



APEX TO SUCCESS- MTA APEXIFICATION IN MAXILLARY LATERAL INCISOR: A CASE REPORT

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ABSTRACT

In endodontic therapy, the primary goal is to completely fill the root canal space to prevent reinfection. When dealing with teeth that have incomplete root development due to trauma, decay, or other pulpal issues, the absence of a natural constriction at the root canal's end presents a challenge in controlling obturating materials. The objective is to seal the significant communication between the root canal system and the surrounding tissues and to create a barrier against which the obturation material can be effectively compacted. This case report describes the successful management of a permanent maxillary lateral incisor with an open apex using Mineral Trioxide Aggregate (MTA) for apexification.

KEYWORDS : Apexification, apical plug, dental trauma, endodontic treatment, mineral trioxide aggregate, open apex.

INTRODUCTION

Conventional root canal filling methods face significant challenges when dealing with teeth that have necrotic pulp, immature apices, and periapical lesions. These difficulties arise due to the lack of a natural apical constriction and the presence of moisture contamination.^[1] As a result, there is an increased risk of root filling material extrusion and complications in achieving effective apical seals, which can negatively impact the long-term success of the treatment. This is well managed by the procedure called as Apexification.^[2] It is defined as 'A method to induce a calcified barrier in a root with an open apex or the continued apical development of an incompletely formed root in teeth with necrotic pulps' (American Association of Endodontists 2020).^[3] By creating an artificial apical barrier with MTA, this technique provides an alternative to the traditional, lengthy apexification process using calcium hydroxide (Ca (OH)₂).^[4]

MTA is highly effective for sealing both iatrogenic and pathological communications between endodontic and periodontal spaces, and its sealing ability is not compromised by moisture.^[5] When in contact with peri-radicular tissue, MTA encourages the formation of cementum-like hard tissue.^[6] Placing an MTA plug in the apical part of the root aids in apical repair and prevents overfilling of the root canal. This enhances the retention of natural teeth with a permanent restoration and can also increase the fracture resistance of immature teeth.^[7]

This case reports presents successful treatment of permanent maxillary lateral incisor with open apex wherein MTA was used for apexification.

Case Report

A 35 years old male patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of discoloration of upper front tooth from past 5 months. There was a history of trauma to the same tooth due to fall about 20-25 years back. The patient's medical history was not contributory. Clinical examination revealed discolored permanent maxillary right lateral incisor (Figure 1.a). The tooth did not demonstrate any abnormal mobility or tenderness to percussion. No response was elicited on both cold and electric sensibility tests. Periapical radiograph revealed wide open apex and periapical radiolucency around the root end with respect to permanent maxillary right lateral incisor (Figure 1.b). MTA apexification was planned as the preferred treatment.

After rubber dam isolation, the maxillary right lateral incisor was accessed and working length was determined using electronic apex locator and confirmed radiographically (Figure 1.c). The canal was irrigated with normal saline. Root canal preparation was carried out using # 80 K-file (Dentsply Maillefer, Switzerland) with circumferential filing motion. Thorough root canal debridement was done using alternative irrigation with copious amount of 2.5% sodium hypochlorite and normal saline. A volume of 3 ml of 17% ethylene diamine tetra acetic acid (EDTA) solution (Waldent, India) was used for smear layer removal. Calcium hydroxide was placed in the root canal as intracanal medicament and access cavity was restored with Cavit (Prevest Dentpro, India). The patient was recalled after 5 days. At subsequent appointment, the tooth was again isolated with rubber dam and the root canal was passively irrigated with 2.5% NaOCl (Prevest Dentpro, India) to remove any remnants of the calcium hydroxide medicament along with complete disinfection. Then the triple antibiotic paste consisting of equal amounts of ciprofloxacin, metronidazole, and doxycycline was given as intracanal medicament for one week.^[8]

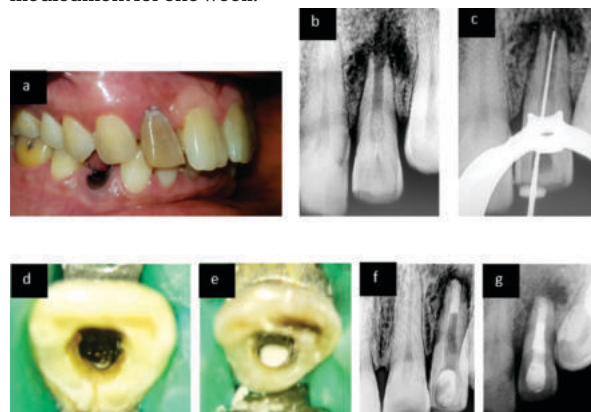


Figure 1: a) Pre-operative Photograph; b) Pre-operative Radiograph showing open apex and periapical radiolucency; c) Working Length Radiograph; d) Access Cavity under DOM; e) MTA apical plug; f) MTA apical plug radiograph; g) Post Obturation Radiograph.

