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Oral Session P01 – Endodontics

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INTERNATIONAL JOURNAL OF PAEDIATRIC DENTISTRY

Poster Session P01/Endodontics

P01–1

Application of mineral trioxide aggregate in achieving apical barrier in permanent teeth

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Introduction: Three children were referred to the children's dental department for endodontic management of permanent incisors requiring the creation of an apical barrier with the use of Mineral Trioxide Aggregate (MTA). Case 1, a 14-year-old boy presented with two nonvital upper permanent lateral incisors, both with dens invaginatus and incomplete root development. Case 2, a 9-year-old girl presented with a nonvital immature upper left permanent central incisor following a history of trauma. Case 3, a 16-year-old female presented with a nonvital upper right permanent central incisor with an apical root fracture. All cases presented with a chronic sinus and associated periapical radiolucency on the affected teeth.
Clinical management: Endodontic treatment was undertaken on all three cases using the microscope. On the first visits, the teeth were dressed with nonsetting calcium hydroxide. On the following visit, an apical barrier was achieved with the orthograde placement of MTA (Pro Root MTA, Dentsply, Tulsa, USA) and confirmed radiographically. On the same visit, the root canals were obturated using thermoplastic obturation technique. The access cavities were restored with RMGIC over the gutta-percha and composite. At the follow up appointment (ranged from 8–12 months), all teeth were clinically asymptomatic and radiographic examination revealed signs of healing.
Conclusion: The placement of MTA in single visit can be successfully used to achieve an apical barrier for permanent teeth in different clinical scenarios, in which the prolonged use of nonsetting calcium hydroxide was the traditional recommended treatment.

P01–2

Clinical and radiographic evaluation of diode laser pulpotomy on human primary teeth: a 12-month follow up

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Introduction: The purpose of this preliminary investigation was to evaluate the clinical and radiographic success rate of Diode laser pulpotomy in comparison to conventional formocresol pulpotomy of human primary molars.
Materials and methods: A randomized, single-blind, split-mouth study was designed with a sample size of 14 children aged 3–9 years (mean age = 6.5). A total of 20 pairs of teeth from these 14 patients were included based on their need for pulp treatment due to caries exposure. Clinical and radiographic criteria of healthy teeth were considered in case selection. One tooth from each pair was randomly assigned to the Diode laser pulpotomy group while the other was assigned for the formocresol pulpotomy group. Following the routine removal of coronal pulpal tissue in every tooth, Diode laser was applied at 10 W, 20 Hz (with 0.08-mm tip) in experimental group and a 1:5 diluted formula of formocresol was introduced to the canal orifice of the control group. A mixture of reinforced Zinc oxide eugenol paste was then placed over the pulp stump, and the tooth was restored either with stainless steel crown or amalgam. All teeth were then followed clinically and radiographically at 3, 6 and 12 months.
Results: Assessing the collected data revealed that from the total of 14 subjects all returned for their follow ups. Clinical success of the individual teeth was found to be achieved in all of the tests and control teeth in this period (100%). This was while radiographic findings showed a 95% success after 6 and 12 months. Analyzing the data revealed no significant difference using Fisher exact test too ($P > 0.05$).
Conclusion: It seems that the diode laser energy may be considered as an alternative to formocresol for pulpotomy in primary teeth. A longer period of follow up with a larger number of cases is underway for further and more reliable results.

P01–3

Dental pulp tissue regeneration in mini-pig by deciduous dental pulp stem cells

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Introduction: A biological tooth substitute that could replace decayed or lost teeth would provide a vital alternative to currently available clinical therapy. The aim of this study was to establish an animal model of utilizing deciduous dental pulp stem cells (SHED) and tissue engineering method to examine the functional properties of SHED on the injured dental pulp.
Materials and methods: SHED were isolated by using enzyme digestion from mini-pig's deciduous teeth. These cells expressed capacity to generate clonogenic cell clusters in culture and were identi?ed to be a population with high proliferation capability. Pulp amputation was performed on four posterior and four anterior teeth of mini-pig and the SHED materials were placed directly on the pulp amputation sites and sealed. The experiments were divided into four groups: 1. gelfoam as control 2. SHED with cultured medium 3. SHED with lovastatin. 4. SHED with odontoblast induction medium were transplanted on to the pulp stumps. The pulp reactions were examined histologically by H&E stain 3 months after the pulp amputation.
Results: The result showed that reparative dentin and collagen were regenerated on the amputation sites. The amount of regenerative dentin in each group was roughly similar. However, the SHED + lovastatin group seemed to have a greater amount of reparative dentin above the pulp stump. Therefore, lovastatin might enhance odontoblast differentiation.
Conclusion: The regeneration and functional reconstruction capability of SHED *in vivo* was established which possibly can be utilized for teeth replacement therapy in the future. This study was supported by National Taiwan University Hospital, Taipei, Taiwan

