycin-induced kidney and heart diseases.

**Methods:** This study discusses the effects of N-acetyl-L-cysteine (NAC) on apical periodontitis (AP) in rats with adriamycin-induced kidney and heart diseases. The study involved dividing 48 Wistar albino rats into 6 groups, including a control group, ADR group, AP group, AP+ADR group, AP+NAC group, and AP+ADR+NAC group. After 3 weeks, the rats were decapitated, and blood and tissue samples were collected for analysis.

**Results:** The results showed that NAC treatment reduced the serum levels of TNF-α, IL-1β, BUN, Creatinine, CK, and LDH, which were elevated in the test groups compared to the control group. Additionally, NAC treatment reduced heart-to-body weight ratio (HW/BW) and kidney-to-body weight ratio (KW/BW) in the test groups. The volumetric apical bone resorption analysis showed a decrease in the total area and volume of resorption cavities with NAC treatment. These results suggest that NAC has potential antioxidant and anti-inflammatory effects, which may help reduce adriamycin-mediated heart and kidney damage and have a positive effect on apical periodontitis in individuals with nephropathy and cardiomyopathy.

**Key learning points:**

- N-acetyl-L-cysteine (NAC) has potential protective effects against apical periodontitis (AP) in rats with adriamycin-induced kidney and heart diseases;
- NAC treatment reduced the serum levels of inflammatory cytokines and hemodynamic parameters in the test groups compared to the control group;
- NAC treatment reduced heart-to-body weight ratio (HW/BW) and kidney-to-body weight ratio (KW/BW) in the test groups;
- NAC treatment reduced the total area and volume of resorption cavities indicating a decrease in AP;
- NAC could be a promising adjunct therapy for the treatment of AP in individuals with systemic diseases, including cardiomyopathy and nephropathy.

# OP034 - ATTENUATED DEVELOPMENT OF APICAL PERIODONTITIS WITH AGE- A MURINE MODEL

Goldman E[1,2], Abramovitz I[2], Klutstein M[1]

*[1]Institute of Dental Sciences, Hebrew University, [2]Endodontic Department, Hadassah Medical Center*

**Aim**: Older age is associated with reduced immune function. Our aim was to study how age affects the development of Apical periodontitis (AP), an inflammation occurring in the periodontal tissues surrounding the apices of infected teeth.

**Methods:** AP was induced in mice, and 2 age groups were compared (young: 6-8 weeks, adult: 8-10 months). The teeth and jaws were histologically processed and stained by Hematoxylin Eosin (H&E), Brown and Brenn (B&B), and tartrate-resistant acid phosphatase (TRAP). In addition, the samples were scanned by micro-computerized tomography (micro-CT) to evaluate the volume of the PA lesions. On the cellular level, cell density in the PA region was computationally assessed on H&E slides by a colorimetric evaluation software.

**Results:** The young group presented more canals with necrotic radicular pulp compared to the adults. There was no difference in bacteria location in the canals between the groups. The periapical cell density was higher in the young group compared to the adults. More multinucleated osteoclasts were present in the lesions of the young mice, in correlation to the higher volume of bone resorption in the lesions of the young group.

**Conclusions:** Overall, we conclude that the immune reaction to AP stimuli was attenuated in the adult mice compared to the young.

# OP035 - THE INFLUENCE OF PATIENT'S RACE ON THE OUTCOME OF ENDODONTIC TREATMENTS: A POOLED ANALYSIS OF 1 YEAR RECALL DATA FROM FOUR CONE BEAM COMPUTED TOMOGRAPHY OUTCOME STUDIES

Patel N[1], Mannocci F[1], Scambler S[1]

[1]*Kings College London*

**Aim:** 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.

**Methods:** Data collected from four prospective clinical outcome studies were pooled. Patients were recalled 12 months after the completion of the treatment. Treatment outcome was determined by clinical findings and cone beam computed tomography (CBCT) examination. Statistical analysis included the description of categorical and continuous variables and simple binary logistic regression models, Chi2 tests and Kruskal-Wallis tests.

**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.

**Key learning points:**

- 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 about differences in racial outcomes;
- Clinicians can ensure extra care is taken to follow endodontic treatment protocols thereby reducing discrepancies.

# OP036 - METHODS OF ASSESSING ORAL HEALTH–RELATED QUALITY OF LIFE IN THE LITERATURE, AFTER ENDODONTIC TREATMENT

Jaajaa A[1], Abiad R[1]

[1]*Beirut Arab University*

**Aim**: To determine the methods of assessing oral health-related quality of life and the best method to be used in future research.

**Methods**: An electronic search was conducted among three electronic databases (Pubmed, EBSCO, and google scholar) following the PRISMA guidelines. The search was performed to identify the available studies on methodology of assessing oral health-related quality of life in endodontics, through the searched databases. Using the keywords “oral health-related quality of life”, “root canal treatment”, and “root canal retreatment”. A total of 160 records were identified, 110 through PubMed, 42 identified through EBSCO, and 8 records were identified through google scholar. After duplicates removal, screening, and removal due to unmatching the keywords 31 full-text articles were assessed for eligibility. Ten more articles were removed afterwards because they did not contain the needed information. At the end, the articles that were used in this literature review were 21 articles.

**Results:** Among the 21 studies, the most common assessing methods of OHRQoL were standardized OHIP-14 and 17-item version of OHIP. The least commonly used methods of assessment were quality of life scale and the 9-item version. For postoperative assessment, 3 articles used postoperative quality of life (POQoL). In conjunctive with OHRQoL assessment 7 papers used visual analogue scale (VAS) for pain assessment. Most of articles that assessed quality of life related to endodontics used the 17-item version. Comparision of different types of assessment will be presented in the poster.

**Conclusions:** Based on the results of this literature review, standardized 17-item version of OHIP seems to be the best method to be used in the endodontic field, mainly due to its accurate results, ease of use by the examiner and not too difficult to be understood by the patient.

# OP037 - OUTCOME OF ROOT CANAL TREATMENT USING A NEW READY-TO-USE BIOCERAMIC AS FILLING MATERIAL – INTERIM RESULTS OF A MULTICENTRIC RANDOMIZED CLINICAL TRIAL (12 MONTHS FOLLOW-UP)

Simon S[1], Marchi V[3], Colombel H[3], Robert S[3], Revalec N[3], Dorn A[3], Leprince J[2]

*[1]University of Rouen, [2]University of Geneva, [3]Private practice*

**Aim:** The aim of this study was to evaluate the efficiency of root canal filling with Bioceramic and prove the non-inferiority of a new ready-to-use product to BioRoot RCS (Septodont) in terms of performance and safety.

**Methods:** In a multicentric Randomized Clinical Study conducted in France and Belgium, one hundred sixty patients (RCT and NSRCT) were randomly assigned into 2 groups according to the root canal sealer – new ready-to use bioceramic root canal sealer (group 1) compared with BioRoot RCS® (Septodont – (France) (group 2). The primary endpoint was 2-year efficacy rate of endodontic treatment based on radiological criteria assessed in a blinded manner by independent reviewers and clinical criteria assessed by the investigator.

**Results:** The efficacy rate of the endodontic treatment at 12 months was 92.6% and 90.8% for patients treated by the new ready-to-use bioceramic root canal sealer and BioRoot RCS, respectively. The difference was not significant. Adverse events rate was comparable in the two groups. There are no device-related serious adverse events were reported in the two groups.

**Key learning points:**

- Root canal Filling with Bioceramic material is a relevant technique.
- In the frame of this study (NCT04757753) root canal treatment with the new ready-to-use bioceramic root canal sealer is as effective and safe as BioRoot RCS.
- These promising results at 12 months should be confirmed at 2 years.

**Funding:**
The clinical trial was sponsored by SEPTODONT.

# OP038 - RESORPTIODONTICS: OBSERVATIONAL STUDY AND NEW TREATMENT FLOWCHART FOR ROOT RESORPTIONS

Alovisi M[1]

[1]*University Of Turin*

**Aims**: the first aim was to analyse prevalence, characteristics, risk factors, and proposed treatment plan for internal and external root resorptions through clinical and radiological cone-beam computed tomography (CBCT) evaluation. The second aim was to present a new clinical flowchart for the management of the root resorptions.

**Methods**: a clinical observational study was conducted at the University of Turin (Italy). Ninety-two patients with the diagnosis of one or more internal or external root resorptions were selected. The anamnestic, clinical, and radiological data were collected to assess the clinical features, morphology, risk factors, and proposed treatment. The CBCT scans (110 Kvp, 2mA) were analysed with two dedicated software and a mask was created to isolate the resorbed area and to calculate the volume through a 3D model. Whenever indicated, histological analyses were performed to confirm the diagnosis.

**Results:** The most common root resorptions were the external inflammatory and they were localized mainly on the frontal maxillary teeth, while the first molars were mostly affected by internal resorptions. The prevalent risk factors were malocclusion and orthodontic movements generally with aligners, followed by trauma and parafunction. Clinically, both internal and external resorptions resulted often asymptomatic with nonspecific signs and symptoms, leading to late diagnosis. Therefore, the mean extension and volume resulted high compared with the root and crown and the margins appeared often subgingival with bone growth into the lesion. Internal resorptions reported a more favourable prognosis than external ones that frequently lead to tooth extraction. Thus, the root resorptions' localization, margins, pulpal involvement, presence of osteosclerosis and periodontal status are main factors influencing therapy. As the treatment of such lesions implicates a multidisciplinary approach, periodontal, restorative, endodontic and aesthetic concerns, a new clinical flowchart for the decision making with internal and external root resorptions based on clinical and CBCT data is proposed.

# OP039 - EXTERNAL CERVICAL RESORPTION: HOW TO TREAT?

Askerbeyli Örs S[1]

[1]*Hacettepe University Faculty of Dentistry Department of Endodontics*

**Aim:** To share the latest information on the diagnosis and treatment of external cervical resorption.

**Summary**: External cervical resorption (ECR) is an aggressive type of root resorption that may occur due to damage to the periodontal ligament or subepithelial cement in the cervical region of teeth. A new classification by Patel et al., based on CBCT, enables more accurate treatment planning. The amount of degraded dentine, and the location and extent of resorption, are essential factors during treatment planning. Various treatment options have been proposed for teeth with ECR, such as extraction, monitoring, and repairing the defect with or without root canal treatment. The defect can be repaired using an external approach, an internal approach, a combination of both, or through intentional extraction and replantation. When bone-like tissue is present at the portal of entry and/or probing is not possible, an internal approach is recommended to remove resorptive tissue and seal the portals of entry. An external approach is usually preferred when portals of entry are accessible, probing is feasible, and the ECR lesion contains granulomatous tissue. The defect can be repaired with composite resin and/or glass ionomer cement (GIC) after completely cleaning the resorption cavity. Calcium silicate-based cements (CSCs) have also been recommended for repairing the resorption cavity, especially when pulp capping is necessary. The location of perforation and the mechanical properties of the applied material may influence the prognosis. The behaviour of the preferred material under force may affect the survival of the restored tooth.

**Key learning points:**

- CBCT-based ECR classification improves treatment planning;
- Various treatment options: extraction, monitoring, repair;
- Repair approaches: external, internal, combination and replantation;
- Material choice affects prognosis.

# OP040 - COMPARISON OF THE EFFICIENCY OF DIFFERENT IRRIGATION METHODS FOR REMOVAL OF CALCIUM HYDROXIDE FROM SIMULATED INTERNAL RESORPTION CAVITIES

Kemeç U[1], Özalp Koca A[1], Berkdemir N[1], Arıcan Alpay B[1], Özyürek T[1]

*[1]Bahçeşehir University School of Dental Medicine, Department of Endodontics*

**Aim**: This study aimed to compare the effectiveness of the conventional syringe method, PUI, EDDY, and PulpSucker in removing calcium hydroxide from root canals with simulated internal resorption cavities.

**Methods:** Forty eight extracted human mandibular premolars were used in this study. Root canal preparations were completed with T-endo Must 25 (25/.06). After the teeth were divided into two equal parts along their long axis, standard internal resorption cavities were formed in both halves at a distance of 8 mm from the root tip. Calcium hydroxide was applied to the resorption cavities and the roots were reassembled. After 2 weeks incubation period with 100% humidity, the teeth were randomly divided into 4 groups (n=12) according to irrigation methods used (conventional irrigation, passive ultrasonic irrigation, EDDY and Pulp Sucker). Following the irrigation protocol, images of each half of the canal with a resorption cavity were obtained under a dental operating microscope at 40X magnification. Measurements were made on these photographs using the Image J. For each sample, the percentage of the remaining calcium hydroxide surface area to the total surface area of the resorption cavity was calculated. Obtained data compared with Kruskal–Wallis and Mann–Whitney tests.

**Results:** The difference in remaining calcium hydroxide between all groups was statistically significant ($p<0.05$). EDDY removed statistically higher percentage of calcium hydroxide from internal resorption cavities than conventional irrigation, ultrasonic activation and PulpSucker system.

**Key learning point:** Sonic irrigation activation techniques can be used effectively to remove calcium hydroxide from internal resorption cavities.

# OP042 - MANAGEMENT OF AN EXTERNAL CERVICAL RESORPTION: CLINICAL CASES

Loré V[1], Engelvin P[1], Caussin E[1], Golbano R[1], Cornut H[1], Laroye A[1], Izart M[1], Gabriel R[1], Marchi V[1], Beres F[1]

*[1]DU d'Endodontie de l'Hôpital Bretonneau*

**Summary**: External cervical resorption is a pathological process leading to the destruction of the dental organ by inner cells, starting at the cervical part of the tooth. Nowadays, only a few studies with a high level of evidence can be found concerning this pathology because of its low prevalence.
Usually diagnosed at a late stage due to the absence of symptoms, external cervical resorptions constitute a real challenge for the practitioner, in particular on how to be minimal invasive while having a good access to the lesion and maintaining the pulp vitality. Moreover, external cervical resorption is a complex process whose etiology is difficult to identify due to the multifactorial nature of this pathology.
Radiography are essential in the diagnosis of external cervical resorption. However, 2D X-ray images are not always precise enough to establish the diagnosis and evaluate the prognosis. This is why 3D X-ray images are frequently made in addition. Several studies have shown that the use of CBCT can influence the practitioner's decision-making. Indeed, CBCT had greater sensitivity and specificity than conventional radiography in detecting external cervical resorptions.
In addition to the acknowledge of their pathophysiological process as well as the existing classifications, it is now possible to set up appropriate therapeutic in order to treat and restore the affected tooth.

**Aim:** The aim of this work is, after doing a quick review of the pathophysiological process of external cervical resorption, to illustrate thanks to clinical cases, the different approaches to access the lesion. Either externally, through the periodontal tissues, or internally, via the endodontium, in order to allow ideal management and promote the prognosis of the tooth.

