Case Report

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Apexification Using Mineral Trioxide Aggregate: A Case Report

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ABSTRACT

Background: The ultimate goal of the endodontics is to debride and hermetically seal the root canal up to the apex. However, the tooth with an open apex poses a great problem. There are myriad factors involved as far as the aetiology of the open apex is concerned that is caries, trauma, extensive apical root resorption, etc. Out of all the treatment approaches, one of the most important and conservative approaches is Apexification. Although calcium hydroxide as a material has proved to be a boon in such cases gradually, it was found to have some detrimental effects. With the advent of various materials available in the market, MTA has successfully proven its worth out of the lot, keeping in view its superior remineralization and above all creating a perfect hermetic apical seal. This case report presents the efficacy of MTA in open apex.

Keywords: Apexification, Calcium Hydroxide, MTA.

INTRODUCTION

To achieve optimum results in root canal therapy, proper debridement and sealing of apex are of utmost importance. However, in patients having nonvital teeth with open apices, achieving the apical seal is a challenge due to large apex, diverging walls, thin dentinal walls that are susceptible to fracture and frequent periapical lesions. [1].

Earlier in 1966, the surgical approach was practised for making an apical barrier that is required for the management of blunderbuss canal, but it generally leads to shortening of root length which in turn poses a great problem as it leads to unfavourable crown root ratio.[2] But nowadays, the most common conservative method used for the management of open apex is apexification.[3] Earlier, the most common material used for forming a calcific barrier in apexification was calcium hydroxide which was introduced by Herman in 1920 and said that calcium hydroxide, if mixed with camphorated parachlorophenol (CMCP), can induce a calcific barrier for management of open apex.[4] Despite good results, it also has shown various disadvantages like tunnel defects in dentin bridges which fail to provide a hermetic seal, takes longer treatment time, follows up became difficult, increased number of appointments, the possibility of fracture due to increased treatment time.[5]

However, nowadays, MTA has been introduced as new material and alternative to Calcium Hydroxide with lesser disadvantages. It was first introduced in dentistry in 1993 by M.Torebinejad [6] They are used for creating apical plugs during apexification, repairing root perforation during root canal therapy, and treating internal root resorption. This can be used for root-end filling material and treating internal root resorption. Nowadays, MTA available in the market comprises of 75% Portland cement, 20% bismuth oxide, 5% Dehydrated calcium silicate, Tricalcium silicate, Dicalcium silicate, Tricalcium aluminate, Tetra calcium aluminoferrite which leads to the formation of mineralized apical tissues in immature anterior

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teeth.[7] It is biocompatible, forms a dentinal bridge, and can release cytokine from bone cells which promotes hard tissue formation.[8] But still, MTA poses some disadvantages like difficult handling properties, discoloration potential, long setting time, and high cost which leads to further search for better material in these cases.

CASE REPORT

A 22-year-old male patient reported to the Department of Conservative Dentistry and Endodontics in Santosh Dental College Ghaziabad with a chief complaint of discolouration and fractured upper front teeth with the history of trauma five years back. On clinical examination, Ellis class II fracture was seen in both maxillary central incisors (11,21) with discolouration in his all upper anterior teeth (Fig 1). Tooth normally responded to percussion, palpation, and had normal probing depth but did not respond to pulp sensibility tests [9] with respect to right and left maxillary central incisors. On radiographic examination, the open apex was seen with a mild bone loss with respect to maxillary central incisors. The patient was informed about the problem, treatment plan and prognosis of the tooth then after obtaining his written consent, root canal therapy following apexification using MTA followed by veneer preparation w.r.t 12,13,22,23 was started.

Then, the tooth was anaesthetized using 2ml of 2% lidocaine containing 1:200,000 epinephrine (LOX 2%, Neon laboratories Ltd., Mumbai, India) and isolated under rubber dam. An access cavity was prepared with an endo access bur no. 1 (DENTSPLY, Switzerland), and canal orifices are located using DG-16 endodontic explorer. The patency of the canal was checked with 15 no. K-file (Mani, Japan) and working length was determined radiographically and apex locator (Fig 2). The canal was irrigated gently using a 2% chlorohexidine and normal saline to remove organic debris. Calcium hydroxide was placed in the canal as an intracanal medicament for 1 week to inhibit the osteoclastic activity (Fig 3).

At the second appointment, calcium hydroxide is flushed using a 2% chlorohexidine and rinsed with saline. Then, canals were finally dried with the paper points. MTA (Dentsply, Tulsa Dental, and Johnson City, USA) was fixed according to the

Fig 1: Pre-operative radiograph showing Elli's class II fracture w.r.t 11, 21.

