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One Visit MTA Apexification: Case Report

Abstract

Immature teeth with necrotic pulp and periapical lesion are difficult to treat via conventional endodontic therapy. Traditionally, calcium hydroxide has been the material of choice for the apexification of immature permanent teeth but apexification with calcium hydroxide is associated with certain difficulties, such as very long treatment time required, possibility of tooth fracture, and incomplete calcification of the bridge. Single visit apexification using an apical plug of novel biocompatible material like mineral trioxide aggregate (MTA) has been indicated as an alternative to long-term intracanal use of calcium hydroxide in immature permanent teeth. This paper presents two cases with traumatized upper anterior teeth and a positive clinical resolution in these is encouraging for the use of white MTA as a apical plug, in immature teeth with open apex.

Key Words

Apexification; apical barrier; mineral trioxide aggregate

Akansha Garg[1], Bonny Koul[2], Ajay Nagpal[3], Shashit Shetty B[4]

[1]Post Graduate Student, Department of Conservative and Endodontics, KD Dental College and Hospital, Mathura, Uttar Pradesh, India
[2]Post Graduate Student, Department of Conservative and Endodontics, KD Dental College and Hospital, Mathura, Uttar Pradesh, India
[3]Reader, Department of Conservative and Endodontics, KD Dental College and Hospital, Mathura, Uttar Pradesh, India
[4]Professor & Head, Department of Conservative and Endodontics, KD Dental College and Hospital, Mathura, Uttar Pradesh, India

INTRODUCTION

Development of root continues up to 3 to 4 years after eruption of the tooth.[1] Traumatic or carious exposure of the pulp during this time period may lead to cessation of root end development due to damage of Hertwig's epithelial root sheath and necrosis of the pulp that leads to a necrotic immature tooth with blunderbuss canal anatomy.[2] This morphology may also occur in mature and fully formed root in conditions like extensive resorption after orthodontic treatment or severe periapical inflammation. Iatrogenic factors like over instrumentation beyond the apex may also lead to formation of a wide open apex. The treatment of teeth with blunderbuss anatomy is difficult because of the size of the canal and presents with unique endodontic and restorative challenges and requires careful assessment and treatment planning. Also the absence of apical seal predisposes the apical extrusion of irrigants and filling materials thereby posing a question mark on three-dimensional sealing of the root canal system. American Association of Endodontists (2003) defined apexification 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'. The goal of this treatment is to obtain an apical barrier to prevent the passage of toxins and bacteria into the periapical tissues from the root canal. Technically, this barrier is also necessary to allow the compaction of the root filling material.[3] Calcium hydroxide pastes have been considered as the material of choice to induce the formation of a hard tissue apical barrier. It has several disadvantages, such as variability of treatment time (average 12.9 months),[4] difficulty of the patient's recall management, delay in the treatment and increase in the risk of tooth fracture after dressing with calcium hydroxide for extended periods.[5] Alternatives to calcium hydroxide have been proposed; the most promising being mineral trioxide aggregate (MTA). Using MTA apexification can be carried out in single visit, which is advantageous over traditional calcium hydroxide. Therefore the present case reports highlight the non-surgical management of asymptomatic tooth with blunderbuss canal using MTA apical plug technique.

CASE REPORT

Case 1

A 17 year old female patient, reported to the Department of Conservative Dentistry and Endodontics, KD Dental College, Mathura, with a chief compliant of discoloured left maxillary central

