

## Management of Open Apex with Mineral Trioxide Aggregate-2 Case Reports

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### Abstract

The permanent teeth with open apex are difficult to treat as a traditional root canal procedure. 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 canal, the canal was cleaned using intracanal instruments and 3% NaOCl and normal saline. To obtain canal disinfection calcium hydroxide paste was temporized in the canal. In subsequent appointments, 3-4 mm MTA plug was created and allowed to set. In one case the tooth was restored with a cast post and core. In second case the root canal was obturated with gutta-percha. In subsequent follow up both the teeth were clinically and radiographically asymptomatic and the healing of the apical area continued. These finding suggests that MTA can induce formation of apical barrier in the case of non-vital tooth with open apex.

**keywords:** MTA, Naocl, Blunderbuss Canal,

### Introduction

Apexification is an endodontic treatment option which is done with the aim of apical repair as a hard tissue barrier across an open apex of a tooth. This treatment process is usually used for treatment of a permanent tooth with non vital pulp and an open apex. Complete disinfection by biomechanical preparation and three dimensional obturation of the root canal system are essential for long term endodontic success. In certain cases such as immature teeth, absence of natural apical constriction creates a challenge. One of the aims of endodontic treatment is to form an apical barrier or a stop against which one can place root canal filling material avoiding over extrusion<sup>1</sup>.

Different materials utilized in several procedures are used around the world to initiate formation of root end barrier. Calcium hydroxide with or without antiseptic, freeze dried allogenic dentin powder, bone ceramic, tricalcium phosphate, osteogenic protein, collagen, calcium gel have been used previously in managing teeth with open apex. Traditionally calcium hydroxide has been used extensively

to induce apical barrier formation. This treatment modality is unpredictable, often lengthy (requires 5–20 months of treatment time to form apical calcific barrier) <sup>2</sup> and requires multiple recall visits. It also includes the dislodgement tendency of the coronal temporary restoration leading to re-infection <sup>3</sup>. It has also been shown that use of calcium hydroxide decreases the resistance of dentin to fracture.

Recently MTA and Portland cement are being used to form apical plug in open apex cases. In 1999 Torabinejad and Chivian for the first time showed the use of mineral trioxide aggregate (MTA) as an apical plug <sup>4</sup>. Nowadays the first choice of material, suitable for single visit apexification is Mineral trioxide aggregate <sup>3,4,5,6</sup> because it is highly biocompatible <sup>7,8</sup>, has high bacteriostatic activity when in contact with body tissues <sup>9</sup>, good sealing ability leading to very low micro leakage <sup>8</sup> and as root end filling material <sup>8</sup>.

This case report represents the management of immature teeth with open apex with a single step apical barrier placement using MTA and colla plug as an internal matrix.

## Case Reports

### Case 1

A 47 year old female patient with non-contributory medical history reported to the department of conservative dentistry and endodontics with the chief complaint of fractured tooth in the upper front region of the jaw since 2 months. Dental history revealed that the patient had her tooth .evaluation revealed normal soft tissue structures with no apparent pathosis. Intra-oral examination revealed fractured (crown enmass) maxillary right central incisor. There was no pain on percussion or palpation. Radiographic examination revealed open apex on maxillary right central incisor. Hence, the diagnosis of Ellis Class VIII fracture with open apex was made.

**Treatment plan :** Apexification with MTA followed by cast post and core

**Treatment procedure :** 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 3% of sodium hypochlorite and normal 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. To limit the MTA within the canal Colla Cote was used as an apical barrier before placing the 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 wax pattern for cast post and core was fabricated. A cast metallic post-core was prepared and cemented with glass ionomer cement. The tooth was then restored with a porcelain-fused metal crown.

Clinical examination performed at the 1-year follow-up visit revealed adequate clinical function, the absence of pain and tenderness to percussion or palpation, as well as the absence of mobility and sign or symptoms of inflammation or infection; moreover, radiography displayed normal PDL and lamina dura.



