Single Step Apexification Using Mineral Trioxide Aggregate : Report of Two Cases

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Abstract

The major challenge in performing endodontic treatment in teeth with necrotic pulps & wide open apices is to obtain an optimal apical seal of the root canal system. Initial aim of the therapy is to induce a hard tissue barrier at the tooth apex. This process is known as apexification. The aim of the procedure is to limit bacterial infection and create an environment conducive to the production of mineralized tissue in the apical region.

Calcium hydroxide is commonly used for this purpose. Its requires many appointments with duration ranging from 3 to 24 months. During this period the root canal is susceptible to reinfection which may promote apical periodontitis and arrest apical repair. Recently, Mineral Trioxide Aggregate (MTA) has been successfully used for single step apexification where in, the root canal can be obturated immediately.

In the present study two cases were treated where in Mineral trioxide aggregate (MTA) was used successfully for one step apexification in teeth with open apex.

Key words: Apical barrier, Incomplete root formation, Pulp necrosis, Open apex, Mineral trioxide aggregate, Apexification.

Introduction

The completion of root development and closure of the apex occurs up to 3 years following eruption of the tooth (Nolla 1960).[1] When teeth with incomplete root formation suffer pulp necrosis, the root development ceases and apical closure cannot be achieved. Root canal treatment at this time is a significant challenge, because of the size of the canal, the thin and fragile dentine walls and the large open apex. Because of the lack of an apical constriction, an alternative to standard root canal treatment, apexification or root end closure has been advocated. **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'.[2] The goal of this treatment was 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.

Calcium hydroxide pastes have been considered as the material of choice to induce the formation of a hard tissue apical barrier. Its efficiency has been demonstrated by many authors, even in the presence of an apical lesion.[3,4] This chemical has several disadvantages, such as variability of treatment time (average 12.9 months),[5] 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.[6,7,8] Alternatives to calcium hydroxide have been proposed; the most promising being mineral trioxide aggregate (MTA).[9,10,11,12] The advantages of this material 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.

In addition, because of its noncytotoxicity,[13] MTA has good biological properties[14,15] and stimulates repair.[16] Teeth with incomplete root formation and contaminated canals, MTA induced the formation of an apical barrier with hard tissue that permits lateral condensation of gutta-percha in the remainder of the canal.In this study two case reports are presented in which MTA was used for apexification in open apex cases to develop an apical stop to facilitate obturation.

Case Report 1

A 16 year old male patient reported to the Department of Conservative Dentistry and Endodontics,Govt. Dental College, Jaipur. With a chief complaint of fractured upper anterior tooth with a history of trauma nine years ago.Tooth responded normally to percussion, palpation and had normal periodontal probing and mobility. Radiographic examination demonstrated the presence of open apex (Fig 1). The tooth did not respond to the pulp vitality tests. The access cavity was prepared. Working length was established. The canal was gently debrided with large K-files (Mani, Prime Dental, Mumbai) and copious amounts of 1% sodium hypochlorite. Calcium hydroxide intra canal medicament was placed for one week to disinfect the root canal. At the second appointment, calcium hydroxide was flushed with 1% sodium hypochlorite and rinsed with saline. Final irrigation was done with 17% EDTA and the canal was dried with paper points. MTA

(Dentsply, Tulsa Dental, Johnson City,USA) was mixed and carried to the canal with an amalgam carrier. Apical plug of 4mm of MTA was placed and confirmed radiographically (Fig 2). A sterile cotton pellet moistened with sterile water was placed over the canal orifice and the access cavity was sealed with Cavit (3M ESPE, Seefeld, Germany). After 72 hours, the hard set of MTA was confirmed and the remainder of the root canal was obturated with gutta-percha and AH-Plus sealer (Dentsply, De-Trey, Konstanz, Germany) by lateral condensation technique (Fig 3). Custom cast metal post and core porcelain fused to metal crown was given after 15 days to restore the esthetics. (Fig 4)

Report 2

An 18 year old female patient who had trauma ten years ago reported with a chief complaint of discoloration of maxillary left central incisor. On radiographic examination blunder buss canal was evident (Fig 5). The same treatment protocol for apexification (Fig 6) and obturation & the access cavity was restored with composite (Fig 7) as above was followed and later the tooth was restored with porcelain fused to metal crown to restore the esthetics (Fig 8).

Discussion

An immature permanent incisor tooth is defined as one where the apex can be considered to be open.

Root canal treatment of these teeth requires a root end closure technique to form a complete calcific barrier at the apex of the tooth against which a guttapercha filling can be condensed without the possibility of sealant or guttapercha going through the apex into the periapical tissues.

NaOCl is known to be toxic, especially in high concentrations. When rinsing immature teeth with open apices, there is an increased risk of pushing the irrigant beyond the apical foramen. Therefore, it is advisable to use less concentrated NaOCl, which is less toxic. In all 2 cases, 1% NaOCl was used. [17]

Calcium hydroxide intracanal medicament for one week. The latter has been shown to eliminate bacteria in the root canal when applied for this period.[18]

MTA has been developed by Torabinejad and co workers in 1990 at Loma Linda University. It is available as grey and white MTA. The material consists of tricalcium silicate, tricalcium aluminate, tetracalcium aluminoferrite, calcium sulphate dihydrate and silicate oxide. Presence of bismuth oxide makes it radioopaque. pH of the material is 12.5 at three hours. MTA has a compressive strength comparable to IRM and Super EBA and reaches its maximum compressive strength in 72 hours. Due to this reason, obturation was done after 72 hours as MTA attains its maximum strength in this time period.[19]

In the above case reports, the protocol for apexification with MTA was followed and obturation was done with guttapercha with AH plus sealer.

Conclusion

MTA has numerous applications in endodontic therapy that range from apexification to pulpotomy. The primary advantages of this material as an apical barrier include reduction in the number of appointments, development of proper apical seal and excellent biocompatibility. This article demonstrated one of the indications of MTA as apexification material. Although additional research is necessary to determine additional indications for MTA, its use in endodontics certainly appears favourable and promising.

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Case - 1

Pre-Operative | Post-Operative

Fig. 1

Fig. 2

Fig. 3

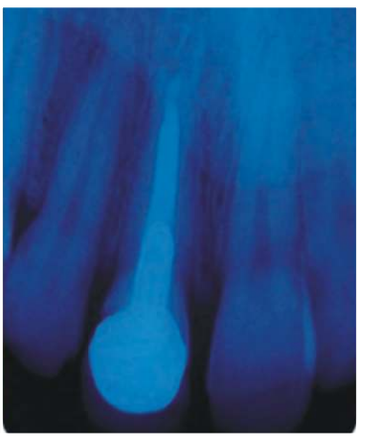

Fig. 4

Case - 2

Fig. 5

Fig. 6

Fig. 7

Fig. 8