# OP043 - BIOFILMS IN ENDODONTICS: A HISTORICAL OVERVIEW AND CURRENT ELIMINATION APPROACHES

Keles A[1]

[1]*Hacettepe University Faculty Of Dentistry Department Of Endodontics*

**Aim:** To examine the history of biofilm and assess contemporary protocols for removing it from root canal walls.

**Summary**: Antonie van Leeuwenhoek, a Dutch draper, created the first single-lens microscope for examining his own fabrics. Using these primitive microscopes, he discovered the vast world of microorganisms, which he called "little animals." The first oral microbiologist, an American dentist, Willoughby Dayton Miller, conducted a groundbreaking study in 1894 that discovered microorganisms inside the root canals. Kakehashi and colleagues' seminal 1965 study, which has garnered the highest number of citations in endodontics, demonstrated that the primary cause of pulp necrosis and periapical granulomas are bacteria. Microorganisms typically exist as part of communities attached to wet surfaces to form biofilm. Early references to the concept of biofilm can be found in the marine industry in the 1930s. Microorganisms living in communities on surfaces of ships exposed to water for long periods of time were referred to as "slime" or "slimy bacterial layers," even though the term "biofilm" had not been coined yet. The term "biofilm" was first used in an article on water filters in 1975 and first appeared in a dental article in 1981. In 1987, Noir et al. observed bacterial deposits on the walls of infected root canals, although they did not identify them as a biofilm. Today, methods are being developed to eliminate biofilm from root canal walls, including combining irrigation solutions, new materials such as nanoparticles, or different activation methods such as photo-dynamic activation.

**Key learning points:**

- Microorganisms had been observed as communities before the term biofilm was coined;
- Since some solutions are not as effective as sodium hypochlorite, it continues to be the gold standard for eliminating biofilm;
- While some current expensive methods are effective, they are not more effective than conventional methods.

# OP044 - NANOMETRIC TOPOGRAPHIC AND BIOFILM INITIAL ADHESION ANALYSIS ON ENDODONTIC SUBSTRATES TREATED OR NOT WITH IRRIGANTS BY ATOMIC FORCE MICROSCOPY

Bombarda de Andrade F[1], Velasquez-Espedilla E, Pedrinha V, Coelho J, Cuellar M, Barros M, Ribeiro A

[1]*Bauru School Of Dentistry - University of São Paulo*

**Aim:** To evaluate the initial adhesion process in the early stages of biofilm formation on surfaces of plasticized gutta-percha and treated human dentin by means of atomic force microscopy (AFM), also evaluating the roughness of these surfaces.

**Methods**: Gutta-percha blocks (cones or plasticized gutta-percha) were made in metallic rings and submitted to decontamination under a UV light. The images, topography and roughness of the samples were acquired by AFM, 15 minutes after the placement of the inoculum of Enterococcus faecalis at a standardized concentration to simulate the onset of biofilm development. Dentin blocks were obtained from the root of human canines using a bone trephine, polished and sterilized in an autoclave. The irrigants utilized were (n=6): G1) 17% EDTA, G2) 2.5% NaOCl; G3) 2.5% NaOCl + 17% EDTA, G4) 5% NaOCl + 18% HEBP. The evaluations in AFM were arranged in two stages. Stage I: The inoculum was placed over the dentin and the effect of the irrigants on the newly formed biofilm was visualized after 15 minutes. Stage II: The dentin was treated with the irrigants and then the inoculum was placed, verifying by AFM the greater or lesser microbial adhesion in this treated substrate. A software was used to quantify bacterial cells.

**Results**: The topography of gutta-percha affected the initial adhesion of E. faecalis, favoring its occurrence mainly in valley regions, in rough surfaces. The plasticized gutta-percha was less irregular, accumulating less bacteria. In stage I the groups G2 and G3 showed greater removal of biofilm and in stage II, G3 showed less adhesion of E. faecalis after surface treatment. The substrate roughness was higher in the G3 group, showing the influence of the EDTA chelating agent. The association of NaOCl and EDTA eliminated greater number of formed biofilms, as difficulted the adhesion of bacteria over the dentinal substrate.

# OP045 - CLINICAL EVALUATION OF THE EFFICACY OF THE FINAL IRRIGATION PROTOCOL IN THE ERADICATION OF BACTERIAL SPECIES IN TEETH WITH CHRONIC APICAL PERIODONTITIS

Sesar A[1], Budimir A[2], Šegović S[3], Pavelic B[3], Anić I[3], Bago I[3]

*[1]Dental Polyclinic Zagreb, [2]Department of Medical Microbiology, Prevention and Infection Control, School of Medicine, University of Zagreb, [3]Department of Endodontics and Restorative Dentistry, School of Dental Medicine, University of Zagreb*

**Aim**: To identify bacterial species in necrotic root canals of teeth with chronic apical periodontitis and to evaluate the additional antimicrobial effect of the final irrigation protocol against bacterial load in necrotic canals after chemo-mechanical instrumentation.

**Methods**: Forty patients with necrotic teeth with chronic apical periodontitis were selected for this study based on previously defined inclusion and exclusion criteria. The root canals were instrumented using a reciprocating instrumentation technique with 2.5% sodium hypochlorite (NaOCl) solution. The final irrigation protocol included: 3 ml 2.5% NaOCl, 2 ml ethylenediaminetetraacetic acid (EDTA) and 2 ml NaOCl. The root canals were filled using cold lateral condensation technique using an epoxy resin-based sealer and gutta-percha cones. A single visit root canal treatment was performed by a specialist endodontist in all cases. Microbiological samples from the root canal were collected using a paper point technique: before instrumentation (sample 1.), after chemo-mechanical treatment (sample 2.) and after the final irrigation protocol (sample 3.). Microbiological analysis was carried out by identification of bacteria using MALDI-TOF mass spectrometry and colony forming units (CFUs) counting by the culture method. The results were analyzed using Wilcoxon test with a significance level of 0.05.

**Results**: There are no significant differences in relation to the representation of aerobic and anaerobic bacteria between individual samples ($p>0.05$). The first sample showed the presence of 55 aerobic and anaerobic bacterial species in the patients. The most common bacteria that appeared in all samples was Streptococcus oralis. The results showed significant reduction of bacteria species after root canal instrumentation and after final irrigation protocol ($p<0.001$).

**Conclusion**: The final irrigation protocol is an important antimicrobial step during root canal treatment causing significant eradication of intracanal infection.

# OP046 - INVESTIGATING THE ANTIMICROBIAL EFFICACY OF HYPOCHLOROUS ACID AGAINST ENTEROCOCCUS FEACALIS

Aly A[1], Jarad F[1], Longridge N[1], Valappil S[1]

[1]*University Of Liverpool*

**Aim**: The aim is to present findings of different laboratory models used to compare the antimicrobial activity of OraWizeR (hypochlorous acid) with other irrigants including Saline, 1% Sodium hypochlorite (NaOCl), 2% Chlorhexidine (CHX), 0.2% CHX, and 17% EDTA.

**Introduction**: Irrigation of the root canal space with an antimicrobial agent is considered one of the most important stages of endodontic treatment. Sodium hypochlorite is the most commonly used irrigant but is a severe irritant if extruded or ingested. Alternative safer solutions such as hypochlorous acid (HOCl) have been proposed.

**Methods/results**: Planktonic bacteria were used in two different models. Disk diffusion assays were carried out on E. faecalis NCTC775 grown on BHI agar and diameters of zones of inhibition were measured. Direct suspension test was also completed by mixing test agent with bacterial inoculum and remaining bacteria enumerated using serial dilution. Results indicated bacterial susceptibility to OraWize using the direct suspension test but no activity using the disk diffusion assay. EDTA resulted in the largest zones of inhibition ($P<0.05$).
E.faecalis biofilms were generated on nitrocellulose membrane filters for 48hrs and subjected to 5 min, 15min or 1h incubation with each of the test agents. Additionally 18-day biofilms were generated on bovine dentin disks and exposed to test agents for 5 minutes. Remaining bacteria were enumerated using serial dilutions whilst biofilm viability was investigated using LIVE/DEAD staining and confocal laser scanning microscopy (CLSM).
Results indicated a time dependent anti-biofilm action for OraWize. 1% NaOCl demonstrated superior anti-biofilm activity compared to all other test groups ($P<0.01$). CLSM images provided insight into viability and density of treated biofilms in 3-dimensions.

**Key learning points:**

- Limited correlation between use of planktonic and biofilm models.
- Irrigant type, exposure time and concentration of irrigant influence antimicrobial action.
- CLSM is a powerful adjunct to enhance the findings of culturing techniques.

# OP047 - HIGH-SPEED IMAGING ANALYSIS OF THE MOTION CHARACTERISTICS OF SONIC AND ULTRASONIC IRRIGANT ACTIVATION DEVICES

Meire M[1], Al Ani M[1], Swimberghe R[1], de Moor R[1]

*[1]Section of Endodontology, Department of Oral Health Sciences, Ghent University*

**Aim:** To describe the motion characteristics and oscillatory properties of selected ultrasonically and sonically powered irrigant activation systems.

**Summary:** This lecture focuses on the behaviour of oscillating tips used for irrigant activation. Using a high-speed camera, recordings of two ultrasonically (EndoUltra and IrriSafe) and one sonically (EDDY) oscillating irrigant activation systems were made under the following experimental conditions: a large reservoir containing water or 3% NaOCl, and a root canal model filled with 3% NaOCl. Tip amplitude, oscillation frequency, the number and location of nodes and antinodes, and movement pattern were determined. Oscillation frequencies were 6.3 (Eddy), 31 (Irrisafe) and 45 (EndoUltra) kHz. Tip amplitude was 426 (Eddy), 25 (Irrisafe) and 38 (EndoUltra) µm. Irrisafe and Endoultra presented a standing wave pattern with 5 antinodes (including the tip) and an oscillation direction mainly in a single plane; Eddy displayed a traveling wave pattern and a multiplanar oscillation. Eddy and EndoUltra showed significantly higher displacement amplitude in 3% NaOCl than in water. High-speed imaging videos are used to demonstrate the different oscillation characteristics and 3D movement of the systems.

**Key learning points:**

- To appreciate high-speed imaging as a methodological tool;
- To understand the oscillation characteristics of ultrasonically and sonically powered irrigant activation systems;
- To be aware of the differences in motion characteristics between the selected systems.

# OP049 - OCCLUSAL TRAUMA AND PULPAL NECROSIS: A DIAGNOSTIC DILEMMA

Sherpa M[1], Zimet P[2]

*[1]Queen Mary University London, [2]La Trobe University*

**Introduction:** Trauma from occlusion and its effects on the dental pulp have been noted as an underreported topic. Trauma from occlusion may be acute from a high restoration or chronic due to bruxism. The potential symptoms associated with occlusal trauma include dentine hypersensitivity, pulpitis and pulp necrosis. The symptoms reveal the intimate relation between the enamel, dentine, dental pulp and periodontal ligament complex. The complicated nature and lack of obvious etiopathosis of pulpal symptoms due to trauma from occlusion often leads to difficulties in diagnosis and potentially resolution of symptoms for the dental patient.

**Aim:** This narrative review aims to summarise the literature on this topic, and introduce a hypothesis of the mechanism of pulpal response to trauma from occlusion.

**Summary:** The pathogenesis of pulpal inflammation and its progression from pulpitis to pulpal necrosis will be reviewed. The relation of the odontoblast as the initiator of pulpitis as well as the role of the odontoblast in tooth sensitivity will be discussed. The consequences of the pulpal inflammatory process are multifaceted and within the non-compliant pulpal environment may ultimately result in pulpal necrosis. While the literature has addressed the role of the odontoblast as an agent of neurogenic inflammation, there is a paucity of literature discussing how trauma from occlusion initiates the odontoblastic and pulpal response. The relation of the odontoblast as a conduit between infected enamel lamellae or craze lines and the subsequent pulpal response will be investigated.

**Key learning points:**

- Highlight occlusal trauma as a potential cause of pulpal response e.g. hypersensitivity, pulpitis and pulpal necrosis;
- Review the function of odontoblasts as initiators of the pulpal inflammatory process as well as their role in sensation and nociception;
- Discuss the progression of the inflammatory process in the pulp;
- Provide a hypothesis of how trauma from occlusion can result in pulpal symptoms.

# OP050 - EVALUATION OF ARTIFICIAL INTELLIGENCE OF PERIAPICAL STATUS AND RESTORATIONS OF ENDODONTICALLY TWO YEARS TREATED TEETH

Keskin N[1], Uslu G, Günec H

*Department Of Endodontics, Faculty Of Dentistry, Yıldırım Beyazıt University, Ankara, Turkey*

**Aim:** The purpose of this study is to assess the accuracy of radiographic diagnosis for caries and periapical infection by contrasting undergraduate students, endodontics specialization students with artificial intelligence (AI) applications, based on the reliable conclusions made by specialist dentists.

**Methods**: Among the 1,540 patients who applied to Ankara Yıldırım Beyazıt, Dentistry Faculty for endodontic treatment during the years 2020-2023, 68 volunteer patients who met the study criteria were included in this retrospective study. 68 radiographic and 191 teeth which were treated endodontically two years ago was examined by 2 Undergraduate students, 2 endodontics specialization students for endodontics, 1 Endodontist and an artificial intelligence application. They performed diagnosis on the same panoramic radiographs independently and evaluated periapical conditions, caries and restoration assests of the related teeth. Presence of restoration and caries were scored as present/absent. Radiographic periapical status of teeth was evaluated using Periapical index scoring (PAI). The statistical analyzes were performed using the chi-square test and Pearson correlation coefficient was calculated. Intra- observer and inter-observer agreement was calculated using the kappa test ($\alpha$=0.05).

**Results**: Among all the teeth examined, AI showed middle agreement to detection caries and restoration between the other observers $\kappa$ (0.595). A value of $\kappa$ (0.271) showed low agreement the PAI score between Endodontist and AI. The high intra-observer consistency level obtained in the evaluation of PAI scores, caries and restoration in this study.

**Conclusions**: The artificial intelligence application gave inaccurate results, in detecting periapical lesions. On the other hand, in caries detection, the diagnosis rate was high for both artificial intelligence and other observers. AI program can enhance the assessment of dental problems using two-dimensional panoramic radiographs.

**Keywords**: Artificial Intelligence, periapical pathology, computer-aided diagnosis.

# OP051 - NON-SURGICAL SECONDARY TREATMENT VERSUS IMPLANT PLACEMENT: 8-YEAR HISTORICAL PROSPECTIVE STUDY

Zamparini F[1], Spinelli A[1], Lenzi J[3], Gandolfi M[2], Prati C[1]

*[1]Endodontic clinical section, Dental School, Department of Biomedical and Neuromotor Sciences, University of Bologna, [2]Laboratory of Green Biomaterials and Oral Pathology, Dental School, Department of Biomedical and Neuromotor Sciences, University of Bologna, [3]Department of Biomedical and Neuromotor Sciences, University of Bologna, 40138 Bologna, Italy*

**Aim:** This historical prospective study aims to evaluate the outcome of premolars with carious and periapical lesion that underwent to secondary treatment (ST) versus premolars affected by deeper carious and periapical lesions that were extracted and replaced by implants (EI).

