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Mineral Trioxide Aggregate (MTA) Apexification: A novel method for management of traumatised young immature permanent tooth

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ABSTRACT

The treatment of choice for management of immature root with a necrotic pulp and apical periodontitis is apexification. It includes induction of apical closure to produce more favorable conditions for conventional root canal filling. Earlier, the most commonly advocated medicament was calcium hydroxide which is recently replaced by Mineral Trioxide Aggregate (MTA). MTA shows outstanding properties like its biocompatibility, antibacterial property, sealing ability and potential for regeneration of periradicular tissues. This article presents a case with traumatized upper anterior teeth with open apex which is managed effectively with MTA.

Keywords: Open apex, Apexification, MTA.

INTRODUCTION

At the time of tooth eruption, root development is only 62-80%i.e. 2/3rd of the root is formed. If trauma or caries exposure occurs, the pulp undergoes necrosis, dentin formation arrested and root growth is ceases[1].Management of immature root is a challenging task. The infected root canal space cannot be disinfected with the standard protocol. Also, obtaining apical seal is difficult because of lack of apical barrier for containing the root filling material. Treatment of choice in such cases is the apexification procedure, i.e., forming an apical barrier.

Earlier calcium hydroxide was used to induce hard tissue formation at the apical end before placing the obturating material. However, calcium hydroxide shows certain disadvantages like the duration of time needed to form apical barrier, the number of dressings needed for complete closure of apex, the role of infection caused in the canal in between the appointments[2].

In 1993 Mahmoud Torabinejad at Loma Linda University introduced a novel material, Mineral Trioxide aggregate (MTA). MTA has various advantages over calcium hydroxide that it can be done in a single visit procedure; neither gets resorbed nor weakens the root canal dentin and also sets in wet environment[3].

MTA shows outstanding properties like its biocompatibility, antibacterial property, sealing ability, and potential for regeneration of periradicular tissues[4]. Based on these it is considered as an appropriate apexification material.

Thus, the present case report demonstrates the successful use of MTA to induce root end closure in necrotic young permanent incisors.

CASE REPORT

A 10 year-old boy was reported with a chief complaint of fractured upper right maxillary central incisor with a history of trauma 3 months ago. The medical history was not contributory. No significant family history was revealed. Extraoral

findings were unremarkable. Clinical examination revealed Ellis class III fracture in maxillary right central incisor. The incisor was slightly tender to percussion. No mobility was seen. On electric pulp testing, the upper right central incisor was non-responsive. Radiographic examination demonstrated the presence of fractured open apex right maxillary central incisor with no periapical pathology (Fig.1). The available treatment options were discussed with the patient and root canal therapy using MTA as an apical barrier followed by post and core with crown was selected.

Fig. 1: Preoperative radiograph.

In the first appointment, after giving local anesthesia the tooth was isolated under a rubber dam and an access cavity was prepared. Pulp was extirpated and cleaning and shaping was done with circumferential filing up to #70 K-file. The canal was irrigated with 2.5% of sodium hypochlorite and saline and calcium hydroxide dressing was placed for disinfection of root canal. Patient was recalled after1-week.

On second visit, the calcium hydroxide dressing was removed. An apical barrier of 4 mm was established using MTA (Dentsply, Pro Root). Apical plug of about 4 mm of MTA was placed and confirmed radiographically (figure 2). A moist cotton pellet was placed over the MTA and access cavity was sealed with cavity (3 M ESPE, Seefeld, Germany). Patient was recalled the next day.

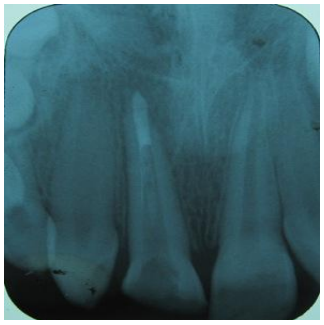

Fig. 2: Mineral trioxide aggregate apical plug placed in relation to upper right central incisor

On third visit, the setting of MTA was confirmed using plugger and the root canal was obturated with gutta-percha (Fig.3). The tooth reinforcement was carried out as the remaining crown and dentinal thickness of the canal was very less. The post and core pattern was fabricated followed by tooth preparation with shoulder margin at the labial surface and chamfer at lingual surface and sent to the lab for fabrication of metal post and core.

Fig. 3: Obturated root canal

After cementation of post and core with dual core resin cement, impression was taken using putty, cast was poured using die stone and the model was sent to the lab for fabrication of Porcelain fused to metal (PFM) crowns. The crown was cement (Fig. 4) and occlusion was checked. Patient was recalled for regular follow up of 6 months.

Fig. 4: Intraoral periapical radiograph showing placement of metal post and core with PFM crown in upper right central incisor

DISCUSSION

Pulp necrosis of permanent immature teeth due to trauma or caries results in interruption of root formation and apical closure. The endodontic treatment of non vital immature anterior teeth is complicated because of large open apices, thin dentinal walls, and frequent periapical lesion. The success in endodontics is dependent on obtaining a perfect seal at the apical portion. So, it is necessary to implement apexification technique for inducing a hard calcific barrier at the apical end of the root, to achieve definitive root canal filling material. The root end material must seal the apical portion of the canal effectively to achieve hermetic seal between the root canal system and periodontium[5].

A variety of materials have been proposed for induction of apical barrier formation. Calcium hydroxide has become the material of choice for apexification; it is bactericidal with an alkaline pH which is responsible for stimulating apical calcification[6]. Despite its popularity for the apexification procedure, calcium hydroxide has some inherent disadvantages, including variability of treatment time, unpredictability of apical closure, difficulty in patient follow-up and delayed treatment[7]. Also, it has some tissue altering and dissolving effects.

Therefore, in 1998 MTA was approved as a therapeutic endodontic material for humans. MTA has been shown to have superior sealing ability to amalgam, zinc oxide eugenol, intermediate restorative material (IRM) and super-ethoxybenzoic acid[8]. MTA has an alkaline pH exhibit superior biocompatibility and cytotoxic city. MTA also, provides a favorable environment for the cementum deposition because of the presence of calcium and phosphorus ion which induces osteoblastic or cementoblastic activity for cementum deposition.

Additionally, during the maturation of MTA, an appetite like interface is formed which fills in the gap formed during the shrinkage phase and improves the fracture resistance of the root canal walls[8]. The main aim of post and core is to replace the lost tooth structure. The recent studies have shown that the metal post and core bonded to the tooth provides a monobloc effect and improves the strength hand integrity of the tooth thus making the tooth more resistant to fracture. To replace the lost dentin, composite resin was used because it reinforces the tooth and the modulus of elasticity of composite is close to that of dentin[9].

Maroto et al. have reported successful apexification with MTA in a tooth that did not respond favorably after 3 years of therapy with calcium hydroxide[10]. In a comparative study on effectiveness of MTA and calcium hydroxide in apexification of traumatized young permanent incisors, MTA demonstrated good success and an effective option for apexification[11]. In the present case patient is asymptomatic with no clinical and radiographic abnormality after 1 years of follow up. A positive clinical and radiographic outcome of this case is encouraging for the use of MTA as an apical plug, in immature teeth with open apex.

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