Case Report

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Apexification with apical growth and closure using Metapex in a Necrotic Immature Permanent Tooth with Periapical abscess: A Case Report with 16 months follow-up."

ABSTRACT:

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). It has been reported in the literature of dentistry that apexification treatment in teeth with open apex is more than 40 years old. Apexification procedures had been carried out in different ways using various techniques and materials. Regardless of thetype of materials used for apexificationmethod by different authors, apexification procedures appear to be the most subtle and accepted clinical practice in non-vital young permanent teeth. In our case, radiographic examination showed the start of apical closure 6 months after the completion of the treatment protocol. The growth of root end and complete apical closure was confirmed 16 months after the treatment, indicating the implausible potential of Metapexto induce apical growth and closure in young permanent toothwith periapical lesion.

Keywords: Apexification, Metapex, Calcium hydroxide, Young permanent tooth, Immaturepermanent teeth

Introduction:

Depending upon the vitality of pulp in young permanent teeth, two possible approaches available are Apexogenesis and Apexification. Young permanent teeth, the teeth with open apices are also known as immature permanent teeth. The apical closure of root in a tooth takes approximately 3 years after the eruption of crown in oral cavity; till that period the tooth is certainly named as young permanent tooth.[1] Apexogenesis is defined as'a vital pulp therapy procedure performed to encourage continued physiological development and formation of the root end.'[2] Apexification is defined as 'a method toinduce a calcified barrier in a root with an openapex or the continued apical development of anincomplete root in teeth with necrotic pulp'.[2]

Apexification has been the treatment of choice since years in necrotic immature permanent tooth with open apices. It induces further development of an apex to close the foramina, but does not promote the thickness of the entire canal wall dentin.1Plethora of techniques has been suggested in the past for induction of apical closure in pulpless teeth to produce more favourable conditions for conventional root canal filling.[3-5] The consensus drawn from almost all significant studies was the removal of the necrotic tissue followed by debridement of the canal and placement of a medicament. However, it has not been conclusively established that a medicament is necessary for induction of apical barrier formation. Loads of authorshave described apical closure even without theuse of a medicament.[4-5,7-8]

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Among the medicaments used, Calcium hydroxide serves as a gold standard in an apexification procedure and is a 'panacea' as far as non-vital pulp therapy of young permanent tooth is concerned. Kaiser in 1964 proposed that calcium hydroxide when mixed with camphorated parachlorophenol (CMCP) would induce the formation of a calcified barrier across the apex.[9] The apical closure with calcium hydroxide was popularised and classified by Frank in four types:Type I: Root will develop normally with a physiological process of apexogenesis with the growth of root apex and closure and root length comparable to adjacent tooth; Type II: The root will lengthen without a physiological maturation of the apex; Type III: The root healing can only take place with the formation of a cap of mineralised tissue at the apex level; Type IV: The root healing can only take place with the formation of a cap of mineralised tissue coronal to the apex.[10]

A commercial productnamed Metapex (MetaBiomed Co., Ltd, Korea) has been widely usedas a root canal filling material in primary teeth. It contains iodoform (40.4 percent), calcium hydroxide (30.3percent), and silicone oil (22.4 percent). It is a viscous paste mixture of calcium hydroxide and iodoform with barium sulphate as an opacifierhas shown great success when used for pulpectomy in primary teeth.[11] However, studies are scrubby to quantify calcium hydroxidein this form as a standard for apexification procedure in young permanent teeth.

The purpose of this case report is to add another example to the frame of dental literature supporting this treatment modality as a mainstream treatment option for necrotic, immature permanent teeth.

Case Description:

An 11-year-old boy was referred from a local dentist for the evaluation and treatment of a maxillary anterior swelling in association with his permanent maxillary left central incisor to theDepartment of Pediatric and Preventive Dentistry in Dental Panacea, Faridabad, Haryana, India. The child had a labialgingivalswelling of the upper left central incisor and the access opening was already done by the referring dentist. The case when came to the department was an immature permanent tooth with a radiopaque medicament packed into the pulp canal space. On clinical examination, the patient was asymptomatic, and the tooth was discoloured and presented as Ellis class IV fracture. The tooth had an open apex associated with a large radiolucency [Fig. 1]. The tooth was tested to coldtest with ice and heat test with gutta-percha sticks and the negative response was recorded. The dental history disclosed that the patient had suffered dental trauma nearly 2 months back, sustaining a complicated crown fracture of his permanent maxillary left central incisor.

Under local anaesthesia, re-access was made to the pulp space and the canal was irrigated copiously with 1.25% sodium hypochlorite (NaOCl) and dried with sterile paper points. The metapex was packed down in the canal space for 2 weeks to disinfect the canal. The access cavity was closed with cotton pellets and intermediate restorative material (IRM;Dentsply). The patient was asymptomatic when he returned for further treatment 2 weeks later. Under local anesthesia, the tooth was re-accessed; Metapexpaste was removed with 40 no. K-file and the canal space was irrigated using 10 mL of 1.25% NaOCl and 10 mL of sterile water to disinfect the pulp canal. No instrumentation of the canal space was performed after irrigation. After drying the canal with absorbent paper points,metapex was placed 2mm short of the open apex to induce apex closure.

