CASE REPORT

Apexification with Mineral Trioxide Aggregate: A Case Report

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ABSTRACT

Mineral trioxide aggregate (MTA) was developed for use as a dental root repair material by Dr. Mahmoud Torabinejad at Loma Linda University School of Dentistry and was formulated from commercial Portland cement combined with bismuth oxide powder for radiopacity. MTA is used for creating an apical plug during apexification, repairing root perforations during root canal therapy and treating internal root resorption and can be used as both a root-end filling material and pulp capping material. Originally, MTA was dark gray in color, but white versions have been on the market since 2002.

KEYWORDS: Mineral Trioxide Aggregate, Apexification, Open Apex, Calcium Hydroxide.

INTRODUCTION

Introduction of newer materials are never ending especially in the field of dental science. Various materials have been formulated, tested and standardized to obtain maximum benefit for good clinical performance. One such new material is Mineral Trioxide Aggregate (MTA).[1] Studies reveal that MTA exhibits good sealing ability, excellent long term prognosis, relative ease of manipulation, good biocompatibility and tissue regeneration. The most important step in endodontics is to debride and obturate the canals thoroughly and three dimensionally.[2] Clinical application of MTA includes - Pulp Capping, Non vital pulpotomy, Vital pulpotomy (Apexogenesis), and Apexification.[3,4]

The most commonly advocated medicament is calcium hydroxide. The use of calcium hydroxide was first introduced by Kaiser in 1964 who proposed that this material mixed with camphorated para chlorophenol (CMCP) would induce the formation of a calcified barrier across the apex. Calcium hydroxide can be mixed with a number of different substances (camphorated mono chlorophenol, distilled water, saline, anesthetic solutions, chlorhexidine and cresatin) to induce apical closure.[3] In recent times, interest has centered on the use of mineral trioxide aggregate (MTA) for apexification. It has been used in both surgical and non-surgical applications.[4]

Apexification can be defined as a 'method to induce a calcific barrier in a root with an open apex or continued apical development of teeth with incomplete roots and a necrotic pulp.[5]

Calcium hydroxide has been the first choice of material for apexification[6] with repeated changes over the course of 5-20 months to induce the formation of calcific barrier.[7] Its efficiency has been demonstrated by many authors even in the presence of an apical lesion.[8,9]

The unpredictable and often lengthy course of this treatment modality presents challenges, including the vulnerability of the temporary coronal restoration to re-infection[10] and has several disadvantages such as variability of treatment time (average 12.9 months)[11], difficulty of the patients recall management, delay in the treatment and increase in the risk of tooth fracture after dressing with calcium hydroxide for extended periods[12]. For these reasons, single visit apexification has been suggested. Mineral trioxide aggregate (MTA) has been proposed as a material suitable for one visit apexification[13,14,15] because of its biocompatibility bacteriostatic activity, favorable sealing ability and as root end filling material.

MTA offers the barrier at the end of the root canal in teeth with necrotic pulps and open apices[13] that permits vertical condensation of warm gutta-percha in the remainder of the canal.

CASE REPORT

A 32-year-old male patient reported to the Department Of Conservative Dentistry And Endodontics, Saraswati-Dhanwantari Dental College & Hospital & Post Graduate Research Institute Parbhani, with a chief complaint of fractured upper anterior tooth with a history of trauma 11 years ago. Clinical examination revealed Ellis class II fracture in maxillary right central incisor and discolouration. Tooth responded normally to percussion, palpation and had normal periodontal probing and Grade II mobility. Radiographic examination demonstrated the presence of open apex and bone loss (Fig 1). The tooth did not respond to the pulp vitality tests. The available treatment options were discussed with the patient and root canal therapy using MTA as an apical barrier was selected.

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Figure 1

Figure 2

As grade II mobility was assessed clinically hence decided to stabilize the tooth with composite splinting (Fig 2) then the tooth was isolated under rubber dam and access cavity prepared. Working length was established by radiograph. The canal was gently debrided with large H-files (Mani, Prime Dental, and Mumbai) and copious amounts of 5% 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 5% sodium hypochlorite and rinsed with saline. Final irrigation was done with 2% chlorhexidine and the canal was dried with paper points. MTA (Dentsply, Tulsa Dental, and Johnson City, USA) was mixed according to the manufacturer's instructions and carried to the canal with an amalgam carrier. Apical plug of 6 mm of thick paste of MTA was placed and confirmed radiographically (Fig 3). 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 thermoplasticized gutta-percha (Obtura II, Obtura Spartan, and Fenton, Missouri, USA) and zinc oxide eugenol sealer (Fig 4). followed with post endo restoration with composite (Fitek Z350 XT 3M ESPE). Patient was recalled after 3 months.

After 3 months when patient came back, a periapical radiograph was taken, which showed complete formation of the root apex in maxillary right central incisor, without any signs and symptoms and periapical radiolucency (Fig 5).

Then again patient was recalled after 6 months a periapical radiograph was taken, which showed complete healing of bone loss (Fig 6). Hence splinting was removed and later the tooth was restored with porcelain fused to metal crown to restore the esthetics.

Figure 3

Figure 4

Figure 5

Figure 6

DISCUSSION

The goal of apexification is to obtain an apical barrier to prevent the passage of toxins and bacteria into periapical tissues from root canal.[16] In the literature, many materials have been used for apexification, such as calcium hydroxide in combination with sterile water, saline, local anesthetic, CMCP, zinc oxide paste with cresol and iodoform,[17] polyantibiotic paste[18] and tricalcium phosphate.[19] Calcium hydroxide is one of the most important medicaments used in treatments of pulp conditions and apical periodontitis.[20] The use of CaOH in apical barrier formation has shown promising results. Because of its enhanced success rate, easy availability for the clinician and affordability for patients, it has gained widest acceptance in the literature.[21]

Some of the postulated mechanisms of CaOH are as follows:

1. Presence of high calcium concentration increases the activity of calcium dependent pyrophosphatase
2. Direct effect on the apical and periapical soft-tissue
3. High pH, which may activate alkaline phosphatase activity
4. Antibacterial activity.

MTA has been developed by Torabinejad and coworkers in 1990 at Loma Linda University. It is available as grey and white MTA. The material consists of tricalcium silicate, tricalcium aluminate, tetracalcium aluminoferrite, and calcium sulphate dihydrate and silicate oxide. Presence of bismuth oxide makes it radiopaque. 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.[21] Due to this reason, obturation was done after 72 hours as MTA attains its maximum strength in this time period.

In teeth with necrotic pulps, divergent open apices make adaptation of MTA difficult. Aminoshariae et al. (2003) evaluated placement of MTA using hand and ultrasonic condensation and suggested that hand condensation resulted in better adaptation and fewer voids than ultrasonic condensation. Accordingly, in these cases hand condensation was used to compact MTA at the apex.[22]

A total of 5 mm barrier is significantly stronger and shows less leakage than 2 mm barrier in the present case, MTA was placed for around 6 mm in the apical region.[16,22]

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 development of proper apical seal and excellent biocompatibility. Single visit apexification with a novel biocompatible material like MTA is a new boon in effective management of teeth with open apex .This innovative procedure is predictable and less time consuming one.

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