**Methods:** Patients attended the Clinical Endodontic Section of the University Dental School from January 2007 to December 2015 were considered eligible when at least one root-canal-treated premolar resulted affected by endodontic pathosis (n=147). Preoperative periapical-index (PAI), residual-crown-structure, root-canal post, periodontal parameters (PPD, BoP, CEJ-MBL) were recorded. The decision for EI or ST was made in accordance to best clinical practice. ST were made in accordance with validated protocols using ultrasounds, manual instrumentation, and copious irrigation. Root canals were filled with Thermafil+AH-Plus, restored with adhesive composite and with metal-ceramic crowns after 3-6 months. Implants were placed with non-submerged (tissue-level) flapless technique and loaded after 3-4 months with cemented metal-ceramic crowns. Each patient was included in an annual recall program.
Kaplan-Meier survival-curves were performed to evaluate the tooth/implant survival and the complications occurred.

**Results**: After 8 years, 76 ST and 60 EI were evaluated (128 patients; 60-M; 68-F). Total drop-out was 12.9%. Not-healing periapical lesions were reported in 5 premolars (6.5%). Eight root fractures were reported (10.5%) and resulted the major conditions that affected the survival. One implant was removed for periimplantitis, 5 implants showed abutment loosening that required their repositioning. Periodontal and aesthetic parameters resulted stable in both groups. Final implant failure rate was 1.7%, ST failure was 19.5%.

**Conclusion:** The study suggests that after 8 years ST showed a greater number of complications when compared to EI.

**Key learning points:**
The clinicians must consider the type of complications and the risk in the long term for root fracture in relationship with premolars pre-operative conditions.

# OP053 - MICRO-CT EVALUATION OF CALCIUM HYDROXIDE PASTE REMOVAL FROM ROOT CANALS USING LASER ACTIVATED, ULTRASONIC ACTIVATED AND SONIC ACTIVATED IRRIGATION METHODS - AN IN- VITRO STUDY

Pandey P[1], Tikku A[1], Verma P[1]

*[1]King Georges Medical University*

**Aim:** The study aims to determine the efficacy of different irrigation activation systems (manual, sonic, ultrasonic, and laser) in removing calcium hydroxide paste from root canals through micro-CT evaluation.

**Methods:** A total of seventy standardized plastic models, simulating one main and two lateral root canals were used for the study. An oil-based calcium hydroxide (CH) medicament was placed inside the root canal and the apices were sealed using wax to simulate a closed irrigation system. The simulated root canal models were then assigned to different groups according to the irrigation system used to remove the CH paste - Group 1: Manual irrigation using side vented needles (control group), Group 2: Ultrasonic activated irrigation, Group 3: Sonic-activated irrigation using endo-activator, Group 4: Er:YAG laser-activated irrigation and Group 5: Er,Cr:YSGG laser-activated irrigation. Micro-CT imaging and Dolphin imaging software was used to calculate the percentage of CH removal from the canals. The data was statistically analyzed. $P<0.05$ was considered to be statistically significant.

**Results**: Er:YAG laser group (69.50%±4.36%) showed the highest amount of calcium hydroxide removal from the main canal followed by Er,Cr:YSGG laser group (67.24%±7.24%), ultrasonic activated group (63.51%±6.91%), sonic activated group (44.25%±6.66%), and least in manual needle irrigation group (37.29%±5.73%). Laser and ultrasonic-activated irrigation effectively removed intracanal medicament from the main and lateral canals, although no statistically significant difference was seen.

**Key learning points:**

- Complete removal of CH from the root canal was not achieved with any of the tested irrigation systems. As the removal of intra-canal medicament is challenging for clinicians, the study may help the clinician to select the most efficient method to remove CH medicament.
- Laser-activated irrigation can remove the calcium hydroxide more efficiently than other irrigation systems, within the limitations of the study.
- Manual irrigation was found to be the least effective in the removal of CH.

# OP054 - CLINICAL APPLICATIONS OF DENTAL LASERS IN ENDODONTICS

Yumak B[1], Kandemir Demirci G[1]

*[1]Ege University Faculty of Dentistry Department of Endodotics*

**Aim:** The aim of this presentation is to examine the dental laser studies in Endodontics and to present with case examples. Thus, the collective information needs of endodontists working in the dental laser field will be met.

**Summary**: Light Amplification by Stimulated Emission of Radiation (LASER) has taken its current position by changing and developing for about 100 years. Dental lasers have become popular in endodontics as well as in other areas of dentistry in recent years. Lasers are widely used in dentistry and endodontics in many applications such as the removal of dentinal hypersensitivity, modification of dentin structure, vital pulp therapy, cleaning and shaping of the root canal system, and endodontic surgery. Argon and Helium-Neon (He-Ne) lasers are successful in the relief of dentinal hypersensitivity. Neodymium:doped yttrium aluminum garnet (Nd:YAG), Erbium (Er:YAG) and Carbon Dioxide lasers can be used in vital pulp therapy (pulpotomy) due to their adequate hemostasis and antibacterial activities. The use of lasers in vital pulp treatments also has advantages such as promoting dentin repair and pulp biostimulation. Er:YAG laser is used to prepare the access cavity, shape and clean the root canal, Nd:YAG is used to remove pulp remnants and debris from the apical foramen and control bleeding. For this reason, clinicians' laser preferences differ according to each requirement. Compared with traditional methods, the use of laser in many endodontic therapies is promising. As a result, the popularity of the laser will continue to grow. This popularity has also accelerated the conduct of various researches and studies. Thanks to the new studies, the development and more frequent use of these systems has been encouraged.

**Key learning points**: Dental treatments using lasers are preferred more often every day and lasers provide more effective results in a shorter time than conventional treatment methods.

# OP055 - MANAGEMENT OF C-SHAPED ROOT CANALS: CASE SERIES AND LITERATURE REVIEW

İlgenli I[1], Demir E[1]

[1]*Ege University, Faculty Of Dentistry, Department Of Endodontics*

**Aim**: Abnormal canal anatomy may be a challenge for clinicians in terms of managing the root canal treatment. The C-shaped root and canal morphology is an illustration of this circumstance. The purpose is to examine the relevant literature, provide data on incidence, technical details, describe several classifications of C-shaped root canal morphology, and present three cases with one-year follow-up.

**Results:** Two cases of acute apical periodontitis and one case of acute apical abscess were evaluated in this case series. At the initial sessions, the root canals were found. Intracanal pus draining was also done in the case of the acute apical abscess. K- and H-type hand files were used in combination with rotary instruments in each of the three cases. Chemo-mechanical cleaning of the root canals was carefully and painstakingly performed with passive ultrasonic irrigation protocol in all cases. Treatments were finished in the second sessions. The teeth were symptom-free and demonstrating considerable healing after one-year, according to clinical and radiological follow-ups.

**Key learning points:**

- Mandibular second molars with conical-shaped roots on diagnostic radiography should be considered in terms of C-canal morphology;
- The access cavity should be made in accordance with the morphology of the root canal and the shape of the pulp chamber to produce successful outcomes in C-shaped canals;
- In C-shaped root canals, there is a strong probability of root canal irregularities, anastomosis, lateral canals, and apical deltas; therefore, good shaping and effective irrigation should be performed. Otherwise, microorganisms may remain in these regions and multiply rapidly, resulting in failures in endodontic treatment;
- Clinicians should undertake thorough clinical and radiographic examinations in terms of the prognosis of endodontic treatment and should have enough knowledge of the anatomical variations that may be present in teeth, particularly in mandibular molars.

# OP056 - ARE WE SUSCEPTIBLE TO APICAL PERIODONTITIS? THE ANALYSIS OF GENES BEHIND APICAL PERIODONTITIS DEVELOPMENT

Jakovljevic A[1], Nikolic N[2], Milasin J[3]

*[1]Department of Pathophysiology, [2]Implant-Research Center, [3]Department of Human Genetics*

**Aim:** This presentation aimed to reveal the current knowledge of genetic factors and explain the mechanisms of their influence in the pathogenesis of apical periodontitis (AP) development.

**Summary:** For many years AP has been considered only as a direct consequence of polymicrobial infection. It is clear that as a result of the harmful effect of different microorganisms and their virulence factors, the host's immune system is activated leading to the recruitment of various cell types and the production of cell-specific mediators that finally cause the break-down of tooth-supporting tissues and the formation of periapical lesions. However, the mono-causality concept of etiopathogenesis of AP is definitely obsolete, and it is now clearly considered as a multifactorial disease, suggesting that its complex nature involves overlapping inherent and environmental risk factors. Recent investigations showed that individual genetic variations may contribute to different AP presentations and/or treatment outcomes. Variation in genetic constitution between individuals modulates inflammatory and immunological responses in general, resulting in a range of different responses to common environmental challenges. Nevertheless, the mechanism of interaction between heredity and different environmental factors in the modification of AP susceptibility and prediction of its progression still remains poorly investigated.

**Key learning points:**
After this presentation, the audience will be able to understand:

- Genetic modulation mechanisms of inflammatory and immunological host responses;
- Concept of single nucleotide polymorphisms in disease susceptibility;
- Basic genetic mechanisms involved in the pathogenesis of AP on animal experimental models and in humans;
- Explanation of causes and consequences of previously investigated gene polymorphisms (proinflammatory cytokines, matrix metalloproteinases, bone resorption modulators, chemokines, etc.) in AP presentations and/or treatment outcomes;
- Translation of basic knowledge into clinical relevance, and;
- Future perspectives and ideas for further investigations.

# OP058 - RADIOGRAPHIC OUTCOME OF NON-SURGICAL ENDODONTIC RETREATMENT: A RETROSPECTIVE STUDY

İlgenli I[1], İşbilen F[1]

[1]*Ege University Department of Endodontics*

**Aim:** To assess the quality of the coronal restoration and root canal fillings (RCF) on teeth that underwent non-surgical endodontic retreatment (ER).

**Methods**: Endodontic-Retreatments that were performed by endodontists in the department of endodontics between Jan.01.2021 and Jan.01.2022 were analysed, retrospectively. Periapical radiographs of 199 treated-teeth from 186-patients were included. The PAI-scores were used to assess the coronal and periapical conditions of the teeth. The Image-J software was used to conduct measurements in order to provide an impartial assessment. The gender, dental regions, and success rates were examined using a chi-square test with $p < .05$.

**Results**: One-hundred-fifty-six (78.3%) teeth in the research were found to be retreated successfully, while 43 (21.7%) weren't. Technical errors were most frequently found in the length of the RCF (18, 59%) across all categories in which the quality of root-canal-treatment was assessed (L=length of RCF; H=homogeneity of RCF; CS=coronal-seal; CF=complications-failures). The extent of the RCF was found to be adequate in 160, insufficient in 18, and protruding in 19-teeth. RCF was uniform in 165 and uneven in 19-teeth. The post-restoration was performed on 15-teeth. It was determined that 9 of the teeth that underwent non-surgical ER received a PAI-1, 60 received a PAI-2, 36 received a PAI-3, 43 received a PAI-4, and 51 received a PAI-5 score. The 149-teeth included in the research had an average coronal filling score of CS-1, 32 of them CS-2, and 18 of them CS-3. No statistically significant variation between the tested groups was discovered. The ER success rate was determined to be 78.3% within the confines of our study. The statistical factors did not differ significantly from one another.

**Key learning points:**

- Identification the success rate of endodontic-retreatments done by endodontists;
- Observation of the technical errors and their rates in endodontic-retreatment;
- Assessment of the lesion size improvement at the end of 1-year.

# OP059 - NON-SURGICAL ENDODONTIC RETREATMENT: CLINICAL DECISION MAKING AND PREDICTABLE MANAGEMENT OF CASES WITH POST-TREATMENT DISEASE

Dua D[1], Dua A[2]

*[1]Royal Bahrain Hospital, [2]Dr. Ali Hakeem Dental Center*

**Aim:** To enumerate factors influencing clinical decision making in non-surgical endodontic retreatment and describe evidence-based clinical protocols for a predictable treatment outcome.

**Summary:** The potential for endodontic success is quite high though, clinicians are, at times, are confronted with post-treatment disease which instigates the need for endodontic retreatment. Endodontic retreatment is defined as the "procedure to remove root canal filling materials from the tooth, followed by cleaning, shaping, and obturating the canals." Nonsurgical retreatment generally is prioritized before surgical endodontic treatment. Evidence- based literature reinforces the most stated causes for post treatment disease as inadequate obturation, missed canals and separated instruments. Retreatment involves the removal of post and cores, broken instruments, and previously placed obturation materials, negotiating blocked canals, bypassing ledges, repairing perforations and sealing apical transportations. Nonsurgical endodontic retreatment becomes a further challenge when dealing with a complex tooth anatomy. The importance of diagnostic imaging modality cannot be neglected to analyze the possible reason of non-healing outcome of previous endodontic treatment. This presentation focusses on identifying and describing various factors which influence the predictability in treatment outcome of non- surgical retreatment in endodontics.

**Key Learning points:**

- Identify the causes of post treatment disease;
- Compare and justify the decision making between surgical and non-surgical endodontic retreatment;
- Enumerate factors affecting restorability of tooth;
- Describe the importance of CBCT and diagnostic radiographs;
- Demonstrate knowledge in case management of various causes of non- healing outcome after endodontic treatment;
- Describe factors affecting predictable treatment outcome in nonsurgical endodontic retreatment.

# OP060 - PREDICTABLE APPROACH TO IDENTIFY AND MANAGE MISSED ROOT CANAL ANATOMY IN NON-SURGICAL ENDODONTIC RETREATMENT

Dua A[1], Dua D[2]

*[1]Dr Ali Hakeem Dental Center, [2]Royal Bahrain Hospital*

**Introduction**: Success of endodontic treatment is largely dependent on thorough cleaning and shaping, disinfection and adequate obturation of the entire root canal system. Inability to locate and disinfect all the canals has a significant impact on treatment prognosis. Endodontic failure could occur due to a variety of reasons but research has shown that one of the most likely cause is missed canals. In order to locate all the canals and effectively debride the teeth, the clinician must have a sound knowledge of the intricate root canal anatomy of different teeth and the laws of pulp chamber.

**Aim:**The aim of this presentation is an attempt to highlight different techniques and clinical tips to identify all the canals, proper interpretation of the preoperative radiograph, utilizing CBCT, importance of magnification, use of ultrasonic tips and various disinfection techniques to achieve a predictable successful outcome in non-surgical endodontic retreatment.

**Key Learning points:**

- Identify the significance of interpreting preoperative radiograph at different angulations and importance of CBCT in accurate diagnosis;
- Describe the different laws of pulp chamber anatomy;
- Compare various studies about Prevalence of missed canals in different teeth and their association with apical periodontitis;
- Discuss the role of magnification to locate all the canals;
- Explain the importance of ultrasonic tips and other techniques to explore and negotiate the missed canals.

# OP062 - THE SCOPE OF ARTIFICIAL INTELLIGENCE IN ENDODONTICS

Mustafa R[1]

[1]*Conservative department ,Faculty Of Dentistry, Jordan University Of Science And Technology*

**Summary**: Artificial intelligence (AI) can be defined as computers or robotics performing a task that humans usually do. Although the term AI has gained a lot of popularity in recent years, many individuals, including medical doctors and dentists, are still unfamiliar with AI's principles and effects in the work field. The purpose of AI is to provide software that can reason on input and explain output. It has a variety of uses nowadays, from self-driving cars, virtual assistants, and meteorology prediction to clinical diagnosis.