Patient was recalled and was found asymptomatic. The access cavity was viewed under Dental operating microscope (DOM) (Figure 1.d) Irrigation was done and the canal was dried with absorbent paper points (Meta BioMed,

Korea) followed by placement of resorbable collagen matrix (ColoPlug, ColoGenesis, India) in the apical region to act as a scaffold and MTA (Angelus, Londrina, PR, Brazil) was mixed according to the manufacturer's instructions and carried to the canal with MTA carrier and packed against the collagen matrix. MTA Apical plug of about 4 mm was placed and confirmed radiographically (Figure 1.e,f). A sterile cotton pellet, dampened with sterile water, was placed over the canal orifice, and the access cavity was sealed with Cavit. After 72 hours, the hard set of MTA was confirmed and the remainder of the root canal was obturated with thermoplasticized gutta-percha technique using Obtura III max system (Obtura Spartan) followed by composite resin restoration (Figure 1.g). Then after one week, Zirconia full coverage crown was given and post operative radiograph was taken. (Figure 2).



Figure 2: a) Post-operative photograph showing cementation of full coverage zirconia crown; b) Post-operative radiograph after full coverage crown cementation.

DISCUSSION

The main goal of the apexification procedure is to form an apical barrier that blocks toxins and bacteria from reaching the periapical tissues through the root canal^[9]. Traditionally, calcium hydroxide paste was employed to promote the formation of a calcified barrier before proceeding with the root canal treatment. Creating a physiologic hard tissue barrier with calcium hydroxide, typically takes between 3 to 18 months. This prolonged period can require multiple patient visits and increases the risk of the tooth fracturing before the roots are sufficiently strengthened. The conventional apexification material, $\text{Ca}(\text{OH})_2$, has several drawbacks, including variability in treatment duration, unpredictability in achieving apical closure, challenges in patient follow-up, difficulties in controlling and preventing infection, recurrence of infection, potential for cervical fractures, and an increased risk of root fractures.^[10]

Mineral Trioxide Aggregate (MTA) was developed by Dr. Mahmoud Torabinejad at Loma Linda University in California in 1993.^[11] MTA is composed of dicalcium silicate, tricalcium silicate, tricalcium aluminate, calcium sulfate, and bismuth oxide.^[12] MTA is highly biocompatible and provides excellent sealing properties. It is associated with favorable clinical outcomes for a range of applications, including the repair of perforations, vital pulp therapies, root-end fillings, root canal fillings, and as an apical plug.^[13]

When MTA comes in contact with tissue fluids various ions are leached such as calcium, silica, bismuth, iron, aluminum, and magnesium. After root-end resection and examination under both optical microscopy and scanning electron microscopy (SEM), researchers identified a white layer between the MTA and the root canal walls. Further investigation using energy-dispersive X-ray spectroscopy revealed that this white layer was composed of calcium, phosphorus, and oxygen, resembling hydroxyapatite (HA).^[14] So it can be concluded that when MTA interacts with tissue fluids, it generates $\text{Ca}(\text{OH})_2$, which releases calcium ions that facilitate cell attachment and growth,^[15] creates an antibacterial environment by its alkaline pH,^[16] encourages differentiation and migration of hard tissue producing cells,^[17] influences cytokine production^[18] and forms HA (or carbonated apatite) on the MTA surface and provides a biologic seal.^[19]

Although traditional MTA has many advantages, it is often limited by its longer setting time. To address this, MTA Angelus was developed. MTA Angelus has a shortened setting time and improved operability while retaining the superior performance of traditional MTA.^[13] Therefore, MTA has now become a gold standard for apexification and hence it was selected in this case as the bioceramic material for the apical plug to manage the open apex in the maxillary right lateral incisor.

CONCLUSION

Managing an open apex can be quite challenging; however, adhering to proper cleaning and shaping protocols and utilizing bioceramic materials can lead to successful treatment outcomes. Long-term follow-up of these cases is crucial.

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