P01–4

Effects of sodium fluoride on deciduous tooth pulp cells

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Introduction: Fluoride has been used in dental public health programs for a long time. The aim of this study was to investigate the effects of different concentrations of sodium fluoride on the viability, mineralization and differentiation potentials of deciduous tooth pulp cells.
Materials and methods: Dental pulp cells were isolated from human deciduous teeth with enzyme digestion and cultured with sodium fluoride at 0, 10^{-6}, 10^{-5}, 10^{-4}, 5×10^{-4} and 10^{-3} M in regular culturing medium and mineralizing medium. The proliferation, calcification and differentiation potentials of cells were then examined with MTT assay and RT-PCR analysis. The bone- or dentin-related genes (ALP, osteocalcin, type I collagen, DSPP and DMP1) were evaluated after culturing for 5, 10, and 15 days.
Results: A cell-based quantitative evaluation of MTT assay showed that the concentration of NaF at 10^{-6} M and 10^{-5} M in culturing medium promoted cell proliferation. Whereas the concentration of NaF at 10^{-6} to 10^{-3} M in mineralizing medium promoted cell proliferation. Different concentrations of NaF alter the bone- or dentin-related gene expression. It was found that NaF at the concentration of 10^{-6} to 10^{-4} M may speed up the differentiation potential of deciduous tooth pulp cells.
Conclusion: Our results demonstrated the effects of NaF on the proliferation and differentiation potential of deciduous tooth pulp cells are dose dependent, concentrations of NaF at 10^{-6} M and 10^{-5} M are best for cell proliferation and 10^{-6} to 10^{-4} M are best for cell differentiation.

P01–5

Comparison of rotary and manual instruments in canal preparation of primary molars

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Introduction: Rotary instruments enable a significant reduction in the preparation time, and cleaner and better shaped root canals. This fact has been studied on permanent teeth.This study was an attempt to compare the NiTi rotary instruments (Hero-624) and K-files in the root canal preparation of primary molars. Time and canal transportation were compared.
Materials and methods: This is an experimental, *in vitro* study. Thirty human extracted primary molars 8 mm in length were selected. After preparing an access cavity, the specimens were further divided into groups, 15 for NiTi and 15 for K-files. Before canal preparation with a # 15 K-file and after canal preparation with a master apical file, canal curvature was evaluated by means of radiovisiography using the Weine technique. Apical transportation was calculated. Time taken for preparation was recorded by chronometer. The results were analyzed with *t*-test and Mann–Whitney *U*-test.
Results: Mean of canal transportation angle was 3.42 for the NiTi group and 7.33 for the K-file group ($P < 0.04$).Mean instrumentation time was 4.28 for the NiTi group and 8.76 min for the K-file group ($P < 0.001$). There was a significant difference between the two groups.
Conclusion: In primary teeth preparation time, canal transportation with Hero-624 rotary instruments was less compared to K-file. To conclude, we would encourage using rotary instruments on primary teeth.