The field of AI in healthcare is expanding, including dental areas such as oral diagnosis, pedodontics, periodontics, oral and maxillofacial surgery, endodontics, and others. In endodontics, its application can be:

- Studying root canal system anatomy.
- Detecting periapical lesions and root fractures.
- Determining working length measurements.
- Predicting the viability of dental pulp stem cells.
- Predicting the success of the retreatment procedures field.

There are various types of AI algorithms such as machine learning (ML), deep learning (DL), artificial neural network (ANN), and convolutional neural network (CNN).

It is evident that AI is already and will increasingly continue to be a part of dental practice; in addition, it can be an effective approach to analyzing clinical dental data. therefore, it is essential to improve our knowledge about AI in endodontics, its models, its applications, advantages, complications, and how to implement it in our daily dental practice.

# OP064 - ERGONOMY IN THE ENDODONTIC OFFICE

Manea S[1], Nicola S[2], Scărlătescu SA[3], Pangică AM[1], Perlea P[3]

*[1]Titu Maiorescu University, Faculty Of Dentistry, [2]private practice, [3]Carol Davila University Bucharest Romania, Faculty of Dentistry*

**Aim:** To emphasize the importance of applying ergonomic principles in the organization and operation of the endodontic office. Different configurations will be analyzed and improvement possibilities will be addressed.

**Summary:** Ergonomics is the process of designing or arranging workplaces, products and systems, so they fit the people who use them.
Not knowing or not applying the ergonomic principles in dental practice can lead to pain and disorders, as high incidence and prevalence of musculoskeletal disorders are reported in dentistry.
The endodontist is privileged compared to other specialties because he uses the microscope which, in addition to lighting and magnification, also offers superior ergonomics.
Nevertheless there are a lot of other things to consider. Knowing how to design the dental office, using the right equipments (patient chair, delivery systems, operator's stool, dental operating microscope), added by a well-trained assistant and recognizing the postural and positioning errors that are made daily and correcting them, can ensure a healthy workflow for the endodontist.
Because endodontists work long hours in static postures, time and space for breaks and stretching are required to prevent health problems related to their job.

**Key learning points:**
Improving the ergonomy of the Endodontic Office in conjunction with regular breaks for stretching durink work can prevent (or delay) musculoskeletal disorders.

# OP065 - USE OF HIGH-FIDELITY 3D JAW MODELS FOR ENDODONTIC MICROSURGICAL SIMULATION TRAINING

Chan P[1], Lui J[1]

[1]*National Dental Centre Singapore*

**Aim**: High-fidelity 3D jaw models were developed for Endodontic microsurgical simulation training to facilitate the acquisition of surgical skills and improve familiarity with the surgical field. The aim of this presentation was to elaborate on the residents' experience and the impact of the simulation training on their confidence levels in performing Endodontic microsurgery (EMS).

**Methods:** The simulation training curriculum was structured using the Ericsson 1996 framework on deliberate practice. Residents in their surgical training (n=4) were given bi-weekly simulation practice using 3D-jaw models mounted on simulation heads from July to August 2021, along with coaching and immediate feedback on their performance by their supervisors. The residents responded using a 5-point Likert scale on their level of agreement for eight items related to their confidence levels on various aspects of EMS for the pre-and post-workshop questionnaire and five items related to the Endodontic microsurgical training after their first EMS. Focus group discussion was also conducted.

**Results:** 100% of the residents agreed that the simulation training covered critical content necessary for them to become competent at EMS. There was an improvement in the knowledge gained, surgical skills, and confidence levels to perform EMS. The residents also felt that the training led to reduced stress levels when performing their first EMS. Five major themes emerged: fidelity; safe environment; cognitive rehearsal; peer learning; and the role of debriefing and reflective practice.

**Key learning points:**

- Endodontic microsurgical training using high-fidelity 3D models has demonstrated high student satisfaction and an increase in confidence levels and preparedness for EMS among the residents;
- This structured Endodontic microsurgical training using high-fidelity 3D models provides a safe and efficient learning environment to develop the capacity and capability of the residents, and improve their confidence in performing surgery while ensuring that the residents are competent to provide the highest standards of care for their patients.

# OP066 - FAILURE OF ANAESTHESIA DURING ENDODONTIC TREATMENT TO TEETH WITH LIVING DENTAL PULP

Polymerou L[1], Mazinis E[1]

[1]*Department of Endodontology, School of Dentistry, Aristotle University of Thessaloniki*

**Aim:** Local anesthesia is a prerequisite for endodontic treatment above all in teeth with living dental pulp. However, high failure levels damage the efficacy of the treatment and the doctor-patient relationship. The aim of this presentation is to research and bring forward reasons for and tactics to improve our clinical efficiency.

**Summary**: The reasons could be divided in local factors such as pulpitis where biochemical and physiological factors contribute to lower pain tolerance. Furthermore, we should mention the type, concentration, concentration of vasoconstrictor agent and volume of the selected anesthetic and the technique used. Other factors include anatomical considerations such as the presence of the retromolar channel, the bifid inferior alveolar and the mylohoid nerve play sometimes an important factor. Lastly we should consider the psychological state of the patients which drives them to demand sometimes even sedation and plays a major role in the failure of the anesthetic "effect" even in the presence of anesthesia.
Strategies to cope with these problems are already developed or being developed and include the different anesthetic techniques such as the intraosseous, intralingual and intrapulpal technique with considerable level of success. Products used to improve these techniques such as the STA,x-tip and QuickSleeper are already in use.
Moreover, the administration of premedication and N2O show promising signs for suffering patients.

**Key learning points:**

- Use of articaine is preferred with better results in double doses;
- Ibuprofen and NSAID's improve the success of anesthesia;
- Use of N2O can be a solution for highly stressed patients;
- Use of different techniques for anesthesia such as the intralingual, intraosseous etc. is advised in cases of anesthetic failure not just augmenting the volume of anesthetic agent;
- Better training to anti-stress, anesthetic techniques and anatomical knowledge for new practioners.

# OP069 - PHARMACOLOGICAL APPROACHES IN ENDODONTIC PAIN MANAGEMENT

Koç C[1]

[1]*Dept. of Endodontics, Faculty of Dentistry, Aydın Adnan Menderes University*

**Aim**: The aim of this presentation is to evaluate clinicians' pharmacological approaches in endodontic pain management with current literature data and to discuss the effectiveness of these approaches.

**Summary:** Pain is the driving force that causes patients to seek dental treatment. Although the use of appropriate analgesics may be beneficial for alleviating endodontic pain, it is not considered as a method to relieve endodontic pain on its own. Endodontic procedures are majorly sufficient to resolve the peripheral mechanisms, pharmacotherapy may be necessary to reduce nociceptor input and suppress central pain processing. Severity of pulp and/or periradicular inflammation, endodontic procedural factors, irrigation solutions used, occlusal reduction applications to the treated tooth, and individual patient variables may play role in severity of pain. Nonsteroidal anti-inflammatory drugs (NSAIDs) and combinations with other drugs are frequently used in pain control. The priority of opioid prescription remains unclear because of the potential adverse effects and the efficacy of NSAIDs alone or in combination with acetaminophen in providing pain control equal to or superior to that provided by opioids. A few clinicians have been reported to prescribe excessive opioids unnecessarily. Endodontists are limited to the literature data they can reach in determining their analgesic prescribing habits

**Key learning points:**

- Factors that play a role in the severity of pain;
- Alternative analgesic combinations for patients unable to take NSAIDs;
- Concern about abuse and indiscriminate overprescription of opioids;
- Preference for opioids for endodontic pain:
- Recommendations to clinical practice guidelines prepared by professional organizations.

# OP070 - USE OF COLD ATMOSPHERIC PLASMA PRODUCED BY DIELECTRIC BARRIER DISCHARGE IN DIRECT PULP CAPPING THERAPY AND VITAL PULPOTOMY: CLINICAL EXPERIENCE

Pavelic B[1], Pavlovic I[1], Bago I[1], Segovic S[1], Anic I[1]

*[1]School of dental medicine*

**Aim:** To present the positive therapeutic effect of cold atmospheric plasma produced by dielectric barrier discharge in clinical procedure of direct pulp capping and vital pulpotomy.

**Summary:** Cold atmospheric plasma is a more or less ionized gas consisting of large number of different species: electrons, ions, radicals, neutral and/or excited atoms and molecules. It is created using the cold atmospheric plasma generator with a set of glass probes of different shapes. Inside the glass probe is a noble gas or a specific mixture of different noble gases, that conducting and emitting electromagnetic energy. When probe gets in contact with the therapeutic area, it emits energy and creates a cold atmospheric plasma field, which shows an antimicrobial and biostimulating effect on the surrounding tissue.
Due to the specific anatomical and histo-morphological characteristics of the dental pulp, therapeutic procedure of direct pulp capping and vital pulpotomy presents a particular challenge in daily clinical work.
For the disinfection of the affected area, the therapeutic procedure requires use of antimicrobial agents that not have or have a minimal harmful effect on vital tissue. The antimicrobial effect and the newly created biological condition in the affected area are positive prerequisites for carrying out a successful therapy procedure.

**Key learning points:**

- Use of cold atmospheric plasma showed positiv therapeutic effect in direct pulp capping therapy and vital pulpotomy of permanent teeth;
- Based on the achieved antimicrobial and biostimulating effect but without harmful effect, the application of cold atmospheric plasma could represent a new method of choice in biological disinfection during the therapeutic procedure of direct pulp capping and vital pulpotomy;
- In order to confirm the first positive clinical experiences, further basic and clinical studies should be performed.

# OP071 - MANAGEMENT OF EXTERNAL CERVICAL RESORPTION

Domínguez Bonilla G[1], Galal K[1]

[1]*Universitat Internacional De Catalunya*

**Introduction:** External Cervical Resorption (ECR) has drawn the attention of Endodontists specialists and practitioners due to its intricate and intrusive pattern, and the diverse levels of advancement observed and documented in literature. This case report entails the management of external cervical resorption in the maxillary central incisors, specifically tooth 1.1.

**Aim:** To impede the progression of resorption and lessen the inflammation in the palatal tissues.

**Clinical History:** A male patient of 19 years arrived at the clinic's hospital of the University with the following chief complaint: "I dislike the colour of the tooth and it is moving forward" - regarding tooth 1.1. The patient's medical history demonstrated that he was in good health and classified as ASA1 according to the American Society of Anaesthesiologists. After scrutinizing the patient's dental history, it was discovered that the patient had previously undergone orthodontic treatment. With regard to tooth 1.1, the patient had a history of traumatic injury in 2011, regeneration treatment in 2011, and internal bleaching in 2017. Based on clinical and radiographic evaluations of the previously treated tooth, transient apical resorption was diagnosed. Pre-operational 3D radiographs displayed external cervical resorption and resorption of the palatal bone. The treatment plan was outlined as follows: raising a flap and cleansing the resorption area with trichloroacetic acid under total isolation, repairing the resorption with nano-filled composite, and stabilizing the tooth using a semi-rigid splint.

**Conclusion**: External cervical resorption is recognized as a highly dynamic and consistently evolving process; therefore, comprehension of the diverse forms of resorption is essential to assess the progression of the resorption, diagnose it and establish a proper treatment plan according to the variant that we encounter.

**Key learning points:**

- Diagnosis (Radiographic and clinical examination);
- Management of External Cervical Resorption;
- Restorative management.

# OP072 - MANAGEMENT OF AVULSION AND REPLACEMENT RESORPTION FOLLOWING TRAUMA TO ANTERIOR TEETH: A CLINICAL CASE

Muñoz González L[1], Tona J, Vazquez M, Olivieri G, Abella Sans F

[1]*Universidad Internacional De Cataluya*

**Aim:** describe the management of a trauma case with an avulsion and replacement resorption in a middle childhood patient.

**Summary:** A male patient, 9 years old after an accident with avulsion of tooth 12, was taken to an ER, they repositioned the teeth with a rigid splint and indicated antibiotics, analgesics, and a soft diet for 10 days. Two days after he comes to the Odontopediatric Department at UIC and after a clinical and radiological analysis, they confirmed there is a fracture of the premaxilla and he is referred to the Endodontic Department. We changed the rigid splint to semi-rigid for teeth 11, 12, and 21. The teeth responded positively to the sensitivity and percussion test and showed mobility of 11 and 21. Since the 12 had an avulsion, it was decided to do the root canal treatment on the next visit.
Next visit we did a cavity test and reach the pulp chamber in tooth 12, RCT was done in multiple visits with intracanal medication and obturate with an apical plug with MTA and backfill with flow guttapercha. The cold test was repeated for 11 and 21, and they showed decreased response to cold.
At follow-up, toot 11 and 21 did not respond to cold, toot 21 showed replacement resorption. We did the RCT of tooth 11 and the RCT of tooth 21 in multiple visits with intracanal medication until no further signs of resorption were seen and we obturated with Biodentine. At follow-up, the patient is asymptomatic with negative percussion. We suspect ankyloses of tooth 21 because of a “metallic dull sound”, with no signs of infraoclusion. Follow-up every 3 months.

**Key learning points:**

- Decision-making in avulsion with closed apex;
- Management of replacement resorption in middle childhood patients;
- Management and follow-up of ankylosed teeth.

# OP073 - THE CONTEMPORARY MANAGEMENT OF EXTERNAL CERVICAL RESORPTION AND THE USE OF CBCT RADIOLOGY

Shykhon M[1], Green D

[1]*Birmingham Dental Hospital*

**Aim**: This presentation aims to give an overview of the management of external cervical resorption. This will include an overview of the diagnosis and aetiology of resorptive lesions and how CBCT radiology can be utilised to aid in diagnosis and treatment planning. The Heithersay and Patel Classification will be reviewed and their application in clinical practice will be explained. A clinical case will be presented to demonstrate the treatment steps and restorative materials used. Finally, the prognosis of resorptive lesions will be discussed.

**Summary:** The patient was referred to the Restorative Department at Birmingham Dental Hospital by her General Dental Practitioner for external cervical resorption associated with the UR1. The UR1 was unrestored and the patient recalled no history of trauma. A CBCT radiograph was taken which confirmed the UR1 was unrestored and has a resorptive lesion associated with the buccal cervical margin. This showed external invasive cervical resorption, Heithersay Classification 3.
The first treatment appointment involved extirpation of the UR1 and removal of the hyperaemic root canal remnants. A large Gutta-percha point was used to temporary occlude the canal to prevent accidental sealing of the canal whilst surgically repairing the buccal defect. Following this, a full thickness mucoperiosteal flap consisting of intra-crevicular incisions was raised to fully visualise and repair the defect. Granulation tissue was removed, and the cavity was refined and restored with Glass Ionomer Cement (GIC) and flap closure was achieved using Prolene sutures. The second treatment appointment involved the definitive preparation and obturation of the root canal system using rotary instrumentation and warm vertical compaction. The access cavity was restored with GIC and composite.

