IJBPAS, March, 2023, 12(3): 1127-1134

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

MANAGEMENT OF NECROTIC IMMATURE PERMANENT TEETH- A CASE REPORT

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Received 14th April 2022; Revised 11th May 2022; Accepted 1st Aug. 2022; Available online 1st March 2023

https://doi.org/10.31032/IJBPAS/2023/12.3.6938

ABSTRACT

Regenerative endodontic Procedures provide an unconventional approach which relies on the principle of tissue engineering. Pulp necrosis of immature permanent teeth may impair root development and apical closure of root canals. Completion of root development takes around 3 years after eruption of permanent teeth. Management of immature non vital teeth is very challenging for a clinician because teeth may have wide open apex and thin root canal walls that may diverge towards the apex. Conventional cleaning and shaping of the canals and obturation may not be possible because of the lack of apical stop. Since debridement of pulp canal space is difficult, there is an increased possibility of root perforation and cervical root fracture, besides the presence of an open immature root apex jeopardize the apical seal of a root canal treatment resulting in subsequent failure. The purpose of this report is to present the case of a patient wherein apexification of an immature permanent maxillary left central incisor tooth was induced by the Metapex paste (Calcium hydroxide and Iodoform).

Keywords: Apexification, Calcium hydroxide, Immature permanent tooth, Metapex, Open apices

1. INTRODUCTION

Pulp degeneration and necrosis are a common sequalae of traumatic injuries to young permanent anterior teeth. The main challenge in cases with open apices is to overcome the lack of apical stop, against which endodontic fillers can be compacted **[5]**. The prevalence of Traumatic Dental Injuries in permanent anterior teeth in India varies from 7.3 to 8.79%. Anterior teeth are at the most susceptible position due to their projection. The apical closure of root in a tooth takes approximately 3 years after the eruption of crown in oral cavity **[1]**. When the young anterior teeth with open root apex gets involved in traumatic dental injuries, the ensuing pupal necrosis often leads to arrest of normal process of root formation **[3]**. Depending upon the vitality of pulp in young permanent teeth, two possible approaches available are Apexogenesis and Apexification **[1, 3]**. Apexogenesis is defined as 'a vital pulp therapy procedure performed to encourage continued physiological development and formation of the root end'. Apexification is defined as 'a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp' **[6]**. Materials such as calcium hydroxide powder or mixed with different vehicles, collagen-calcium phosphate gel, osteogenic protein, bone growth factor, oxidized cellulose, tricalcium phosphate and MTA have been used for apexification **[4]**. The use of calcium hydroxide for the apexification in the pulpless tooth was first reported by Kaiser (1956) and it was popularized by the work of Frank. The calcium hydroxide can be used alone or it can be mixed with camphorated monochlorophenol (CMCP), metacresyl acetate, Cresanol, physiologic saline, Ringer's solution, distilled water and anesthetic solution **[6]**. A commercial product named Metapex (Meta BioMed Co., Ltd, Korea) is been used as a root canal filling material in primary teeth. It contains iodoform (40.4 %), calcium hydroxide (30.3%), and silicone oil (22.4 %). The triple antibiotic paste (TAP) consisted primarily of a mixture of ciprofoxacilin, metronidazole and minocycline which has been reported to be effective in bacterial elimination and canal disinfection. However, very few studies have reported on the efficacy of this material when used for apexification. The present article reports on the cases in which Metapex was used to promote root-end growth and apical closure (apexification) in an immature

permanent tooth over a period of 6- 24 months, until apical closure is achieved **[2]**.

2. CASE DISCUSSION

A 9-year-old female patient reported to the Department of Pedodontics and Preventive Dentistry with a chief complaint of pain, swelling and discoloured left upper anterior tooth (11) **(Figure 2)**. He gave a history of trauma to the upper anterior region 6 month back and history of pain on biting from the front tooth since last one months. The tooth was tender on percussion with no intraoral sinus tract. The tooth tested negative for the electric pulp test. On clinical examination, there was the presence of a uncomplicated crown fracture irt 11 **(Figure 1)**.