P01–6

Estimating the extent of mineralization in hard tissues of young permanent teeth

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Introduction: Analysis of the extent of mineralization in hard tissue of young permanent teeth and in permanent teeth of adult patients.
Materials and methods: The research was based on the densitometry results of dental volumetric tomography (DVT) combined with Picasso Pro (Watech). We studied the tomograms of 159 patients aged 12–25 and tomograms of 36 patients aged 25–30 years.
Results: While studying the data of comparative densitometry on different areas of young teeth it was revealed that the maximum indicator of enamel mineralization amounted to 1183 ± 20.99 HU units and that of dentin to 706 ± 14.2 HU units; minimal in the apical portion of roots were 348 ± 26.1 HU units. In patients aged 25–30 years old the same tendency was revealed. The maximum values in the area of enamel and crown dentin were practically identical to values registered in young permanent teeth i.e., 1207 ± 13.07 HU units in the area of enamel and 756 ± 12.83 HU units in the area of crown dentin. Minimum indicators on the apical portion of the root canal being 543 ± 10 HU units crucially exceeded that of the young group being 348 ± 26.1 HU ($P < 0.01$).
Conclusions: The extent of dentin mineralization in the apical portion of roots in young permanent teeth is much less than in adults. This should be taken into account when planning endodontic treatment.

P01–7

Physical stability of different formulations of an endodontic iodoform-based paste

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Introduction: Guedes-Pinto iodoform-based paste (GPP) is the most common filling material for endodontic treatment in primary teeth in Brazilian dental schools, due to its good results for the past two decades. However, its formula must be manipulated immediately prior to using, becoming an issue in components proportion standardization and increasing of clinical time. Therefore, a premixed manufactured GPP would be desirable, which requires addons to maintain all pharmaceutical aspects, such as physical stability.
Materials and methods: This study evaluated the physical stability of the original GPP formula and four new formulations of GPP with different extra excipients (GPP-DE). The physical stability was visually evaluated using a four-grade score scale to classify the changes of consistency, color and homogeneity of all pastes after 150 days of storage at room temperature (20 to 25°C) and refrigerated (5 to 7°C) conditions.
Results: After 150 days, all groups maintained the initial pasteous consistency. The initial color of the original formula (yellow) changed severely to a dark orange aspect, although all four new formulations had a slight change. The original GPP also lost its

homogeneity, clearly showing components separation and precipitation, while all the new formulations maintained their homogeneity during all 150-days period. The storage condition did not interfere in the physical stability of any studied formulation.
Conclusion: The addition of excipients improved the physical stability of the four new formulations (GPP-DE) in comparison to the original formula (GPP).

P01–8

Clinical and radiographical outcomes of three pulpotomy techniques performed by dental students

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Introduction: The aim of this study was to compare the clinical and radiographical success rate of three pulpotomy techniques (formocresol, calcium hydroxide and calcium hydroxide/iodoform).
Materials and methods: Ninety-one primary molars with dental caries in 91 children between 6 and 10 years old were treated by three pulpotomy techniques. The pulpotomies were performed by fifth-year undergraduate dental students. Members of senior staff at the clinics supervised all the procedures. Informed consent was obtained from children's parents. The teeth were randomly assigned to the experimental (calcium hydroxide and calcium hydroxide/iodoform) or control (formocresol) groups. After coronal pulp removal and haemostasis, remaining pulp tissue was covered with calcium hydroxide or calcium hydroxide/iodoform paste in the experimental groups. In the control group, formocresol was placed with a cotton pellet over the pulp tissue for 5 min and removed; the pulp tissue was then covered with zinc oxide-eugenol. All teeth were restored with stainless steel crowns. Clinical and radiographic successes and failures were recorded at 1, 3, 6 and 12-month follow-ups by the authors. Data were statistically analysed with chi-square tests.
Results: The follow-up evaluations revealed that the clinical success rate was 89.7 % for formocresol, 33.3% for calcium hydroxide and 17.2 % for calcium hydroxide/iodoform. The radiographic success rate was 89.7 % for formocresol, 33.3 % for calcium hydroxide and 13.8% for calcium hydroxide/iodoform.
Conclusions: Formocresol was superior to calcium hydroxide and calcium hydroxide/iodoform pastes in primary molar pulpotomies. Internal resorption was the most common radiographic failure in all three pulpotomy techniques.