**Key learning points:**

- Diagnostic imaging and grading;
- The use of CBCT imaging;
- Soft tissue management;
- Sequence of approach;
- Restorative materials;
- Prognostic factors.

# OP074 - MULTIDISCIPLINARY TREATMENT OF EXTERNAL CERVICAL RESORPTIONS BASED ON CBCT EVALUATION OF ENTRY POINT DIMENSIONS AND ACCORDING TO A DECISION-MAKING TREE

Solomonov M[1], Lev R[2]

*[1]Bina Program, Faculty of Dental Medicine, Hebrew University of Jerusalem, Jerusalem, Israel, [2]Sheba Hospital*

**Aim:** To present the prognosis and treatment dilemmas of ECR based on CBCT evaluation and a decision making tree.

**Summary**: External Cervical Resorption is a subtype of root resorptions, which progresses in most of cases in a silent and destructive manner. Its etiology is not always clear, and the character may be aggressive. These lesions pose a diagnostic and therapeutic challenge, often requiring a multidisciplinary approach involving endodontics, periodontics, restorative dentistry and orthodontics. In the past, a classification of the lesions was proposed according to their degree of progression in two-dimensional radiographic imaging.
We will demonstrate the routine use of CBCT imaging to diagnose more accurately the progression of the lesion and its classification and offer an adapted treatment plan based on 3D imaging. The location and dimensions of the entry area by the resorbing tissue into the tooth can be identified in the CBCT imaging, and these are key factors in determining the prognosis and the treatment plan.
The treatment is aimed at removing the resorbing tissue, cutting off its blood supply, and restoring the resorbed tooth material. The therapeutic approach may be surgical or non-surgical, and may in some cases include endodontic treatment. In some cases, orthodontic treatment, root resections, and even extractions will be required.
We will present a decision-making tree that we developed based on the location and dimensions of the resorption lesions, as demonstrated by CBCT imaging.
A series of clinical cases treated in a multidisciplinary manner in accordance with the decision-making tree at the Departments of Endodontics and Periodontology at the Dental Center in Tel Hashomer - "Sheba" Hospital and in a private clinic will be presented.

**Key learning points:**

- Accurate prognosis determination;
- Clear multidisciplinary treatment plan according to decision making tree.

# OP075 - CAN AUTOTRANSPLANTATION LEAD TO EXTERNAL CERVICAL ROOT RESORPTION (ECR)?

Mavridou A[1], Barendregt D[2]

*[1]National and Kapodistrian University of Athens, Dental School, [2]Proclin Rotterdam*

**Aim:** To investigate potential risks of PDL damage and generation of a hypoxic environment during and after autotransplantation. Both of these factors are pre-requisites for ECR initiation and evolution. A focus is also given on how to minimize the risk of ECR during autotransplantation.

**Methods:** In this study ten indicative cases of ECR after autotransplantation were included. To understand the phenomena and mechanisms, clinical findings were combined with advanced 3D analysis (CBCT (Morita, FOV 40x40, 60x60), and a high performance NanoTom scanner (GE Measurement and Control Solutions, Wunstorf, Germany)) and histological analysis.

**Results**: From this analysis we found that autotransplantation can be only linked to ECR under very specific and limited conditions. These conditions should consist (a) PDL and cementum damage during the extraction and reposition process and, (b) creation of a hypoxic microenvironment by e.g. plaque, orthodontics etc.

**Key learning points:**

- There is a risk of ECR after autotrasplantation;
- The risk of ECR can be minimized by using less aggressive techniques (e.g. rotational force during extraction instead of axial) so that the PDL remains intact;
- Even if PDL is damaged ECR cannot occurred without a stimulating factor.

# OP077 - HYDRAULIC CALCIUM SILICATE CEMENTS USED IN THE TREATMENT OF PERFORATING ROOT RESORPTIONS

Heranin S[1]

*[1]V.N.Karazin Kharkiv National University, [2]Dental Centre "Machaon"*

**Aim**: To Show the Potential of Hydraulic Calcium Silicate Cements used in Challenging Endo Cases

**Summary:** Root resorption can be classified into external and internal resorption. Untreated internal root resorption can result in the premature loss of the affected teeth. There is certain confusion between cervical invasive and internal resorption, which is often incorrectly diagnosed as internal resorption. Internal root resorption is a relatively rare endodontic problem, and its etiology and pathogenesis are only partially understood. Although periapical radiograph is the primary method used in endodontic diagnosis, resorptive lesion with presence of perforation can be clearly visible only in CBCT scans. Moreover, information obtained from CBCT scans has a powerful value in long-term follow-ups and play the role of the "Litmus paper" when compared to conventional periapical radiographs. Management of IRR is a big endodontic challenge, especially when it comes to root perforation. Once the diagnosis of IRR has been established, the treatment plan should consider complex irregularities of the root canal system and specific area of IRR defect complicated with the root perforation. Operator should provide precise cleaning and obturation of the whole root canal space as far elimination of infection is difficult. NaOCl and calcium hydroxide used during endodontic treatment are very important to disinfect the root canal system. Filling of the root canal space performed with hydraulic calcium silicate cements, either MTA or Bioceramic material because of its superior sealing properties, bacteriostatic effects, biocompatibility and its ability to set in presence of moisture. The aim of this presentation is to review the diagnosis, treatment planning and clinical management of the perforating internal root resorption with the use of hydraulic calcium silicate cements and their effects on endodontic treatment outcomes.

**Key learning points:**
Biological Positive Effects of MTA/ Bioceramic in Endo.

# OP078 - COMPARISON OF THE FRACTURE RESISTANCE OF OVAL ROOTS WITH OVAL CANALS OBTURATED USING CALCIUM SILICATE-BASED SEALERS

Yetiskul M[1], Ersev H[1]

[1]*Istanbul University Faculty of Dentistry*

**Aim:** The aim was to compare the fracture resistance of oval roots with oval canals filled with TotalFill BC (FKG, La Chaux-de-Fonds, Switzerland), BioRoot RCS (Septodont, Saint- Maur-des-Fosses, France) or AH Plus (De Trey, Dentsply, Konstanz, Germany) following two final irrigation protocols.

**Methods:** Ninety-six human mandibular incisors were decoronated to a length of 14 mm and randomly divided into 8 groups (n=12). In the negative control group, no instrumentation was carried out. Following root canal instrumentation in the other groups, final irrigation was performed using 17%EDTA and distilled water. In the positive control group, the root canals were left unfilled. Before filling the root canals using AH Plus, TotalFill BC or BioRoot RCS with the single-cone technique, an additional irrigation with 2.5%NaOCl was performed in three of the remaining 6 groups. All of the roots were then embedded in acrylic resin blocks, leaving 9 mm of the coronal part exposed and subjected to a vertical loading force of 1 mm/min. The maximum load to produce fracture (N) was recorded. The data were analyzed using Mann-Whitney U test ($P<0.05$).

**Results:** Intact roots in the negative control group showed a significantly higher fracture resistance. Pairwise comparisons of the other groups revealed no significant differences. Calcium-silicate based sealers performed better when the final irrigant was NaOCl. AH Plus, TotalFill BC or BioRoot RCS did not adequately reinforce the oval roots with oval canals. Calcium silicate-based sealers performed similarly to AH Plus. In calcium-silicate based sealer groups, final irrigation with NaOCl seemed to have a positive effect on the fracture resistance of roots.

**Keywords**: Fracture resistance, AH Plus, TotalFill BC, BioRoot RCS, oval canal

# OP079 - EVALUATION OF SOLUBILITY AND WATER SORPTION OF TWO PREMIXED CALCIUM SILICATE-BASED ROOT CANAL SEALERS

Kosar T[1], Celık D[1]

[1]*Department of Endodontics, Faculty of Dentistry, Karadeniz Technical University*

**Aim**: The aim of this study was to evaluate the solubility and water sorption of two premixed calcium silicate-based sealers (EndoSeal MTA; Maruchi, Wonju, Korea, and NeoSealer Flo; Avalon Nusmile, USA) in comparison with an epoxy resin-based sealer (AH Plus; Dentsply DeTrey, Konstanz, Germany).

**Methods**: The materials were prepared according to the manufacturer's instructions, and then placed into 8 x 1.6 mm molds made of polytetrafluoroethylene. After the setting time, the samples (n=5 for each material) were removed from the molds, weighed, and then immersed in distilled water. Solubility and water sorption tests were conducted after 24 hours, 3 days, 7 days, and 14 days. The data were analyzed statistically using one-way analysis of variance and post-hoc Tukey test ($p<0.0001$).

**Results:** Results showed that EndoSeal MTA and NeoSealer Flo had significantly higher solubility and water sorption compared to AH Plus at all time points ($p<0.0001$). Additionally, EndoSeal MTA exhibited higher water sorption values than NeoSealer Flo at 3, 7, and 14 days ($p<0.0001$), although the two calcium silicate-based sealers had similar solubility values at all time points ($p=0.924$, $p=0.354$, $p=0.309$, and $p=0.409$ for 24 hours, 3 days, 7 days, and 14 days, respectively). Moreover, no significant differences were observed in water sorption ($p=0.995$) and solubility ($p=0.999$) over time for all three root canal sealers.

**Key learning points:**
The two premixed calcium silicate-based sealers, EndoSeal MTA and NeoSealer Flo, demonstrated significantly higher levels of solubility and water sorption compared to AH Plus, an epoxy resin-based sealer. It is worth noting, however, that the solubility of AH Plus was found to be in compliance with the ISO 6876:2012 standard, whereas the calcium silicate-based sealers were not. Clinicians should consider the solubility and water sorption properties of root canal sealers when selecting the most suitable materials for clinical use.

# OP080 - PALATAL ROOT-END ENDODONTIC SURGERY

Jeong J[1]

*[1]The University Of Texas Health Science Center At Houston, School Of Dentistry*

**Summary**: When a root canal treatment fails, clinicians normally recommend non-surgical retreatment. If the root canal anatomy is respected during the previous root canal treatment, the outcome of non-surgical retreatment is favorable. Due to the straight morphology of the palatal canal of maxillary first molar, clinicians generally can establish favorable outcome in the palatal root by non-surgical retreatment. However, there are certain indications for surgical retreatment in the palatal root such as a long/large casting post, external root resorption, perforation, extra-radicular biofilm formation, and so on, that require clinicians to perform a surgical procedure in order to save those teeth.

"Palatal Root-end Endodontic Surgery (PRES)" involves root-end resection and retrograde filling in the palatal root and is one of the most difficult procedures in endodontics. While trans-antral PRES or 3D navigated PRES has been either presented or published in the past decades, there are cases that Trans-antral PRES or 3D navigated PRES can't cover so it is necessary for clinicians to be knowledgeable in traditional PRES approach.

In this presentation, I will go over 3 aspects of PRES; anatomical, technical, and decision-making aspects.

At the end of the presentation, the attendee should be able to:

- Apply the anatomical landmarks such as greater palatine foramen, spine, and grooves for locating greater palatine artery and nerve in relation to Palatal Root-end Endodontic Surgery;
- Sketch flap design and strategic access to the palatal root apex;
- Execute root-end resection, removal of the resected palatal root, retro-prep, and retro-filling;
- Apply the modified Continuous Sling-Mattress suture method.

# OP081 - THE WAY (NOT) TO DO APICAL SURGERY

Weissman A[1]

[1]*Endodontic Department, Dental School, Hadassah Medical Center*

**Aim:** To review the most common errors encountered in endodontic micro surgery.

**Summary:**
Endodontic micro surgery is a widely practiced procedure with a reported outcome of about 90%. In order to achieve a predictable result, one has to select the proper case and carry out the technique uneventfully. But is it achievable in each and every case? Of course not. Mistakes are part of everyday practice. In fact, mishaps might occur in every step of the procedure, starting from diagnosis and case selection up to suturing and even post operative care.
Procedural errors should be regarded as an opportunity for learning and improvement. In order to do so, one has to understand the reasons that led to the error, think of ways to prevent it next time and investigate its effect on the outcome.
The presentation will contain clinical cases that will demonstrate the different mishaps.

**Key learning points:**
Participants will learn, regarding each procedural error:

- Why did the mistake happen?
- How can it be prevented?
- What is the effect on the outcome?

# OP082 - EFFECT OF AMNIOTIC MEMBRANE AND PLATELET-RICH FIBRIN MEMBRANE ON PERIAPICAL BONE HEALING: A COLOR DOPPLER STUDY

Tikku A[1]

*[1]King George's Medical University UP Lucknoww, India*

**Aim:** Human amniotic membrane, due to its valuable regenerative and therapeutic properties can support ideal periapical rehabilitation and promote healing after surgery. The aim is to evaluate amniotic membrane's healing potential and compare it with platelet-rich fibrin membrane using color doppler sonography.

**Methods:** The current study was a randomized, double-blinded, parallel-group, single-centre study. Thirty-four systematically healthy individuals requiring periapical endodontic surgery who fulfilled all inclusion and exclusion criteria were selected and randomly placed in two groups. Surgical curettage of the bony lesion was performed and filled with hydroxyapatite graft. Amniotic membrane (Group 1) and platelet-rich fibrin membrane (Group 2) were placed over it and flap was sutured back. The lesion's surface area and vascularity were the parameters seen and calculated using ultrasound and color doppler.

**Results:** In the amniotic membrane group, a significantly higher mean vascularity was seen at one month compared to the Platelet rich fibrin membrane group. However, no significant change in vascularity was seen after 6 months between both the groups. There was no statistically significant difference in terms of change of mean surface area of the periapical bone defect between the two groups. However, in terms of the percentage change in surface area, a significant difference was found from Pre-op to 6 months($p<0.05$) with amniotic membrane group showing more reduction in the surface area of periapical defect.

**Key learning points:**

- Better healing outcomes can be obtained after periapical surgery with the use of Guided Tissue regeneration techniques;
- Human amniotic membrane can be a promising biological scaffold to enhance healing after periapical endodontic surgery;
- Ultrasound and color doppler is a newer and promising modality to evaluate bone healing after periapical surgery.

# OP083 - IS A PUNCTUAL INCREASED PROBING DEPTHS A PATHOGNOMONIC SIGN OF A FISSURE? ABOUT A CASE: MANAGEMENT OF A LARGE LESION IN THE MESIAL ROOT OF A 36 WITH APICAL MICROSURGERY

Nieto Suarez M[1], Estevez Luaña R[1], Pérez Alfayate R[1], Conde Villar A[1], Gúrpide Lasheras M[1]

[1]*Universidad Europea de Madrid*

**Aim:** Apical microsurgery of a 36 with apical periodontitis and point probing at the mesial root.

**Summary:** Root canal treatment is considered a reliable and predictable treatment, maintaining a success rate of 93%. If apical periodontitis persists, non-surgical retreatment is usually the treatment of choice. However, on certain occasions we often resort to surgical retreatment. Endodontic microsurgery is a great alternative characterized by microsurgical techniques that allow the preparation of a root retrocavity with ultrasonic tips and the subsequent placement of a biocompatible material. As long as the anatomical conditions allow it, thanks to these techniques we can seal those complicated anatomies that are impossible to seal by orthograde means.
We are faced with a patient who comes to the dentis's office with discomfort in the third quadrant, with fistulous tract in tooth 36, punctual probing, with positive palpation and percussion. Diagnostic tests: tooth 36 previously treated with symptomatic apical periodontitis was diagnosed. As it had been previously non-surgically treated, a CBCT was performed and we observed a deviation in the original anatomy of the mesial canals and therefore it was recommended: apical microsurgery.