The patient returned for follow-up assessment 6 months from the time of the induction with metapex. The patient was clinically asymptomatic and radiographic evaluation showed reduction in periapial lesion and disclosed significant apical development of the tooth [Fig. 2]. Follow-up evaluation at 12 months from the time of induction revealed similar clinical findings but radiographically apex was not closed [Fig. 3]. After 16 months from the time of the induction apex was found closed radiographically.; and the healing was type I as classified by Frank in 1966.10Radiographs revealed normal periapical structures with continued root development and calcification of the canal space, so radiographic closure after apexification in our case was Type I.[Fig. 4]

Discussion:

Young permanent teeth or immature teeth are the teeth with incomplete formed roots and trauma to these entities are not uncommon in growing children. 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.[12,13]

There are two types of pulp therapy modalities whenever the young permanent teeth are traumatized: apexification and apexogenesis. Apexification is been widely used since it was described by Frank in 1966. This method is used to form hard tissue at the apex to facilitate sealing the root canal. Depending on the type of material used, apexification can be divided into calcium hydroxide (Ca(OH)2) and mineral trioxide aggregate (MTA) apexification. The technique involves cleaning and filling the root canal with a temporary paste to stimulate the formation of calcified tissue at the apex. This paste is later removed after radiographic and clinical evidence of apical closure and a permanent filling of gutta-percha is placed in the canal.[1]

The classification of root formation is imperative before the selection of material and the treatment modality for teeth with immature roots; as open apices include a wide variety of cellular changes and radicular morphologies throughout all phases of root development. Cvek classification is the most clinically applicable one for radicular formations.14Cvek's classification describes the five stages of root development: I = < 1/2 root length, II = 1/2 root length, III = 2/3 root length, IV = wide open apical foramen and nearly complete root length and, V = closed apical foramen and completed root development. While Cvek stage V describes mature, fully formed teeth, the remaining four stages describe teeth with open apices and a lack of apical constriction development but significant morphological differences. Cvek stages I, II and III indicate wide and divergent apical openings, the root canals are significantly wider in the buccal-lingual plane than in the mesio-distal plane, the terminal portion of the root is irregular and the apical foramen diameter is higher than the root canal lumen. In contrast, stage IV is associated with noticeable root length and convergent apical walls.[14] In our case report, the tooth was in stage IV and we decided for Calcium hydroxide apexification for numerous advantageous properties.

Calcium hydroxide has been used in apexification procedures for several years and has been presented to aid in the formation of calcified tissue barriers with tiny negative effects on the periapical tissues. Based on histological evidence, overextended filling pastes of Ca(OH)2 and camphorated parachlorophenol are not very irritating.[8] The presence of osteoclasts and osteoblasts indicated that bone remodeling occurred at the apex of the teeth which is an additional benefit to eventual healing of the periapical tissues with Ca(OH)[2]. In a study, it was stated that calcium ions may affect hard tissue formation by exerting a positive action on new capillaries that are forming in granulation tissue. It was asserted that the presence of a high calcium ion concentration increase the activity of calcium-dependent pyrophosphatase enzyme, which is important in collagen matrix formation. Calcium hydroxide also has the benefit of being absorbable.[3] Many authors showed that significant washout of apical plugs of Ca(OH)2 occurred during the first month after placement and within ninth months, hardly any amount of plugs are left in apical portion of the root canal. Next toremaining Ca(OH)2 particles, giant cells but no inflammatory cells were seen. Therefore, it appears that the effects of displacing a small amount of Ca(OH)2 into the periapical tissues are of insignificant concern.[15] In a study, authors haveprepared the root canals of dogs' teeth with canals underfilled by 3 mm compared favorably with healing around the apex of teeth in which canals were filled to within 1 mm of the radiographic apex. In some teeth the unfilled canal space was filled with tissue that formed a functional attachment apparatus continuous with the periodontium.[16]

The radiographic aspect of the apical closureobtained after apexification treatment has beenclassified by Frank in 4 clinicaltypes according to the presence or absence of theHertwig epithelial sheath and its relationship with theapical residues of the pulp tissue. If the sheath is stillpresent and the apical odontoblasts are still vital, theroot will develop normally with a physiologicalprocess of apexogenesis (Type 1). If the Hertwigsheath is still vital but are missing vital odontoblasts,the root will lengthen without a physiologicalmaturation of the apex (Type 2). When the Hertwigsheath and the odontoblasts are both non-vital, thehealing can only take place with the formation of a capof mineralised tissue produced by osteoblasts andcementoblasts activity either at the apex level (Type 3)or coronal to the apex (Type 4).In our case, we found that it was a Frank type I apexification.[10]

The time required for hard barrier formation in our case was 16 months which is in favor of previous literature affirming that the time required for apical closure was approximately 5months to an average of 15.9 months.5,17 Studies havealso reported that infection and/or the presence of periapical radiolucency at the start of treatment increases the time required for barrier formation.Most of these techniques encompass removal of thenecrotic tissue followed by debridement of the canaland placement of a medicament.[13] Moller et al. have shown that infected necroticpulp tissue induces strong inflammatory reactions inthe periapical tissues. Therefore removal of the infected pulp tissue should create an environment beneficial to apical closure without use of amedication. [4] So in our case, debridement of the infected pulp from canal was done in a standardized manner and then metapex paste was placed for the apexification procedure.

Figures and Legends :

Fig 1. Pre-op IOPA

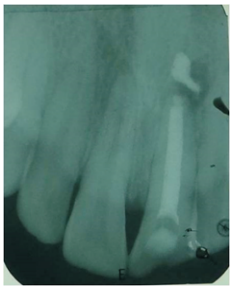

Fig 2. Follow up after 6 MONTHS

Fig 3. Follow up after 12 MONTHS

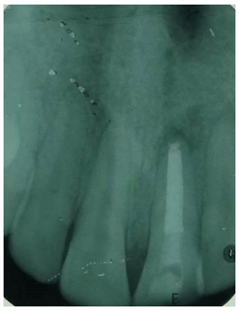

Fig 4. Follow up after 16 MONTHS

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