Figure 1: Operative Clinical Picture

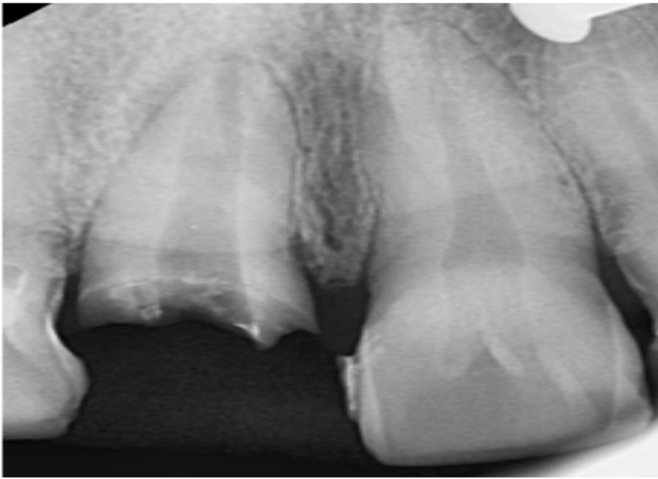


Figure 2 : Preoperative Radiograph



Figure 5 : Clinical Picture Of Cast Post



Figure 3 : MTA Plug



Figure 6 : PFM Crown In Place



Figure 4 : Cast Post Cemented



Figure 7 : After 1 Month



Figure 8 : After 1 Year

A 32 year old male patient with non-significant medical history reported to the department of conservative dentistry and endodontics with the chief complaint of pain in the upper front region of the jaw since 1 month. Pain was dull in character and intermittent in nature. Extra-oral evaluation revealed normal soft tissue structures with no apparent pathosis. On intra-oral examination, maxillary right central incisor was tender on percussion. There was no pain on palpation or mobility with respect to the same tooth. Tooth elicited negative response on thermal as well as electric pulp testing. Radiographic examination revealed open apex on maxillary right central incisor with periapical radiolucency. Hence, diagnosis of pulpal necrosis with symptomatic apical periodontitis was made.

**Treatment plan:** Apexification with MTA followed by obturation with gutta-percha

**Treatment procedure:** Straight line access cavity was prepared with round diamond bur which help to remove all the necrotic tissue from the pulp chamber. Irrigation was done with 3% sodium hypochlorite and normal saline. Working length was estimated by radiographic technique within 1 mm of the radiographic apex. Circumferential filing was done and the canal was irrigated with 3% sodium hypochlorite and 2% CHX. Canal was dried the help of sterile paper points. Calcium hydroxide paste was

placed into the canal and the access cavity was filled with temporary cement. Patient was recall after two weeks. The tooth was asymptomatic on the next visit. Access was reopened and calcium hydroxide was flushed from the canal with normal saline. The canal was dried with sterile paper point. MTA was mixed according to manufacturer's instructions, introduced in to the canal and condensed apically by gentle packing with apical plugger. The apical plug was confirmed with radiograph. A moist sterile cotton pellet was placed over the canal orifice and the access cavity was sealed with temporary filling. On the next appointment, the hardness of MTA was confirmed and the rest of the root canal was filled with thermoplasticized gutta-percha and AH Plus sealer. The access cavity was filled with light cured composite. Post-operative radiograph was taken to check the obturation.

Clinical examination performed at the 6 months follow-up visit revealed adequate clinical function, the absence of pain and tenderness to percussion or palpation, as well as the absence of mobility and sign or symptoms of inflammation or infection. Radiographically the periapical radiolucency showed signs of healing.



Figure 9: Preoperative Radiograph



Figure 10: MTA Plug



Figure 11 : Obturation



Figure 12: After 6 Months

## Discussion

An immature permanent incisor tooth is considered as a tooth with an open apex. A root end closure technique is required before root canal treatment of these teeth so that a calcific barrier can be formed at the apex and against which a root canal filler and sealer can be condensed.