Fig. 1: Preoperative radiograph

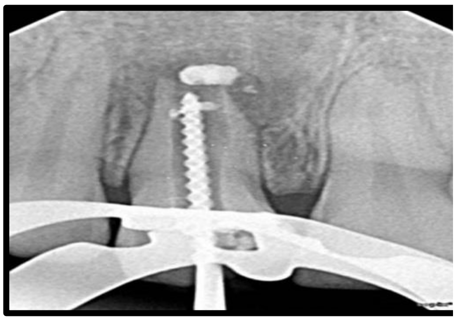

Fig. 2: Working length determination

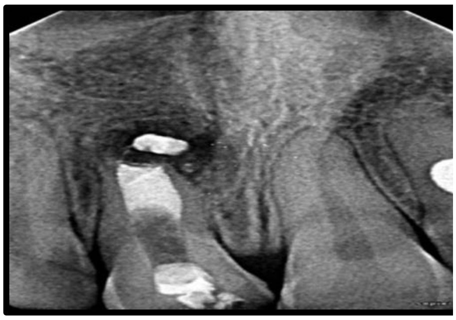

Fig. 3: Apical plug of MTA

Fig. 4: Obturation with crown

incisor and history revealed that patient had suffered trauma at the age of 10. The concerned tooth showed no response to both electric and heat test. On radiographic examination, it revealed a large blunderbuss canal with a radiolucent area in proximity of the apex of the tooth (Fig. 1). There are two treatment options either surgical removal of periapical lesion and retrograde filling or apexification using apical plug of MTA, followed by non surgical root canal treatment. Considering the age of the patient ,crown-to-root ratio (the ratio measuring the length of the part of the tooth that protrudes from the bone, versus the length of the part of the tooth that is fully captured in the bone), need for limiting the restoration within the apex and formation of the lost bone structure, nonsurgical treatment was opted. After rubber dam application conventional access opening was prepared and working length was determined (Fig. 2). Gentle instrumentation was done using #90 K-file (Densply India) in circumferential filing motion. Root canal debridement was done using alternate irrigation with 2.5% NaOCl and saline throughout cleaning and shaping procedure. Canal was dried with multiple paper adsorbent paper points and Metapex (Metapex™, META Biomed Co. Ltd., Korea) was packed in the root canal and patient recalled after one month. After 1 month, tooth was again isolated and root canal dressing was removed and canal was irrigated with 2.5% NaOCl followed by 17% EDTA (OGNA) and final rinse with 2% chlorohexidine. The canal was dried with adsorbent paper points and small pieces of CollaCote (CollaCote® Zimmer dental), a synthetic collagen material, were gently compacted using hand pluggers to produce a barrier at the level of the apex. ProRoot® MTA (Tulsa Dental Products, Tulsa, OK, USA) was placed with MTA carrier in the apical portion of the canal and compacted against the CollaCote barrier. Subsequent increments were condensed with hand pluggers to form a apical plug of thickness 2- 5 mm (Fig. 3). A wet cotton pellet was placed and access cavity was sealed with temporary cement. At the second visit, the tooth remained asymptomatic and the tooth was isolated and accessed as before. A hand plugger was lightly tapped against the MTA plug to confirm a hardened set. The root canal was back filled using Apexit Plus sealer and injectable thermoplasticized gutta percha-Calamus and access cavity was sealed with glass inomer restorative cement and crown was given (Fig. 4).

Case 2

A 18 years male patient, reported with chief complaint of pus discharge in upper front region since 1 months. Clinical examination revealed discolored and fractured maxillary left central incisor (Fig. 5). Tooth showed no response to vitality tests. Radiographic examination revealed a large blunderbuss canal with associated radiolucency in proximity to the apex of the tooth. Access was prepared under rubber dam isolation followed by working length determination (Fig. 6). Biomechanical preparation was done using #100 K-file (Dentsply India) and root canal was irrigated

Fig. 5: Pre-Operative Radiograph

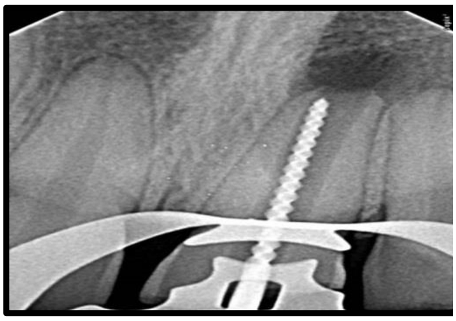

Fig. 6: Working length determination

Fig. 7: MTA plug

Fig. 8: Obturation

alternately with 2.5% NaOCl and saline. Root canal was dried and Calcium hydroxide dressing (Ultracalx Ultradent Inc., South Jordan, UT, USA) was placed for 1 week. In subsequent appointment tooth was again isolated and access prepared, the canal was irrigated using 2.5% NaOCl and 17% EDTA (OGNA). The canal was dried with adsorbent paper points and ProRoot® MTA (Tulsa Dental Products, Tulsa, OK, USA) was condensed using MTA condenser in apical region against the collacote barrier to form an apical plug of thickness 3-5 mm (Fig. 7). A moist cotton pellet was placed inside the access cavity and sealed with temporary cement. In subsequent appointment root canal was back filled with using Apexit Plus sealer and injectable thermoplasticized gutta percha-Calamus and access cavity sealed with composite (Fig. 8).