Figure 1: Initial Intraoral view using extraoral mirror and noticed that crown # irt 11

Radiographically, the tooth exhibited incomplete root formation, characterized by blunderbuss canal and an associated periapical lesion with the same **(Figure 2)**. On the basis of the clinical and radiographic findings, a final diagnosis of pulpal necrosis was made. The treatment plan was apexification with Metapex (calcium hydroxide and iodoform) for 11 followed by obturation with gutta-percha after closure of the root apex. An informed written consent was taken from the parents prior to the procedure. After isolation, access opening was done, and the necrotic pulp tissue was removed. Open dressing given and medicine was prescribed for 5 days i.e., Amoxycillin (250 mg) + Clavulanic Acid (125 mg) ^{Rx} Augmentin 375 (GSK, Pharmaceuticals Ltd) may be taken twice in 24 hrs and ibuprofen (400mg) + paracetamol (325mg) for children aged 7 to 12, ^{Rx} Ibugesic Plus and Metrogyl (200mg) ^{RX} Metrogyl 200 (J B Chemicals and Pharmaceuticals Ltd) should be taken two times in 24 hours.

Figure 2: Initial IOPAR irt 11

After 3 days working length was determined slightly short (2-3 mm) of the radiographic apex. The canal was enlarged till size 70 K-file. Copious irrigation was done with 1% sodium hypochlorite and normal saline solution. Intracanal dressing was given with TAP. Preparation of TAP were metronidazole tablets (400 mg) (Metrogyl 400, J B Chemicals and Pharmaceuticals Ltd), minocycline tablets (100 mg) (Minoz OD 100, Sun Pharmaceutical Industries), and ciprofloxacin tablets (250 mg) (Cipro 250, Torrent Pharmaceuticals Ltd).

Figure 3: Metapex placement IOPAR irt 11 for 6 months

The enteric coating of the tablets was removed using a sterilized sharp blade, and the tablets were pulverized with a sterilized mortar and pestle. The powdered antibiotics were transferred into three sterile amber-colored airtight glass containers and stored in refrigerators.

The TAP was freshly prepared by a pharmacist before each scheduled treatment appointment. For its preparation, powdered antibiotics were proportioned in equal parts by volume (metronidazole, minocycline, and ciprofloxacin = 1:1:1), and then mixed with propylene glycol to get a paste-like consistency. Canal was then dried by sterile paper point and triple antibiotic paste (TAP) given for 15 days. After 15 days $Ca(OH)_2$ dressing given for 21 days and the canal was then dried by sterile paper points and calcium hydroxide and iodoform combination (Metapex, META Biomed Co. Ltd., Korea) was pushed into the canals till it reached the

apex for 3 months. A radiograph was taken to check the same and then the access cavity was restored with glass ionomer cement (GC 2, GC Corporation, Japan) **(Figure 3)**. The patient was recalled after 1 week and the tooth was found to be completely asymptomatic. After 3 months, the radiolucency had reduced to half of its size as compared to the initial size.

Figure 4: Final IOPAR after obturation using GP

Follow-up radiograph at 6 months showed complete healing of the radiolucency in the radiograph. IOPAR confirms that the root formation completed **(Figure 4)**. The apical closure was confirmed with the help of a size 30 K-file. The apical closure was confirmed by using a Gutta-percha (GP) point to check for the presence of a resistant "stop" and absence of haemorrhage, exudates or sensitivity. Metapex was removed from the canal and was obturated with gutta-percha and a full coverage crown was placed on the tooth later **(Figure 5)**. Follow-up radiograph at 9 months showed complete healing of the radiolucency and a calcific barrier was visible in the radiograph **(Figure 6)**.

Figure 5: Final View after PFM crown placement

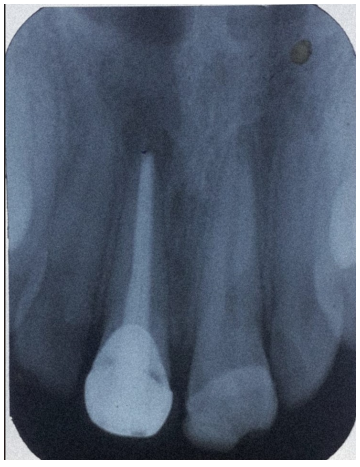

Figure 6: IOPAR of Apexification int 11 at 9 months followup

3. DISCUSSION

Apexification aims to achieve root end closure in non vital teeth with incomplete root formation. In 1966 Frank classified the outcome of apexification into 4 types: Type 1:Normal apexogenesis which is rare, Type 2: Dome shaped apical closure with blunderbuss appearance remaining, Type 3: No apparent radiographic change but positive stop at apex and Type 4: Hard tissue barrier short of apex leaving thin dentinal walls subject to further trauma **[4]**.