P01–9

Comparative evaluation of $Ca(OH)_2$ plus points and $Ca(OH)_2$ paste in apexification treatment

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Introduction: The alkalinity of $Ca(OH)_2$ is used to stimulate the formation of mineralized tissue in the apical part of the immature tooth. Calcium hydroxide plus point (CHPP) [Roeko, Langenau, Germany] is a relatively recent development designed to release calcium hydroxide from a gutta-percha matrix. The aim of this study was to compare CHPP with the conventional calcium hydroxide solution (CHS) clinically and radiographically as materials used in apexification treatment.
Patients and methods: Sixteen children, each with at least one necrotic permanent central incisor requiring apexification treatment were selected for this study. After ethical approval and informed parental consent, treatments were performed by the same pedodontist. 22 selected teeth were divided into two test groups. In group 1, the conventional calcium hydroxide apexification was performed in ten teeth, whereas in group 2, the CHPP apexification was done in 12 teeth. The children were recalled for clinical evaluations every 3 weeks and their radiographical evaluations were done every 3 months with Digora digital radiography system. Chi-square test was used to evaluate the differences between the groups.
Results: The follow-up evaluations revealed failure due to resorbing of the formed apical barrier and tenderness to percussion detected at 8-month evaluation in only one tooth treated with CHPP. Apexification was successfully achieved using CHS and CHPP in the remaining 21 teeth. No statistically significant difference between the groups was observed ($P > 0.05$).
Conclusion: It was concluded that CHPP treated central incisors requiring apexification demonstrated good success. However, long term clinical trials with this material are required.

P01–10

Pulp chamber microflora of primary teeth with inflammatory symptoms in Costarican children

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Introduction: Dental caries is the most important oral disease in Costa Rica's children, and pulpotomy became the most accepted treatment for affected pulps of temporary teeth. For this reason, the present study analyzes the bacterial microflora present in the pulp chamber of primary teeth in 16 10-year-old children diagnosed with pulpitis. Permission was conceded by the ethical commitee of the University of Costa Rica, and each subject and guardian gave written informed consent.
Materials and methods: Samples were collected aseptically at pulpal horn and root canal from every affected tooth. Each sample was plated on selective media for aerobic bacterial growth and incubated at 37°C until the emergence of colonies, which were purified and identified by Biolog semiautomatic system. For anaerobic isolation, a sample was taken by syringe extraction from a microexposition of root's canal and immediatly inoculated in pre-reduced media and incubated at 37°C in anaerobic conditions.
Results: From 16 samples, 50 bacteria were isolated; in 96.9% of the samples just two or less different morphotypes were cultivated. At pulpal horn and root canal level we identified Dermacoccus, Bacillus and Micrococcus (mouth microflora) Microbacterium, Deinococcus, and oportunist pathogens like Pseudomonas and Staphylococcus and Neisseria. Exclusively at root canal we found the anaerobic species Fusobacterium nuclatum, Veillonella, Propionibacterium acnes and Actinomyces meyeri.
Conclusion: All root samples analyzed were colonized with aerobic and anaerobic bacteria, some of them previously related with periapical pathologies, and a direct relation between presences of anaerobic bacteria with the severity of inflammation was observed.

P01–11

Influence of temporary filling material on bacteria contamination during endodontic treatment

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Introduction: To study the influence of different kinds of temporary filling materials on contamination with bacteria.
Materials and methods: Research group included 45 children 15–18 years old, who had been cured of 45 cases of chronic fibrose pulpitis in one-root teeth. The microbiological study had two steps: 1st stage just after mechanical and medicinal intervention: Just after treatment, material was taken with sterile gutta-percha point and sown on a culture medium: meatpeptonium agar, enriched with cattle serum. Then the root canal system was obturated, sterile gutta-percha point was placed on the orifice of the canal and the endodontical approach was isolated. All teeth studied were separated into three groups of 15, depending on the temporary filling material. Zink-oxide noneugenol cement, composite and glass-ionomer cement were used as temporary filling materials. Ten days later in the 2nd stage of the microbiological study, material from beneath the temporary filling was also sown on a culture medium.
Results: Just after mechanical and medicinal treatment, growth of microflora, *E. coli* and solitary Corinebacteria, was found in 13.3% of the cases. In the other 87.6%, there was no growth of microflora. In the second step of the research, using glass-ionomer cement (Group 1) bacteria growth was found in 20% and using zink-oxide noneugenol cement (Group 2) bacteria were found in 70% of the cases and after using composite (Group 3) in 66% of the cavities.
Conclusion: None of the indicated materials are able to secure an optimal germetization of the endodontical approach during all stages of the root canal treatment.