**Key learning points:**
Importance of a good differential diagnosis when there is a punctual probing; management of apical surgery in lower molars; cleaning and complete sealing of the isthmus with placement of bioceramic material (MTA).

# OP084 - THE INFLUENCE OF NITI FILE SYSTEMS USED IN MINIMALLY INVASIVE ENDODONTICS ON THE AMOUNT OF EXTRUDED DEBRIS AND THE PREPARATION TIME

Baba I[1], Guler B[1], Serefoglu B[1]

[1]*Department of Endodontics, Faculty of Dentistry, Ege University*

**Aim:** To assess whether the amount of extruded debris and preparation time differs for NiTi file systems with different kinematics used in Minimally Invasive Endodontic procedures

**Methods**: Ribbon-shaped root canals of thirty-six mandibular anterior incisor teeth were prepared with one of the preparation techniques: Group 1: One Curve mini (25,.04) (Micromega, Besancon, France); Group 2: VDW ROTATE (25, .04) VDW, Munich, Germany); Group 3: One RECI (25, .04) (Micromega) (n = 12). The method of Myers and Montgomery was used when collecting the extruded material. Irrigation procedures were performed with closed-ended needles using a VATEA peristaltic pump to standardize the flow rate of irrigant to 2 mL/min. Extruded debris and irrigant was collected in vials, which were weighed with a microbalance (10-4 g) before and after the root canal preparation. Following the shaping procedure, the vials were stored in a dry-heat oven to allow irrigant evaporation. The amount of extruded debris was calculated by subtracting the initial weight from the post-operative weight. Additionally, root canal preparation times were recorded in each experimental groups. The Data were analyzed statistically using 1-way ANOVA at the 0.05 significance level.

**Results**: All systems caused debris extrusion, however there were no significant difference among the instruments ($P > 0.05$). The time required for canal preparation was similar regardless of the file systems with different kinematics.

**Key learning points:**

- Kinematics of the NiTi file systems used in Minimally Invasive Endodontic procedures had no influence on the amount of extruded debris.
- Root canal preparation time was comparable among the NiTi file systems working with different motion.

# OP085 - Mechanical tests, metallurgical characterization, and shaping ability of three rotary instruments fabricated using Electric Discharge Machining technology

Versiani M[1], Ajuz N[2], Martins J[3], Antunes B[2], Lima C[4], Vieira V[2], Braz-Fernandes F[5], Silva E[2]

*[1]Military Brazilian Police Department, [2]Grande Rio University (UNIGRANRIO), [3]Faculdade de Medicina Dentária, Universidade de Lisboa, [4]Juiz de Fora Federal University (UFJF), [5]NOVA School of Science and Technology, Universidade NOVA de Lisboa*

**Aim:** This study aimed to compare three rotary instruments produced by the EDM process with the heat-treated ProTaper Gold system regarding design, metallurgy, mechanical properties and shaping ability.

**Methods:** HyFlex EDM (25/.~), Neoniti (25/.06), EDMax (25/.06), and ProTaper Gold (25/.08v) instruments (n=58 per group) were compared regarding design (symmetry of the blade, tip geometry, cross-sectional shape, defects), metallurgy (elemental analysis and phase transformation temperatures) and mechanical performance (cyclic fatigue, cutting ability, torsional, bending, and buckling resistance tests). Unprepared canal areas were calculated for each system after preparation of mesiobuccal, mesiolingual and distal canals of mandibular molars (15 canals per group) using micro-CT technology. Statistical analyses were performed using One-way ANOVA post hoc Tukey and Kruskal-Wallis post hoc Dunn´s tests. Significance level was set at 5%.

**Results**: All instruments had asymmetrical blades, no radial lands, no major defects, and almost equiatomic nickel/titanium ratios, but different cross-section designs, tip geometries, and surface appearances. Although instruments had distinct transformation temperature curves, they showed crystallographic martensitic arrangement at 21 °C and mixed austenite plus R-phase at body temperature. Neoniti and HyFlex EDM showed similar results in all mechanical tests ($p>0.05$), while EDMax and ProTaper Gold had similar time to fracture ($p = 0.841$), maximum bending load ($p = 0.729$), and cutting ability ($p = 0.985$). ProTaper Gold showed the highest torque to failure ($p<0.001$) and HyFlex EDM the lowest buckling resistance ($p<0.001$). Mean percentages of unprepared canal areas ranged from 20.4% to 25.7% in the mesial canals, and from 20.8% to 26.2% in the distal canal, with no statistical differences among systems ($p>0.05$).

**Conclusions**: Instruments' geometry and phase transformation temperatures influenced the results of the mechanical tests, but not their shaping ability.

# OP086 - EVALUATION OF STRESS DISTRIBUTIONS OF MANDIBULAR MOLAR TEETH PREPARED USING DIFFERENT ROTARY FILE SYSTEMS

Sönmez S[1], Koç C[1]

[1]*Dept. of Endodontics, Faculty of Dentistry, Aydın Adnan Menderes University*

**Aim**: The aim of this presentation is to evaluate the effects of different rotary systems on the stresses in photopolymerized resin mandibular models using finite element stress analysis method.

**Summary**: The simulated teeth used in the study consist of five identical lower mandibular molar models, containing photopolymerized resin, produced with a 3-dimensional printer. The samples were divided into four experimental groups and one control group. In the experimental groups root canals were prepared by Protaper Gold (PTG; Dentsply Maillefer, Ballaigues, Switzerland), Reciproc Blue (REB; VDW, Munich, Germany), XP- endo Shaper (XPS; FKG Dentaire SA, La Chaux-de-Fonds, Switzerland), Hyflex EDM (HEDM; Coltene/Whaledent AG, Altstätten, Switzerland). The models were scanned (micro–computed tomographic imaging; Scanco Medical µCT 50, Switzerland), finite element analysis models were created, and stresses were calculated under 250-N loading (at a 45 ° angle and vertically).

**Key learning points:**

- The maximum stress values were found to be higher when the roots were loaded at an angle;
- As the volume and width of the prepared canal increased, the maximum stresses increased. In all models, the stresses increased in direct proportion to the channel volume;
- The range of the stress values was XPS > PTG > REB> HEDM > control group;
- When stress distributions were evaluated across the dentin, a similar stress pattern was observed. Although volumetric differences cause an increase in stress throughout the piece and stress concentrations in certain regions; ıt was observed that the distribution of stress was similar according to the groups.

# OP087 - COMPARISON OF TWO HEAT TREATED SINGLE FILE SYSTEMS IN SIMULATED J-SHAPED CANALS PREPARED BY UNDERGRADUATE DENTAL STUDENTS

Çiftçioğlu E[1], Özçelik İ[1], Akbal Dinçer G[1], Küçükay E[1]

[1]*Istanbul Okan University, Faculty of Dentistry, Department of Endodontics*

**Aim**: This study compared the shaping abilities of two heat-treated single file systems (WaveOne Gold (WOG) and One Curve (OC) in simulated resin blocks prepared by undergraduate dentistry students who had their first experience with auto-motorized Ni-Ti instruments; and assessed their experience through a survey.

**Methods**: Seventy J-shaped endo-training blocks were prepared by the 5th-grade Dentistry Students who had yet to use a rotary/reciprocating file system. After 1 hour of training, the students (n=35) were allocated into two groups depending on the first tested system (WOG or OC). Root canals were prepared using WOG Glider (#15.02)+WaveOne Gold file (#25.07) or One G (#14.03)+OC files (#25.06). Then, students shifted groups allowing them to test both systems. They were asked to complete a 6-question questionnaire. Each block's pre- and post-operative images were digitally superimposed. The shaping abilities regarding transportation, transportation direction, and resin removal were evaluated from 9 points, with 1 mm intervals beginning from the apex. The categorical variables were analyzed with Shapiro-Wilk, Kruskall-Wallis, and Mann-Whitney-U tests using the SPSS program. The significance level was set to $p<0.05$.

**Results**: The amount of transportation differed among the evaluated intervals and was only significant between the groups at 6 mm (OC>WOG) (p=0.046). The inner transportation frequency was significantly higher in OC group (p=0.003), while WOG mostly revealed outer transportation (p=0.504). The amount of resin removal was highest in the coronal part with insignificant difference compared to other root thirds. In the coronal part, OC significantly removed more resin from the inner-curve (p=0.000), while WOG from the outer-curve (p=0.000). Students found the WOG system safer than OC (p=0.005).

**Conclusions**: Although systems revealed different shaping performances in different root segments, undergraduate dental students managed to prepare artificial J-shaped root canals on their first attempt with minor procedural errors.

**Keywords**: OneCurve, WaveOne Gold, shaping ability, resin blocks.

# OP088 - INSTRUMENTATION OF THE ROOT CANAL SYSTEM: HUMANS VS BUGS - WHO'S WINNING?

Zaman M[1,2]

*[1]Leeds Dental Institute, NHS , United Kingdom, [2]Royal College of Surgeons Of Edinburgh*

**Aim:** The aims are to provide an overview of the complex anatomy of the root canal system and how different instrument systems and concepts e.g., reciprocation and rotational have evolved over time to tackle this. We will also aim to cover the importance of straight-line access, laws of canal location and instrumentation of the root canal system.

**Summary**: Root canal anatomy is complex, and it is next to impossible to disinfect these in their entirety. Our chances of successful outcomes depend on the quality of access, effective disinfection and finally shaping/instrumentation. Often endodontists are faced with the decision of choosing the most appropriate system of instrumentation so we will also aim to discuss the pros and cons of reciprocation vs rotational instruments and the indications of each along with associated risks. During my specialist training, I have had the opportunity to work with several systems and have learnt useful techniques to tackle challenging canal anatomies which I aim to put forward and encourage discussion and better understanding of root canal treatment.

**Key learning points:**
At the end of the talk, the delegates should be able to:

- Update their knowledge around the variability and complexity of the root canal system;
- Acknowledge the impact of conservative access cavity preparation, straight line access, root canal instrumentation, and irrigating solutions in achieving disinfection;
- Understand the concept of reciprocating and rotating instruments and the principles behind these along with their evolution over time;
- This talk will also provide an overview of the laws of canal location for more predictable location of canal orifices.

# OP090 - ENDODONTIC MICROSURGERY USING PIZOTOME AND GUIDED SURGERY

AlOmari T[1]

[1]*Jordan University of Science and Technology*

**Summary:** Endodontic Microsurgery is the last resort to save teeth with periapical infection. The past few years has increased the interest of learning and conducting endodontic surgery as new materials, tools, and techniques emerged.
Bioceramics and calcium silicate cements help in simplify the retro-fill step of the apical preparation and has increase the success rate tremendously. However, the introduction of pizotome and the advance visualization of the bone defect by CBCT tool has made the microsurgery a predictable and easier procedure that can be done with anatomical challenges such as sinus and nerve proximity.
The utilization of CBCT allow for accurate access of root apexes in many situations, however, in more challenging anatomies, the using of guided resection help in decreasing the trauma and postoperative pain while maintaining the sound bone.

**Aim:** This lecture is focused on the clinical utilization of pizotome on the apical surgeries and is full of clinical cases and videos of how to perform accurate position and design the apical guide.

# OP091 - A SYSTEMATIC REVIEW TO EVALUATE THE EFFECT OF HAEMOSTATIC AGENTS USED DURING ENDODONTIC SURGICAL PROCEDURES

Gladwin L[1]

[1]*Manchester University Nhs Trust*

**Introduction**: Success rates of peri-radicular surgery can be influenced by several pre-surgical, intra-operative and post-surgical factors. One important factor is the ability to achieve adequate haemostasis at the surgical site, currently, there is absence of recent literature reporting on the efficacy of haemostatic agents in fulfilling these ideal properties. Consequently, there is an absence of a consensus on the ideal haemostatic agent.

**Aim:** The authors of this paper completed a systematic review of the current literature available. The aims were to establish the effect of haemostatic agents on the time taken to achieve haemostasis, and on the success of treatment.

**Methods:** Five electronic data bases were searched using Boolean terms to identify: cohort studies, clinical trials, or systematic reviews in English investigating haemostatic agents in endodontic surgery. The predefined Population, Intervention, Comparison, Outcome (PICO) research question was created: "What is the effect of haemostatic agents on the time taken to achieve haemostasis during periradicular surgery?" Data was extracted and assessed using CASP and CEBM tools, PRISMA criteria and Cochrane risk of bias tool.

**Results:** 737 studies were identified, 5 studies received full analysis and were included in the review. Data collected was unsuitable for meta-analysis due to a lack of studies reporting on similar treatments. Analysis of evidence suggests that that aluminium chloride is superior to gauze impregnated epinephrine, calcium sulphate was superior to ferric sulphate and gauze tamponade. No comparison was available between calcium sulphate and aluminium chloride. Inadequate haemostasis was found when no haemostatic agent was used.

**Conclusions**: The lack of high-quality clinical evidence and evidence directly comparing key haemostatic agents, with high risk of bias shown, highlights the need for further research on this topic. Well-designed clinical research investigating haemostatic agents' efficacy, impact on treatment success, and effect on patient outcomes would provide much needed insight on this element of periradicular surgery.

# OP092 - ROLE OF BIOLOGICAL MEMBRANE ON BONE HEALING IN POST ENDODONTIC SURGERY: A RANDOMIZED CONTROLLED TRIAL

Verma P[1]

[1]*King George's Medical University*

**Aims:** 1) To evaluate the absolute and percentage change in the size of the periapical lesion after endodontic surgery by utilizing two biological membranes; 2) To study and compare the change in vascularity of the periapical lesion through color doppler by measuring its peak systolic velocity in both groups.

**Methods:** Due to thee valuable regenerative and therapeutic properties, the biological membrane can support ideal periapical rehabilitation and promote better healing after surgery. The current study is a randomized, double-blinded, parallel-group, single- Centre study. Thirty-four systematically healthy individuals requiring endodontic surgery who fulfilled all inclusion and exclusion criteria were selected and randomly placed in two groups. Surgical curettage of the bony lesion was performed and filled with hydroxyapatite graft. Amniotic membrane (Group 1) and platelet-rich fibrin (Group 2) were placed over it and the flap was sutured back. The surface area and vascularity were the parameters calculated with ultrasound and color Doppler.

**Results:** A significant difference was found in mean vascularity at one month and mean vascularity changes from pre-op to 1 month ($p < 0.05$) between the groups. The mean surface area had no statistically significant difference between the groups. However, in terms of the percentage change in surface area, a significant difference was found from Pre-op to 6 months ($p<0.05$). Amnion is significantly a better promoter of angiogenesis than platelet-rich fibrin. The osteogenic potential of both materials is similar. However, amnion's application, availability, and cost-effectiveness support it to be a better therapeutic option in endodontic surgery.

