SHORT COMMUNICATION

Management of open apex with mineral trioxide aggregate-2 case reports

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Abstract

The permanent teeth with open apex and large periapical lesion are difficult to treat as a traditional root canal procedure, therefore calcium hydroxide place an important role in reducing the periapical inflammation. Management of open apex can be done using mineral trioxide aggregate (MTA) which can be placed in apical 3-4 mm. The case reports present two cases with traumatized upper anterior teeth. The radiographic evaluation revealed open apices with blunderbuss canals, the canal was cleaned using intracanal instruments and 5.25% NaOCl and final irrigation with 2% chlorhexidine. To obtain canal disinfection slurry of calcium hydroxide was temporized in the canal. In subsequent appointments, 3-4 mm was created with MTA and allowed to set. Subsequently, the root canals were obturated. A positive clinical resolution of this case is encouraging for the use of white MTA as an apical plug, in immature teeth with open apex.

Keywords

Intra canal rehabilitation, mineral trioxide aggregate, open apex

Introduction

The maxillary anterior teeth tend to undergo many impact injuries because of its position in the jaw. The apical 3-4 mm is most significant in endodontic practice. When the enamel and dentin reaches the cemento-enamel junction, there is formation of cervical loop from where the root development starts.[1] At the time of tooth eruption, root development is only 62-80% i.e. 2/3rd of the root is formed. If due to trauma or caries exposure occurs, the pulp undergoes necrosis, dentin formation ceases and root growth is arrested.[2] Thorough disinfection of the root canal with proper hermetic seal is important for the success of endodontics. In case of a blunderbuss, canal maintaining the proper apical barrier with the three dimensional seal becomes difficult.[3]

Calcium hydroxide was the material of choice to induce hard tissue formation at the apical end before placing the obturating material. However, calcium hydroxide shows certain limitations like the length 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 and the fracture resistance of the tooth.[4]

Mineral trioxide aggregate (MTA) was developed by Mahmoud Torabinejad at Loma Linda University in the year 1993 as root end filling material. MTA has the advantage over calcium hydroxide that it can be done in a single visit procedure.[5] Apexification using MTA has several advantages as it neither gets resorbed nor weakens the root canal dentin and also sets in wet environment. MTA helps in the formation of cementum and osteoid-like tissue because of its alkaline pH and release of calcium and phosphorus ion.[5]

Endodontically treated teeth with weak canals should be ideally reinforced before post placement. Light polymerized composite resin can be used for this purpose. Composite resin absorbs and distributes forces in a more uniform manner as compared to metals, and increases resistance to fracture, thus providing improved prognosis. An adhesive bonding system used with these resins is based on its ability to create micromechanical retention, which has an added advantage for a weakened root. When the weakened root is internally rebuilt with suitable adhesive dental materials, the root is dimensionally and structurally reinforced to support and retain a post and core for continued function of the tooth. Teeth restored with intraradicular composite resin restoration have been shown to be 50% more resistance to fracture.[6]
The purpose of this article was to report on the clinical and radiographic outcome when MTA is used to obturate teeth with open apices.

**Case Reports**

**Case 1**

A 22-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, Krishnadevaraya College of Dental Sciences, Bangalore with the complaint of an unaesthetic smile. Patient gave history of trauma 9-10 years back. Clinical examination revealed discolored and fractured maxillary right central incisor. Intra oral periapical radiograph revealed incompletely formed apex as well as thin dentinal walls in apical region in relation to right maxillary right central incisor. Tooth elicited negative response on thermal as well as electric pulp testing. Hence, diagnosis of Ellis class IV fracture leading to pulpal necrosis. On first visit, root canal treatment was initiated, cleaning and shaping was done with circumferential filing up to #80 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 after 1-week. On second visit, the calcium hydroxide dressing was removed. An apical barrier of 3-4 mm was established using MTA. A moist cotton pellet was placed over the MTA and access cavity was sealed with IRM. Patient was recalled the next day. On third visit, the setting of MTA was confirmed using finger plugger and the root canal was obturated by sectional obturation technique. The canal reinforcement was carried out as the remaining dentinal thickness of the canal was very less. Luminex aesthetic post system was selected, since it combined both the objectives of reinforcing the tooth as well as light transmission for curing. The canal was etched with 35% phosphoric acid for 15 s, was washed with an endodontic irrigation syringe, and was dried using cotton pellet. A thin coat of dentin bonding agent was applied using a microapplicator tip and was light cured for 20 s using QTH light curing gun. A flowable composite resin was placed into the canal. The plastic light transmitting post was centered, and the resin was cured for 40 s. The post taken out and cemented back into the canal with dual cure resin cement, rely X resin cement which was cured for another 40 s. Next, the tooth preparation was done using a flat end diamond bur with shoulder margin at the labial surface and chamfer at lingual surface. Impression was taken using putty aquasil rubber base impression technique, cast was poured using die stone and the model was sent to the lab for fabrication of metal ceramic crowns. The crown was cement and occlusion was checked