P01–12

Fracture resistance of primary anterior teeth restored with different intracanal post systems

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Introduction: Several intracanal post-systems have been proposed for the restoration of severely broken down primary incisors. However, there are insufficient data on the strength of the various systems. Thus, the aim of this *in-vitro* study was to compare the fracture resistance of endodontically treated primary incisors restored with different intracanal post-systems.
Materials and methods: Thirty acrylic teeth were sectioned 2 mm above the CEJ followed by obturation of the root canals using Metapex. The teeth were subsequently immersed in melted wax upto 2 mm below the CEJ and embedded in brass cylinders (20×30 mm) using methyl methacrylate acrylic resin. Following resin polymerization, the wax was removed from the resin blocks using hot water and replaced with polyether impression material to simulate the periodontal ligament. The teeth were randomly divided into: (i) no post, (ii) shoulder preparation with no post, (iii) composite post, (iv) wire post, (v) omega loop, and (vi) RelyX™ fiber post groups. Prior to placement of the various post-systems 5 mm of Metapex was removed followed by placement of 2 mm of glass ionomer cement. The teeth were restored using composite resin strip crowns and then subjected to loading using an Instron-1185 at a cross-head speed of 0.5 mm/min, 2 mm from the incisal edge at 45° to the long axis until failure. ANOVA and Student-Newman–Keuls test were used for data analysis.
Results: Fracture resistance values exhibited by the RelyX™ fiber post and shoulder preparation with no post were significantly different from the remaining groups ($P < 0.05$).
Conclusion: RelyX™ fiber post group exhibited the highest fracture resistance values among the different intracanal post-systems.

P01–13

Apical microleakage evaluation of chitosan as root filling material

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Introduction: To evaluate the apical sealing of chitosan as a root canal filling material.
Materials and methods: Seventy-five normal single-rooted teeth from outpatient clinic were randomly divided into five groups. Each group contained fifteen teeth. All crowns were sectioned by high speed bur at the site 1–2 mm above cementoenamel junction. Each root pulp was extirpated and working length was established and noted. Each canal was flared out by using No.15-No.40 H files to reach the criteria that No.15 file could be passed through apical foramen. Three per cent of hydrogen peroxide solution and normal saline were used to irrigate each canal respectively and alternately. Routine root canal filling with four kinds of materials (chitosan paste, chitosan-barium sulfate paste, zinc oxide eugenol paste, vitapex paste) respectively. The fifth group served as control which with no filling materials in the root canals. The capability of apical sealing was assessed by the degree of dye penetration on sections of the teeth. Data were analyzed using SPSS 10.0 q test.
Results: There was no significant statistical difference among the groups of chitosan paste, chitosan- barium sulfate paste and ZOE paste, but there was significant statistical difference among the above three groups comparing to Vitapex group. There was also significant statistical difference among four kinds of root canal filling materials comparing to control group.
Conclusion: The capability of root canal sealing of chitosan paste was similar to that of traditional ZOE paste.

P01–14

A comparative evaluation of root canal sealers (study *in vitro*)

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Introduction: Presently none of available sealers meet the ideal criteria for a root canal sealer. The purpose of this study was to evaluate the apical sealing efficiency of four different root canal sealers.
Materials and methods: Eighty-eight single fully formed rooted human dentitions were selected and the sealers used were conventional Zinc oxide eugenole, Endomethasone, Sealapex and AH plus. There were four groups, 22 teeth per group. The anatomic crowns were sectioned at proximal cemento-enamel junction and the cleaning and shaping was carried out using the serial step back technique. Cold lateral compaction was standardized. Radiographs were taken to confirm apical and lateral seal. Teeth were subjected to passive 2% methylene blue at pH = 7. Longitudinal sectioning technique was carried out and the average dye penetration (DP mm) and percentage of leakage (PL%) was measured under

a stereomicroscope with a calibrated scale eyepiece at magnification 6X and calculated after 48 h and after 30 days. The results were analysed using students *t*-test.

Results: After 48 h: ZnOE showed a maximum DP of 9.75 and PL of 67.53 and AH Plus showed the least: DP 3.42 and PL 23.62. Although all four groups leaked more at the end of 30 days, but Endomethasone had significantly more DP 11.52 and PL 72.83. AH Plus leaked less, compared with the others: DP 5.0 and PL 37.68.