Bacterial course of the infection is eliminated by root canal treatment. So irrigating solution with antimicrobial property like sodium hypochlorite was used and calcium hydroxide was placed as intra canal medicament for one week. Previous clinical studies have shown that this procedure can eliminate the bacterial content in the root canal significantly within one week.

Torabinejad et.al in 1990 developed MTA at Loma Linda University while working on management of tooth with open apex. MTA is usually available as two types such as grey and white MTA. MTA is composed of tricalcium silicate, tricalcium aluminate, tetracalcium aluminoferrite, calcium sulphate dehydrate and silicate oxide. Bismuth oxide is added to make the cement radioopaque<sup>9</sup>. MTA has a high pH of 12.5 which makes the material more antibacterial and it has a very good seating time which provide the operator enough working time. It has osteoinductive activity & also act as cementogenic agent which helps to stimulate the immune cells. As a result the cells release lymphokines that is required for the repair & regeneration of cementum & stimulate bone coupling factors necessary for bioremineralisation and healing of osseous periapical defect<sup>10</sup>. MTA have the ability to provoke interleukin (IL) production by osteoblast that can exhibit raised level of IL-1 alpha, IL-1 beta, IL-6 & macrophage- colony stimulating factor<sup>7</sup>. The process of the biologic sealing by cementum disposition is not clear but may occur by the diffusion of calcium ions through dentinal tubules towards the root surface and inhibit bacterial colonization & survival<sup>11</sup>. Both white & Gray

MTA are capable of inducing PDL- cell attachment regeneration, stimulate PDL fibroblasts to initiate osteogenic phenotype and promote the production of osteonectin, osteopontin & osteonectin & increase alkaline phosphates level<sup>12</sup>. It also resists bacterial leakage against *E. faecalis*, *Enterobacter aerogenes*, & *staphylococcus epidermidis*. However Gray MTA appears as a better sealing agent than white, due to its less leakage property (Gray : 9.1%, white : 36.4% after 42 days). Clinical studies have reported that 77% to 85 % open apex healed completely 1-3 year with MTA plug<sup>8,13,14,15</sup>.

As it is hydrophilic, the presence of exudate, blood or tissue fluid enhance setting. A moist cotton pellet over MTA is also indicated in achieving hermetic seal due to setting expansion.

MTA has high compressive strength which is comparable to IRM and Super EBA (It reaches maximum strength in 72 hours<sup>14</sup>). So usually obturation is done after 72 hours placement of MTA. Aminoshariae et al. at 2003 has shown that MTA placement by hand condensation technique results in better adaptation and leave very few voids than that of ultrasonic condensation<sup>15</sup>. According to this, MTA was compacted in the apex using hand condensation.

Unless there is specific reason for delay & as one of the common cause that results in failure of apexification is the bacterial re-contamination due to loss of coronal restoration, the definitive restoration should be completed as soon as possible. For more extensively damaged tooth i.e. trauma, complete coronal coverage supported by post is indicated. The main aim of post and core is to replace the lost tooth structure. The amount of crown structure lost and root canal anatomy in case 1 did not permit the use of conventional prefabricated fibre post as the post diameter would not have allowed for good adaptation to the post space and the resulting thick cement layer would have

affected the bond strength. Keeping these things in mind a decision was made to fabricate a cast metal post and core and then restore the tooth with PFM crown.

### Conclusion

In modern clinical practice MTA has many clinical use in surgical and non-surgical endodontics ranging from apexification, pulpotomy to apical surgery. The main advantages of MTA is when used as an apical plug, it reduces in the number of appointments, develop a hermetic apical seal leading to no micro leakage and excellent biocompatibility. This case report shows one of the indications of MTA as apexification material and it ensures that MTA can be used as an apical barrier & considered as highly effective for treatment of immature non vital permanent teeth with open apex.

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