**Case 2**

A 25-year-old female patient reported to the Department of Conservative Dentistry and Endodontics, Krishnadevaraya College of Dental Sciences, Bangalore, with a chief compliant of discolored upper maxillary central incisor with the history of trauma at the age of 10 years. The tooth showed a negative response to both electric and heat test. Radiographic examination showed

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**Figure 1:** Pre-operative radiograph showing open apex

**Figure 2:** Placement of mineral trioxide aggregate

**Figure 3:** Intracanal rehabilitation done
open apex with large periapical lesion at tooth 11. Access opening was done under rubber dam isolation using endo access bur and working length was determined. Biomechanical preparation was done using no 80 K-file using circumferential filing motion. Root canal debridement was done using alternate irrigated with alternate solution of 2.5% NaOCl and saline. Calcium hydroxide was condensed into the root canal and patient recalled after 1-week. At subsequent appointment after removal of dressing root canal was found completely dry. The canal was dried with paper points and MTA was placed with MTA carrier in the apical portion of the canal, subsequent increments were condensed with hand pluggers till thickness of 3-4 mm. A wet cotton pellet was placed, access cavity sealed with temporary cement. The canal was obturated using roll cone technique [Figures 5-8].

Discussion

The success in endodontics is dependent on obtaining a perfect seal at the apical portion. The endodontic treatment of non-vital immature anterior teeth after trauma remains complicated because of necrotic pulp tissue, large open apices, divergent root walls, thin dentinal walls, and frequent periapical lesion. The main...
aim of root end material is to seal the apical portion of the canal and to obtain hermetic seal between periodontium and the root canal system.[6] The apical closure helps to compact the obturating material into the canal promising for one visit apexification. MTA as an apexification material forms a seal between the material and the tooth. During the maturation of MTA, there is formation of an appetite like interfacial which fills in the gap formed during the shrinkage phase and improves the fracture resistance of the root canal walls.[6] MTA has an alkaline pH exhibit superior biocompatibility and cytotoxicity. MTA provides a favorable environment for the cementum deposition because of the presence of calcium and phosphorus ion which induces osteoblastic or cementoblastic activity and provides favorable environment for cementum deposition. This novel procedure reduces the treatment time. Importance of this approach lies in thorough cleaning of root canal followed by apical seal with material that favors regeneration.[3] The main aim of post and core is to replace the lost tooth structure. Such teeth that have large canals which are difficult to restore with metal posts, as these well adapted cast post and cores lead to shadowing and graying of the root surface, which, in turn, leads to the discoloration of the tooth’s gingival margin. Further, restoration with a cast metal post and core is contraindicated because they cause vertical fractures of the tooth due to the wedging action caused by the cast post.[5] The recent studies have shown that the fiber post bonded to the tooth provides a monobloc effect and improves the strength and integrity of the tooth and makes 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.[10] The modulus of elasticity of a cast post and core is higher compared to that of fiber post hence it can cause root fracture.[11] In clinical situations, where a problem appears to cure the radicular portion of composite light transmitting post helps to transmit light along its length and helps in curing the apical potion of the resin and since the modulus of elasticity is close to that of dentin it reinforces the tooth.[12] In order to maintain the strength of the remaining radicular dentin reinforcing the booth with composite resin and a fiber post plays a role to increase the fracture resistance of tooth.

**Conclusion**

Managing a tooth with open apex with a biocompatible material MTA has become a single visit procedure. This innovative procedure is predictable and less time-consuming one. The management of a structurally weakened root through conservative approach by reinforcement with flowable liner and glass fiber post can be a simple and efficient procedure for the treatment of immature anterior traumatized teeth with excellent aesthetic and functional results. Such teeth restored with this technique best serve the needs of the patients.

**References**