Physiological completion of root apex depends on the maintenance of vitality of the tissues that form root dentine and apical periodontal ligament. HERS inductive action leads to the differentiation of cells of the dental papilla into odontoblasts, which progressively form the root dentine. With the onset of root formation, the initially formed dentine induces fragmentation of the HERS, which then becomes discontinuous and is permeated by cells of the dental follicle which undergo differentiation into cementoblasts close to the newly formed dentine **[2]**. Numerous treatment variants have been tried in the past for immature permanent tooth injuries. It's a tangible challenge to treat the immature teeth because of following reasons: 1. Thin dentin wall: The pulp canal wall is thin, and root fractures easily occur during mechanical debridement; 2.Wide open apex: The apical foramen is not converged, and attaining a favourable apical closure with traditional endodontic treatment is difficult; 3.Challenging behaviour: Patients are relatively young when these dental problems occur, and they are nervous, frightened, and impatient during treatment **[2]**.

Calcium hydroxide and Iodoform paste for root end closure has been reported by Sridhar N and S Tandon **[7]**. They concluded that Calcium hydroxide and Iodoform paste (Metapex) may be used as medicament to promote root growth and apexification. Ghose *et al* has described the apical barrier formed as a cap, bridge or an ingrown wedge made up of cementum, dentine, bone or osteodentine **[8]**. The antibacterial efficacy of three Ca(OH)2 formulations were determined by Cwikla *et al* and found Ca(OH)2 mixed with iodoform and silicon oil (Metapex) to be the most effective dentinal tubule disinfectant **[9]**. Calcium hydroxide placed inside the root canals dissociates into calcium and hydroxyl ions. The hydroxyl ions destroy the lipids resulting in structural damage of bacterial proteins and nucleic acids. The high alkaline pH of Calcium hydroxide activates alkaline phosphatase enzyme which releases inorganic phosphate ions. The inorganic

phosphate ions produced reacts with calcium ions in blood stream forming calcium phosphate. Calcium phosphate, the molecular unit of hydroxyapatite, produces mineralization **[7]**. Lu & Qin *et al*. conducted a study over a period of 30 month in 64 younger permanent teeth and observed for three years, and 24 teeth (37.5percent) successfully achieved apexification, 37 teeth (57.81 percent) were in the process of root end closure, and only 3 teeth (4.69 percent) failed to achieve apexification **[14]**.

Hence, in the present Case report we planned multi visit apexification using a calcium hydroxide formulation with iodoform (Metapex). Six months radiographic follow up showed that there was continued root formation as well as apical closure with a definite apical stop thereby showing Frank's Type 2 apexification which is rare specially considering the fact that tooth was non vital. The present case indicate good results with metapex as an apexification agent taking into consideration the cost factors, ease of placement and radiographic interpretation.

4. CONCLUSION

Apical closure in non-vital permanent teeth can be achieved at the earliest with placement of slowly dissociating calcium hydroxide preparation (Metapex) with an effective coronal restoration. The effectiveness of calcium hydroxide might be attributed to its antibacterial activity and its high pH which has its direct effect on the apical and periapical soft tissues.

ACKNOWLEDGEMENTS

Nil.

COMPETING INTERESTS

Non funding

AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript

CONSENT (WHERE EVER APPLICABLE)

The patient parents signed informed consents, and kept in the records of departmental hospital**.**

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ABBREVIATIONS

1. **IOPAR : Intra Oral Periapical Radiograph**
2. **HERS : Hertwig's epithelial root sheath's**
3. **TAP : Triple Antibiotic Paste**
4. **GP : Gutta Percha**
5. **Ca(OH)2: Calcium Hydroxide**