Conclusion: No teeth showed perfect sealing although a standardized, commonly used method was used. The degree of leakage all sealers increased with time. Apparent adequacy of seal lends support to the clinical use of AH Plus.

P01–15

Endodontic treatment of a maxillary lateral incisor with two root canals

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Introduction: The maxillary lateral incisor usually occurs with a single root and canal. Limited clinical reports have shown a maxillary incisor with two root canals. In the present case, radiographic examination and the endodontic treatment of a maxillary lateral incisor with two root canals and normal clinical crown is described.

Clinical management: A 10-year-old girl was referred to Gazi University, Pediatric Dentistry Department. She had suffered from swelling associated with maxillary left lateral incisor (#22). Visual examination of the tooth was normal. Radiolucency between maxillary left central and maxillary left lateral incisor was clearly observed. Radiographic examination showed the tooth had two root canals. After routine access cavity preparation, the two root canals were instrumented with H files and irrigated with 2.5% sodium hypochlorite and dried with sterile paper point. Afterwards calcium hydroxide paste was placed into the canals. Patient's symptoms were eliminated and the root canal obturation was performed with gutta-percha and a resin based sealer (AH 26, Dentsply- DeTrey GmbH, Germany), using cold lateral condensation technique.

Conclusion: Careful radiographic evaluation may lead to idenfication of additional canals. This case emphasizes the importance of a pre-operative radiographic examination and clinical management.

P01–16

Regeneration of symptomatic permanent teeth by antibiotics and conservative pulp management

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Introduction: Tender teeth associated with gingival swelling and radiographic pathosis are symptoms of irreversible pulpitis. Under the diagnosis, apexogenesis of open-apexed permanent tooth is usually contraindicated. In our two cases of young permanent teeth, the combined therapy of systemic antibiotics and conservative pulp management resulted in continuing root development.

Clinical management: Case 1: A 6Y7M girl presented a buccal swelling, percussion pain and IRM filling on her mandibular right first permanent molar. The radiographs showed widened periodontal space around the open apexes. We performed a direct pulp capping with calcium hydroxide and prescribed antibiotics. Four years following the treatment, the tooth was asymptomatic, apical closure and normal periodontal space was evident. Case 2: A 7Y11M boy had a gingival swelling and grade III mobility of maxillary left central incisor. Past dental history revealed multiple traumatic injuries of the tooth. The radiograph showed open apex of the tooth. Pulpotomy with calcium hydroxide at mid-root level was performed and antibiotics prescribed. In three years follow up, dentin barrier formed in mid-root level and the apical part showed continued root formation and increased dentin wall thickness.

Conclusion: The case reports demonstrated that in young permanent teeth with open apexes, even with classical signs of irreversible pulpitis, it is possible to allow pulp healing. Infection control combined with conservative pulp management may provide opportunity for pulp regeneration in young permanent tooth.

P01–17

Apexification with MTA on a necrotic immature permanent tooth

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Introduction: Pulp necrosis on immature permanent teeth leads to an interruption of dentine formation and stops root development. MTA has been suggested to stimulate an apical closure by means of a reparative response in periapical tissues. This case report describes the treatment of a 10-year-old female patient who suffered a traumatic injury a few years ago, resulting in a complicated crown fracture and a subsequent pulp necrosis on tooth 21. The attempt to induce apexification with calcium hydroxide was without success. Clinically, percussion and palpation were normal but there was a slight mobility. X rays showed an incomplete root end formation and a large periapical radiolucency.

Clinical management: After anaesthesia and rubber dam isolation, the canal was prepared using protapers and an apex detector. MTA was placed in the whole canal by a hand condensation technique under microscopic supervision. An X ray was taken to assess the adequate placement of MTA and after one week, the setting and the tightness of the MTA were tested with a hand plugger and the tooth was restored with composite. Radiological controls at 6 months and 1 year showed a successful healing and a root regeneration around the MTA material. There were still no signs of clinical symptoms after a 1-year follow up.

Conclusion: The apical plug formed with MTA can be interpretated as an artificial barrier and an adequate seal against bacterial infiltration, leading to a correct healing without any clinical or radiological complications after 1 year.