**Key learning points:**

- Amnion promotes faster angiogenesis during the healing of the periapical bone at 1 month;
- Both amnion and PRF had an insignificant difference with respect to the absolute size reduction of periapical lesions.

# OP093 - EFFECT OF EXPOSURE CONDITIONS ON CHEMICAL PROPERTIES OF MATERIALS FOR SURGICAL ENDODONTIC PROCEDURES- A LABORATORY STUDY

Koutroulis A[1], Valen H[2], Ørstavik D[1], Kapralos V[1], Camilleri J[3], Sunde P[1]

*[1]Section of Endodontics, Institute of Clinical Dentistry, Faculty of Dentistry, University of Oslo, [2]Nordic Institute of Dental Materials (NIOM), [3]School of Dentistry, Institute of Clinical Sciences, College of Medical and Dental Sciences, University of Birmingham*

**Aim:** Assess the role of aging and changes in environmental conditions on properties of a prototype radiopacified hydraulic calcium silicate-based cement (TZ-base) with or without incorporation of silver nano-particles (SNP) or bioactive glass (BG) and two commercial materials for use in endodontic surgical procedures.

**Methods**:TZ-base with or without incorporation of SNP or BG, Biodentine, and intermediate restorative material were immersed in ultrapure water or fetal bovine serum (FBS) for 28 days and were characterized with scanning electron microscopy and energy dispersive x-ray analysis. Immersion media were either replaced weekly or not replenished at all and assessed for: alkalinity and calcium release after 1, 7, 14, 21 and 28 days; antibacterial effect against 2-day monospecies biofilms, and cytotoxicity by the 3-(4,5 dimethylthiazolyl-2-yl)-2,5-diphenyl tetrazolium bromide assay after 1, 7 or 28 days. Data were processed with factorial analyses of variance ($\alpha$=0.05).

**Results:** Alkalinity, calcium release, antibacterial activity, and cell cytotoxicity increased over time when the medium was not changed but decreased correspondingly with medium replenishment. FBS-immersion compared to water reduced the alkalinity, bactericidal properties, and cytotoxicity of prototype cements and Biodentine. Biodentine and 20% BG-containing cement had overall lower alkalinity, calcium release, and antibacterial activity than TZ-base, and Biodentine was less cytotoxic than TZ-base. In conclusion, FBS reduced the alkalinity and antibacterial potential of media of calcium silicate-based cements compared to water. Measured effects of aging in vitro depended on medium replenishment and illustrate the complexity of the leaching dynamics.

**Key learning points:**

- Exposure conditions significantly affected materials' leaching properties;
- Aging of hydraulic calcium silicate cements (HCSC) in a clinically relevant medium affected negatively their antibacterial properties;
- Addition of 2 mg/ml silver nanoparticles to HCSC improved their bactericidal effect in water, but not in FBS;
- Laboratory studies should adjust for environmental conditions to better represent the clinical situation.

# OP095 - INVESTIGATION OF THE EFFECT OF DIFFERENT CEMENTS AND PLACEMENT TECHNIQUES ON THE BOND STRENGTH OF GLASS FIBER POSTS IN THREADS APPLIED WITH DIFFERENT POST SPACE PREPARATION METHODS

Gülgü B[1], Caner N, Ayrancı L

[1]*Ordu University Faculty Of Dentistry Department Of Endodontics*

**Aim:** The aim of this study is to examine the effects of different cements and placement techniques on the bond strenght of glass fiber posts in threads applied with different post space preperation methods and to evaluate the failure modes.

**Methods:** 120 human upper central and canine teeth were recruited for the study. Root canals were enlarged with Reciproc R25, R40 and R50 files and filled with gutta-percha and canal sealer. After 1 week, a 10 mm long post cavity preparation was performed using Cytec Blanco post drills. The shaped post spaces were irrigated in 3 different ways: NaOCl, NaOCl+EDTA and passive ultrasonic irrigation of solutions. Cytec Blanco was divided into two to apply the self-adhesive resin cement system RelyX U200, or the self-etch resin cement system Panavia V5 for placing glass fiber posts. Indirect ultrasonic vibration or manual method were used for post placement. Then, 1.2mm sections were taken from the middle and coronal regions of the fiber posts placed, and the push-out strength was examined in the Universal testing machine.

**Results:** Four-way ANOVA was used with SPSS v27 statistical package program to evaluate the data according to the characteristics examined in study. The bilateral interactions of Irrigation×Cement (p=0.002), Cement×Section (p=0.043) and Placement×Section (p=0.049) were found to be statistically significant.

**Conclusion:** In our study, the effects of different post space preperations, cement types and placement techniques on the bond strenght of fiber post were observed. Further studies are needed to investigate the effect of indirect ultrasonic vibration application on manually placed posts.

**Key learning points:**

- Fiber Post;
- Panavia V5;
- Passive Ultrasonic Irrigation;
- Post Cavity Irrigation;
- Push-Out;
- RelyX U200;
- Ultrasonic Vibration.

# OP096 - EFFICACY OF CHEMICAL AND ELECTROCHEMICAL DISSOLUTION WITH NOVAL IN TREATMENT OF BROKEN NITI FILES

Shalan L[1], AlHwaizi H[1]

[1]*College of Dentistry, Baghdad University*

**Aim:** To evaluate the viability of the chemical and electrochemical dissolution of fragments of fractured NiTi instruments in root canals using Novel solution in extracted human maxillary molars using two electrodes.

**Methods:** Fragments of F2 ProTaper instruments were polarized in palatal root canals of extracted maxillary molars using a chemical and electrochemical method, with the solution restricted to a small acrylic microcell coupled to pulp chamber. Two electrodes were used, where one was kept in contact with the intracanal fragment and another was positioned in the solution present in the acrylic microcell. After the tests, a size 08 K-file was used passively to verify the possibility of bypassing the fragment, which was also confirmed by radiographic analysis to evaluate the re-establishment of the root canal path with a size 08 K-file time needed for each technique was measured in addition to change in length of file and change in width.

**Results:** The D'Agostino–Pearson normality and Tukey-test ($P < 0.05$) was used to compare the time needed for the dissolution tests both chemically and electrochemically in addition to change in length and change in diameters. Results After dissolution, all fragments could be bypassed with a size 08 K-file in extracted teeth. The dissolution process did result in significant reduction in time needed to re-establishment of the canal path. (Tukey-test, $P < 0.05$) and significant change in length and diameters.

**Conclusion**: The chemical and electrochemical dissolution of fragments of NiTi files in root canals of extracted human maxillary molars using two electrodes, and the solution restricted to a small reservoir coupled to the pulp chamber resulted in a significant reduction in time needed for the re-establishment of the root canal path with the passive insertion of size 08 K-files was possible in all samples after the tests in extracted teeth.

# OP098 - DENTAL TRAUMA TRAINING ONLINE

Pillai S[1], Bhatti S[1], Djemal S[2]

*[1]University Dental Hospital Manchester, [2]Dental Trauma UK*

**Aim:** To assess the effectiveness and value of Dental Trauma training online.

**Summary**: Dentists encounter patients with acute dental trauma on an irregular basis, resulting in a lack of experience and sometimes confidence in treating them. They would largely expect to learn the foundations of dental trauma management as an undergraduate student and then build on this with any clinical experience they gain.
Dental Trauma UK (DTUK) was set up in 2014 with the aim to fill this void and provide regular dental trauma education initially in the form of an annual conference with specialists from restorative dentistry, paediatric dentistry, endodontics and wider afield. Due to the pandemic, this conference was replaced with webinars online.
The aim of this project was to evaluate how effective online training in the management of dental trauma and its sequelae with the shift from face-to-face to webinars.
Moving further into a largely technologically driven society, education, specifically in an area as universally essential as dental trauma, webinars have proven an effective way of imparting this, in a way that is both convenient and cost-effective.

**Key learning points:**

- Of 151 dental professionals, 94% agreed that DTUK was successful in imparting information on dental trauma management, with 100% agreeing that online delivery worked. The lectures had a 77% excellent rating;
- An advantage to the online lectures is participants can relate their experiences and seek advice; 73% found the question-and-answer session to be excellent with 63% satisfied with responses to their clinical queries;
- 97% agreed that these lectures helped in supporting and advising dentists in the way dental trauma is managed in the UK.

# OP099 - TRAUMATIC AVULSION AND LUXATION INJURIES TO THE MAXILLARY INCISORS AND ITS SUBSEQUENT SEQUELAE: A CASE REPORT

Javed T[1], Karir N[1]

[1]*Birmingham Community Healthcare NHS Trust, Birmingham Dental Hospital*

**Aim:** The aim of this study is to present a clinical case on the management of traumatic dental injuries and their complications including internal root resorption (IRR) and discolouration. Further aims are to discuss the aetiology and management of IRR and the use of Biodentine versus MTA in anterior maxillary teeth.

**Summary:** This case follows a 16 year old male who presented to the emergency clinic at the Birmingham Dental Hospital following a cricket ball to the face. He sustained an avulsion injury of the UL1 which had an extra-oral time of 5 hours and had been stored in milk prior to being reimplanted by the Emergency Department. 24 hours after replantation, the central incisors had extruded by 1mm. The UL1 and UR1 were repositioned digitally and splinted using a 0.016 wire from UR3-UL3 for 5 weeks. The UL1 was extirpated. On review, the UR1 began to discolour and showed signs of loss of pulpal vitality. The UL1 and UR1 were root treated using Biodentine plugs and backfilled using warm gutta percha. The working length X-ray showed an incidental finding of internal inflammatory root resorption of the UL2. This tooth was then extirpated and subsequently root filled. The discolouration was managed using internal bleaching.

**Key learning points:**

- Dental trauma can often be unpredictable therefore the incidental finding of IRR shows the importance of close monitoring in such cases;
- IRR is a rare pattern of resorption and is not well documented in the literature as a complication to dental trauma;
- Further research needs to be conducted to determine the prevalence of IRR in association with different types of traumatic dental injuries;
- Due to the presence of bismuth oxide, MTA has a higher staining potential than Biodentine therefore Biodentine is preferred for use in anterior teeth.

# OP100 - CLINICAL MANAGEMENT OF COMPLEX CASES IN DENTAL TRAUMA USING SIMPLE TECHNIQUES

El Achkar G[1]

[1]*Saint Joseph University*

**Summary**: Permanent teeth undergo resorption when stimulated by a pathological process. Pathologic resorption occurs following traumatic injuries, orthodontic tooth movement, chemical aggression during a whitening procedure, chronic infections of the pulp or periodontal structures. The pathology is diagnosed with periapical radiographs and assessed with full detail with the aid of CBCT, allowing determination of the extension and areas involved in the resorption lesion, as well as the treatment planning. If the process is left untreated, it will result in the premature loss of the affected teeth. The early differential diagnosis and appropriate treatment at the correct time are critical steps to stop the resorptive process within the pulp canal space, prevent teeth loss and improve the prognosis.
The outcome of the treatment at the early stage is good and depends on the amount of remaining dentin wall thickness. In critical and advance cases, trying to be conservative is very challenging and requires in most cases, patience, skills, and advanced techniques; However, simple and low cost procedures can sometimes be very effective and successful.

# OP101 - EXPERIENCE OF ADULT PATIENTS WITH TRAUMATIC DENTAL INJURIES: A QUALITATIVE STUDY

Haq T[1], Watkins F[1], Albadri S[1], Gartshore L[1], Jarad F[1]

[1]*University Of Liverpool*

**Aim:** To explore the in-depth variable experiences of adults who have sustained traumatic dental injuries (TDI).

**Methods**: This presentation will describe the experiences of TDI patients through semi-structured telephone interviews. Ten adult participants who had sustained TDI were recruited from a dental hospital in the United Kingdom. Thematic analysis was used to analyse the data.
The four key themes identified and their corresponding subthemes will be discussed.

**Results:** The first theme identified was the immediate impact of the injury on dental trauma patients. This theme shows that it can be a very distressing time for a patient when they sustain a TDI. The management of the injury was a second key theme which included many participants being satisfied with the treatment received in secondary care, however, treatment times were noted to be long. The third theme was the personal consequences of the injury on participants which included aesthetic concerns and a negative impact on their social life. This theme shows TDI significantly affected the lives of those who sustained injuries. The final theme was participants' attitude towards future dental care. Many participants reported improved confidence in receiving dental care, however, some have increased apprehension after their experiences.

**Key learning points:**

- The complexities around the consequences of TDI can have a significant impact on the lives of patients who sustain them;
- The interplay of these complexities should be borne in mind when managing these patients.

# OP104 - GUIDED ENDODONTICS AND ITS APPLICATION FOR SELECTIVE ROOT RETREATMENT - LITERATURE REVIEW AND CASE PRESENTATION

Benyőcs G[1]

[1]*PreceDent Dental Office*

**Aim:** The aim of the presentation is to demonstrate the application of static/template guided endodontics for selective root retreatment.

**Summary**: `Primum nil nocere`- first do no harm - should be a must during our endodontic treatments. We often just follow a routine; apply the same protocol for every case. By retreatments for example, we are usually used to following the `all or none`treatment approach - removing all restorative and obturation materials from every root canal - regardless of the presence or absence of periapical pathos. In my opinion this approach should not always be followed. Regarding multirooted teeth we could consider the following:
- The retreatment could be limited to a single root or roots clearly showing periapical pathosis while leaving the root(s) with no visible or perceived pathosis untouched.
- Combine the selectivity of apicoectomy regarding nonsurgical retreatments, together with the accuracy of guided endodontics.

The reason is to avoid the risks of the nonsurgical retreatment: iatrogenic errors, weakening of the tooth producing heat, creating perforation, fractures during post removal etc. - if possible.
In my presentation, I will summarize the literature data in the topic of selective root retreatment and 3D printed, template guided endodontics. I will share my personal seven years of experience, applying this method. Also exhibiting a complex case with detailed information about treatment planning and step-by-step procedure, demonstrating with a five-year follow up.

**Key learning points:**
Attendees will be informed about:

- The best evidence available in the topic of the presentation;
- The key factors of the indication of selective root retreatment;
- The steps of planning the template for guided endodontic treatments;
- Step-by-step procedure of implementation;
- Potential mishaps and risks of this approach.

# OP105 - INFLUENCE OF ENDODONTIC ACCESS CAVITY DESIGN ON BIOMECHANICAL PROPERTIES OF MANDIBULAR FIRST MOLARS: A FINITE ELEMENT ANALYSIS

Arıcan B[1], Gündoğar M[2], Uslu G[3], Özyürek T[1]

*[1]Bahçeşehir University School Of Dental Medicine Department Of Endodontics, [2]Medipol University, School of Dentistry, [3]Çanakkale Onsekiz Mart University, Faculty of Dentistry*

**Aim:** It was aimed to compare the biomechanical properties of mandibular first molars with different cavity designs using finite element analysis.