DISCUSSION

Apexification treatment is supposed to create an environment to permit deposition of cementum, bone and periodontal ligament to continue its function of root development. The goal of this treatment is to obtain an apical barrier to prevent the passage of toxins and bacteria into periapical tissues from root canal. Technically this barrier is necessary to allow compaction of root filling material.[6] Mineral Trioxide Aggregate (MTA) was developed at Loma Linda University, in the 1990s, as a root-end filling material as an alternative to traditional materials for the repair of root perforations, pulp-capping and as a retrograde root filling due to its superior biocompatibilty and ability to seal the root canal system. Torabinejad reported the ingredients in MTA as tri calcium silicate, tricalciumaluminate, tricalcium oxide and silicate oxide with some other mineral oxides that were responsible for the chemical and physical properties of aggregate. The powder consists of fine hydrophilic particles that set in the presence of moisture. The hydration of the powder results in a colloidal gel with a pH of 12.5 that will set in approximately 3 hours.[7] Whilst the advantage of calcium hydroxide lies in the fact that it has been widely studied and has shown success, the disadvantages are its prolonged treatment time, the need for multiple visits and radiographs. Thus there is increasing popularity with one visit apexification techniques. One visit apexification has been defined as the non surgical condensation of a biocompatible material into the apical end of root canal. The rationale is to establish an apical stop that would enable the root canal to be filled immediately. The advantages of MTA are multiple: (i) reduction in treatment time, (ii) possibility to restore the tooth with a minimal delay, and thus to prevent the fracture of the root and (iii) it also avoids changes in the mechanical properties of dentine because of the prolonged use of calcium hydroxide.[8] In addition, because of its non-cytotoxicity, MTA has good biological properties and stimulates repair.[9] MTA has been reported to strengthen the cervical fracture resistance of immature sheep incisors as compared to the use of calcium hydroxide.[10] When used in dogs' teeth with incomplete root formation and contaminated canals, MTA induced the formation of an apical barrier with hard tissue. MTA has the ability to induce cementum like hard tissue when used adjacent to the periradicular tissues. MTA is a promising material as a result of its superior sealing property, its ability to set in the presence of blood and its biocompatibility. Moisture contamination at the apex of tooth before barrier formation is often a problem with other materials used in apexification. As a result of its hydrophilic property, the presence of moisture does not affect its sealing ability. Shabahang *et al*., examined hard tissue formation and inflammation histomorphologically after treating open apices in canine teeth with osteogenic protein-1, MTA and calcium hydroxide. MTA induced hard tissue formation with the most consistency, but the amount of hard tissue formation and inflammation was not statistically different among the three materials. MTA has been used over the last 10 years as a suitable alternative to achieve a peri-radicular seal with favourable success rates.

Johannes Mente *et al*., conducted a controlled cohort clinical and radiographic study on 229 teeth treated with direct pulp capping with MTA and calcium hydroxide between 2001 and 2011. The results of this study indicate that MTA provides better long-term results after direct pulp capping compared with calcium hydroxide. Despite this MTA has some known drawbacks such as a long setting time, high cost, and potential of discoloration. Hydroxyapatite crystals form over MTA when it comes in contact with tissue synthetic fluid. This can act as a nidus for the formation of calcified structures after the use of this material in endodontic treatments. Although the overall results in human studies involving MTA materials are very positive, further longitudinal studies are encouraged, as at present insufficient well-designed and controlled clinical studies exists that allow systematic and meta-analysis review of MTA materials in all of its suggested clinical indications.

CONCLUSION

The novel approach of apexification using MTA lessens the treatment duration between first appointment and final restoration. Importance of this approach lies in thorough cleaning of root canal followed by apical seal with material that favors regeneration. In addition there is less chance of root fracture in immature teeth with thin roots because the material immediately bonds with the roots and strengthens it.

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