**Abstract:** Finite element analysis was performed on simulated models of mandibular first molars with 7 different endodontic access cavities; traditional endodontic access cavity-class I (TEC-I), traditional access cavity-class II (TEC-II), ninja access cavity (NEC), conservative access cavity (CEC), truss access cavity (Tr-EC), caries-driven access cavity (Cd-EC), caries-driven truss access cavity (Cd-TrEC). One intact tooth model was used for comparison. Each model was subjected to three different force loads which mimicked the vertical and lateral masticatory forces. The peak von Misses (VM) stress and the stress distribution pattern were evaluated.

**Results**: According to the results, increasing the size of the access cavity was related to higher stress distribution on both enamel and root surface. The stress distribution on enamel and root surface were similar for NEC, CEC and Tr-EC cavity types under simulated vertical and lateral masticatory forces. The highest stress distribution was observed on the enamel surface of the Cd-EC design and the dentin surface of the TEC-II design under all load types. The stress was mainly concentrated on the lingual root surfaces and in the pericervical area.
Within the limitation of this study, the highest VM stress values were observed under simulated multipoint vertical masticatory forces. Within the enlargement of the endodontic access cavity design, the stress distribution on the enamel and dentin surface dramatically increased.

**Key learning points:**
Preparing minimally invasive endodontic access cavity will improve the biomechanical properties of mandibular molars under static forces.

# OP106 - INFLUENCE OF CAVITY DESIGN ON BIOMECHANICAL PROPERTIES OF AN ENDODONTICALLY TREATED MAXILLARY FIRST MOLAR: FINITE ELEMENT ANALYSIS

Uslu G[2], Arıcan Alpay B[1], Gündoğar M[3], Özyürek T[1]

*[1]Bahçeşehir University, [2]İdadent Oral and Dental Health Clinic, [3]İstanbul Medipol University*

**Aim**: This study aimed to compare the biomechanical properties of maxillary first molars with different cavity designs by using the finite element analysis.

**Methods:** The finite element model based on the micro-computed tomography data of maxillary first molar (MFM) were prepared with 5 different endodontic access cavities: traditional access cavity-class I (TEC-I; located on the occlusal surface), traditional endodontic cavity-class II (TEC-II; mesio-occlusal cavity) conventional endodontic cavity (CEC), ninja endodontic cavity (NEC) and extended endodontic cavity (EEC). The mesiobuccal and distobuccal root canals were prepared to 30/.04. The palatal root canals in all models were prepared to 40/.04. Three different static loads were applied: Static I (vertically 250N), Static II (vertically 800N from 5 different contact points) and Static III (total of 225N oblique load from two points). The stress distribution pattern and maximum von Mises (VM) stresses on enamel and dentin were assessed.

**Results:** The stress distribution on enamel were similar for NEC and CEC, and higher in EEC design especially on the edges of margin and composite restoration in all static load types. The stress was migrated from the pericervical area to the apical third of the root. The most stress concentration was observed on the palatal surfaces of roots. In the EEC and TEC-II cavity designs, a slightly higher concentration of stress was observed in the pericervical area compared to the other cavities.

**Conclusion:** The biomechanical properties of MFM will be enhanced by protecting pericervical tooth structure with NEC and CEC designs.

# OP107 - HOW DO DENTAL PRACTITIONERS RESTORE ENDODONTICALLY TREATED TEETH IN TURKEY? A RETROSPECTIVE PILOT STUDY

Usta S[1], Deniz-Sungur D[2]

*[1]Department of Endodontics, Gulhane Faculty of Dentistry, University of Health Sciences, [2]Department of Endodontics, Faculty of Dentistry, University of Hacettepe*

**Aim:** A proper post-endodontic restoration is a crucial factor for the success of endodontic treatments. Therefore, this study aimed to determine the post-endodontic restoration patterns of dental practitioners in Turkey.

**Methods**: Sixty patients who were referred to the Department of Endodontics for non-surgical endodontic retreatment were included in this study to determine the post-endodontic restoration patterns of dental practitioners. Demographic features of the patients (age and gender) and related information about restoration such as tooth type, time period, the specialty and institution of the dental practitioner, possible re-restoration history, cavity and restoration type, and presence of post and post type were recorded. Restorations were evaluated using the United States Public Health Service (USPHS) criteria. Descriptive data analysis was performed and categorical variables were compared by the fisher-freeman-halton exact test ($p<0.05$).

**Results:** A total of 23 female and 37 male patients (mean age: 38.4) contributed to this study. More than half of the teeth were molars (55%). The vast majority of the evaluated restorations were done less than 5 years ago (71.6%) by general dental practitioners (51.7%) in oral and dental health centers (63.3%). The most preferable restoration types were amalgam (41.7%) and composite (28.3%), a metal-ceramic crown (26.7%), and composite-ceramic veneer (3.3%). The presence of prefabricated metal posts was observed in only two cases. There was a significant relationship between restoration patterns and cavity and tooth type ($p<0.05$). In teeth with amalgam restorations, criteria such as anatomical form, surface roughness, marginal adaptation, and color match were associated with a higher rate of impairment compared to other restorations.

**Key learning points:**

- Presenting the post-endodontic restoration patterns among dental practitioners in Turkey based on clinical observations;
- Evaluation of the quality of the selected restorations in accordance with several clinical factors in time periods.

# OP109 - A MULTIDISCIPLINARY APPROACH TO RESTORE TEETH: SURGICAL EXTRUSION - A CLINICAL CASE

Mobayed T[1], Tsotou F[1], Garcia M[1], Abella Sans F[1], Durán-Sindreu F[1]

[1]*Universitat Internacional de Catalunya, Barcelona*

**Aim:** To describe the multidisciplinary management of a non restorable tooth with a surgical extrusion approach that has undergone a nonsurgical endodontic retreatment prior, and restored with a intra-radicular fiber post and zirconia full coverage crown prepared with the biologically oriented preparation technique (B.O.P.T).

**Summary:** A 28-year-old female patient with no relevant medical history who attended to our clinic (CUO, UIC Barcelona) concerning tooth number 2.5. The tooth was deemed unrestorable due to the missing palatal, mesial, and distal walls with only the buccal wall remaining. Moreover, the tooth had a previous endodontic treatment with symptomatic apical periodontitis. The treatment options were: orthodontic extrusion or surgical extrusion; they were proposed to the patient, and she agreed solely to the surgical extrusion. The adjacent teeth had evident carious lesions. Prior to treating the tooth, the dentist decided to restore these lesions. Afterwards, the treatment of the tooth of interest started with a buildup followed by a retreatment, and in a second appointment a surgical extrusion approach was carried out in-order to gain ferrule. The tooth was splinted with a semi-rigid stainless steel splint for 3 weeks. After removing the splint, a post space was prepared and an intraradicular fiber post was cemented for the purpose of restoration retention. In the restorative phase, a B.O.P.T preparation was executed prior to cementing a zirconia full coverage crown. The follow up radiographs 2 years post-op. indicate healing, and the clinical examinations prove tooth functionality.

**Key learning points**:

- Decision making in unrestorable teeth in order to gain ferrule;
- How to approach a surgical extrusion case in patients needing prosthetic rehabilitation;
- Evaluate the results and treatment outcome in cases of surgical extrusion.

# OP110 - "STRESS REDUCED DIRECT COMPOSITE POST ENDO RESTORATION" A RAY OF NORTHERN LIGHT

Vyas K[1]

[1]*Vyas Dental Inn*

**Aim:** This oral presentation aims to discuss what is a stress reduced direct composite restoration and how it can serve as a long term final restoration in structurally compromised endodontically treated teeth in preventing/minimising the catastrophic fractures, which is one of the common reason for extraction of endodontically treated teeth.

**Summary**: Studies have shown that the structural compromise due to existing caries and loss of tooth structure due to access cavity and shaping are the main reasons for weakening of the endodontically treated teeth. Studies have also shown that the highest stresses are on the cervical region of the tooth hence a new paradigm shifted towards preservation of peri cervical dentin and preservation of enamel in cervical region (Bio Rim). Stress Reduced Direct Composite Restoration is a 100% tooth preservation protocol in which all the healthy crown structure is preserved. Restoration is done with materials similar to modulus of components of the tooth, specific techniques are followed to develop bond strength similar to that of the tooth and Fibers are used to reduce polymerisation stresses & to mimic DEJ. Hence Stress Reduced Direct Composite Restoration can serve as the long term final restoration in endodontically treated teeth. Examples of SRDC restorations with follow ups upto 5 yrs, not only in teeth with all the walls,1 wall, 2 wall defects but also in hopeless teeth wherein no other treatment is possible are shown.

**Key learning points:**

- What is Stress Reduced Direct Composite Post Endo Restoration?
- How it helps in preventing/ minimising catastrophic fractures?
- Which all clinical conditions can be considered for SRDC as final long term restoration?
- How this restoration is done?
- How it is a better option than a full coverage crown/ partial crowns?

# OP111 - INVESTIGATION OF ODONTOBLAST MECHANOSENSITIVITY

Marincsák R[1], Racskó M[2], Bohács J[1], Lisztes E[2], Kunka Á[2], Bágyi K[1], Kovalecz G[3], Tóth B[2]

*[1]Department of Operative Dentristry and Endodontics, Faculty of Dentistry, University of Debrecen, [2]Department of Physiology, Faculty of Medicine, University of Debrecen, [3]Pediatric and Preventive Dentistry, Faculty of Dentistry, University of Debrecen*

**Introduction:** Odontoblasts are highly differentiated specialized cells that form the outermost layer of the dental pulp tissue, lining the inner surface of dentin. They play a double role in dental homeostasis, responsible both for dentin production and the transduction of physical stimuli from the outside environment to nearby nerve endings. Odontoblasts can detect mechanical and thermal stimuli by sensing fluid movement in the dentinal tubule induced by these forces via mechanosensitive ion channels.

**Aim:** In our current research, we aimed to investigate the presence and function of several different mechanosensitive ion channels from the Transient Receptor Potential (TRP) and Piezo families in human odontoblasts.

**Methods:** We perform experiments on odontoblast-like cells differentiated from cultured primary dental pulp cells. Ion channel functionality was investigated using Fura-2 AM and pharmacological treatment using channel agonists and antagonists. Mechanical stimulation was simulated by administering a hypoosmotic solution or rapid fluid movement created by the pipetting function of the Flexstation III spectrometer used for measurements.

**Key learning points:**

- Agonists of Piezo1, TRPV2, TRPV4, and TRPA1 were found to elicit significant increases in intracellular $Ca^{2+}$ concentration, which were inhibited by specific antagonists of these channels.
- We were unable to detect the presence of this channel in human odontoblasts, as menthol-induced $Ca^{2+}$ signals were abolished by a specific antagonist of TRPA1 and not by an antagonist specific to TRPM8.
- Increases in intracellular $Ca^{2+}$ content induced by mechanical stimulation were also prevented by antagonists of the aforementioned channels to varying degrees, with Dooku1 and HC067047, antagonists of Piezo1 and TRPV4 respectively, showing the largest effect.

# OP112 - VITAL PULP THERAPY IN IMMATURE PERMANENT TEETH

Takruri M[1]

[1]*Own Clinic*

**Summary:** The main goal of pulp therapy is to maintain the integrity of the teeth and supporting tissues. In this lecture we will discuss different techniques of VPT besides the factors affecting the outcome starting from indications, contra-indications and case selection.

# OP113 - EFFECT OF PLATELET-RICH FIBRIN AND CONCENTRATED GROWTH FACTOR ON THE REGENERATIVE POTENTIAL OF HUMAN INDUCED PLURIPOTENT STEM CELLS (HIPSCS): A COMPARATIVE ANALYSIS

Bharti R[1]

[1]*King George's Medical University Up Lucknow*

**Aim:** Platelet rich fibrin (PRF) has been widely used in regeneration; concentrated growth factor (CGF) has recently evolved itself as a promising material in this field. The purpose of this study is to evaluate their effects on the proliferation, migration and differentiation of human induced pluripotent stem cells (hiPSCs).

**Introduction:** Regeneration is the process by which the integrity of lost tissues can be regained through placement of graft materials in endodontic as well as periodontal and implant surgeries which decreases the post operative recovery period and improves the outcome. Human induced pluripotent stem cells (hiPSCs) have been reprogrammed from differentiated cells to become pluripotent and behave like embryonic stem cells having the potential to form any cell type.

**Methods:** The study evaluates the capacity of CGF and PRF for wound healing by analysing their effect on proliferation by trypan blue assay, migratory capacity by scratch assay and ability to differentiate hiPSCs by quantitative real time polymerase chain reaction. An overall increase in growth with migration and differentiation of cells was observed along with some osteogenic potential using CGF and PRF.

**Key learning points:**

- CGF and PRF prolong the duration of growth factor activity, which is conducive for growth factor synergy, and enhances cell proliferation and osteogenic differentiation;
- CGF and PRF aid in wound healing by migration and differentiation of the surrounding mesenchymal stem cells without risk of immune rejection being autologous in nature offering as a scaffold and source of growth factors with regenerative potential;
- iPSCs provide the possibility to conduct elaborate studies in biomedical research and development, for human disease treatment, regeneration, and development of cell transplantation therapy.

# OP117 - EVALUATION OF THE REMOVAL OF CALCIUM HYDROXIDE–LOADED POLY(LACTIC-CO-GLYCOLIC ACID) BIODEGRADABLE NANOPARTICLES FROM THE ROOT CANAL AND ITS EFFECT ON THE BOND STRENGTH OF MTA

Leelapornpisid W[1]

[1]*Department of Restorative Dentistry and Periodontology, Faculty of Dentistry, Chiang Mai University*

**Aim**: To evaluate the removal of calcium hydroxide–loaded poly(lactic-co-glycolic acid) biodegradable nanoparticles from the root canal system and its effect on the bond strength of the mineral trioxide aggre- gate (MTA).

**Methods**: 126 single-rooted teeth were divided into 3 experimental groups (n = 36) that were treated with touble antibiotic paste (TAP), calcium hydroxide–loaded poly(lactic-co-glycolic acid) and calcium hydroxide (CH) and one control group (n = 18). In the first part, 18 teeth from each experimental group (n = 54) were examined to remove medicament from the root canal. In the second part, 72 teeth (3 experimental groups (n = 54) and one control group (n = 18)) were used for the evaluation of the push-out bond strength of MTA. The data was analysed with Pearson chi-square with Mann–Whitney test ($p<0.05$).

**Results:** Calcium hydroxide–loaded poly(lactic-co-glycolic acid), HICA and CH could not be completely removed from the root canal, there was no statistically significant difference between the residual between each groups ($p>0.05$). Calcium hydroxide–loaded poly(lactic-co-glycolic acid) and CH group showed significantly higher push-out bond strength compared to the TAP group ($p<0.05$).

**Conclusion:** Intracanal medicaments cannot be removed completely. TAP significantly reduced the bond strength of the MTA compared with the Calcium hydroxide–loaded poly(lactic-co-glycolic acid) and CH.

**Keywords**: calcium hydroxide–loaded poly(lactic-co-glycolic acid), calcium hydroxide, mineral trioxide aggregate, root canal medicaments.

HELSINKI

SHEDDING NORTHERN
LIGHTS ON ENDODONTICS

6-9 SEP. 2023

ese

esebiennialcongress.com