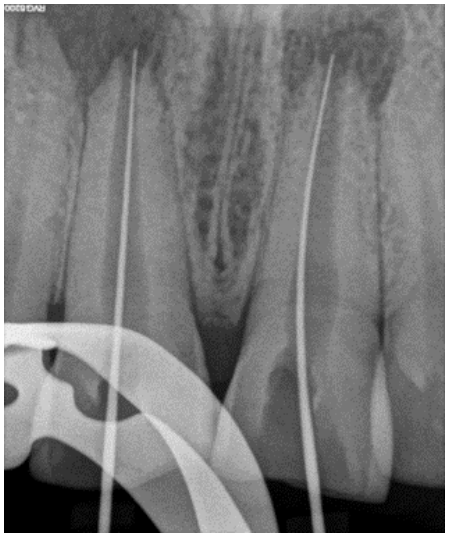

Fig 2: Working Length determination.

Fig 3: Calcium Hydroxide placed as an intracanal medicament.

Fig 4: MTA placed as an apical barrier.

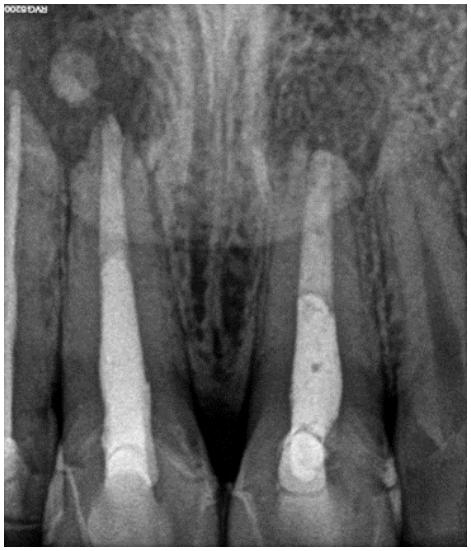

Fig 5: After MTA placement, obturation done with gutta percha.

Fig 6: Crown preparation for veneers.

Fig 7: Lab fabricated model of veneers

Fig 8: Post-operative picture.

manufacturer's instructions and condensed to the canal by MTA condenser, and an apical barrier of 6mm was created. It was confirmed radiographically (Fig 4). A sterile cotton pellet moistened with distilled water is placed, and the access cavity is sealed with cavit (3M ESPE, Seefeld, Germany). The patient is recalled after 72 hours.

After 72 hours, the hard set of MTA was confirmed, and the remaining root canal is obturated with thermoplasticised gutta-percha (Obtura II, Obtura Spartan, Fenton, Missouri, USA) (Fig 5). The cavity is then restored with composite, and the patient is recalled after two weeks for esthetic correction as there were minimal tooth loss and discolouration.

After two weeks, teeth are isolated using a rubber dam. Before tooth preparation, retraction chord (Ultra pack #0, Ultra dent, South Jordan, UT) was placed on the facial aspect of tooth 0.5 mm apically to secure gingival from tearing. Then, tooth preparation was performed for porcelain veneer, and teeth are cleaned with cotton pellet moistened with 4% chlorhexidine (Fig 6). An impression is

then made with putty and sent to the lab for fabrication of veneers(Fig 7).

After one week, the patient is recalled, and veneers are cemented with composite resing luting cement, and excess material is gently removed with a resin-coated brush(Fig.8).

DISCUSSION

Pulp necrosis of permanent immature teeth implies the interruption of root formation and apical closure. In this case, it is required to implement a therapy called apexification to induce a hard calcific barrier at the apex to achieve definitive root canal filling.[10] It is very difficult to treat pulpal injury if it happened during root formation, depending on pulp vitality: apexogenesis and apexification can be implied.[11] If the pulp is vital, apexogenesis can be done as it is the process of physiologic development and formation of root end while apexification is done in case of necrotic pulp. As always, success of treatment depends on accuracy of diagnosis and biologic status of the tooth.

For a proper understanding of this case, the development of root should be discussed. Root development begins when enamel and dentin formation reaches future CEJ. At this stage, outer and inner enamel epithelium are not separated by stratum intermedium and stellate reticulum but develops double-layered epithelial wall which forms HERS. HERS is responsible for determining the shape of the root. Apical diaphragm surrounds the apical opening to the pulp which forms apical foramen. An open apex is found in developing roots of immature teeth as apical closure takes three years after tooth eruption.[12] Root sheath is usually sensitive to trauma but with vascularity and cellularity in apical region root can continue to form even in pulp inflammation, but for this, every effort should be maintained to preserve the viability of HERS.[13]

A variety of materials have been proposed to overcome this problem of open apex to induce calcific barrier. Earlier, Calcium hydroxide was the choice of material to induce a calcific barrier in apexification procedure. As it was believed that due to its bactericidal nature with an alkaline pH makes it a better choice for stimulating apical calcification.[14] But later various shortcomings were seen with this material including tunnel defects, variability in treatment time, difficulty in follow-ups, delayed treatment, tissue alteration.[15] The search continued for better material over time to dissolve these shortcomings and may allow more natural apical closure in apexification cases.

Then, the US Food and Drug Administration approved MTA to be used as a therapeutic endodontic material in 1998 for various applications.[16] This product has shown to have superior characteristics as a direct pulp capping when compared with calcium hydroxide, which would result in intracanal bone formation followed by root development.[17] More recently, ProRoot(white MTA) is developed due to the esthetic problems in grey MTA for anterior teeth. The composition of white MTA is tricalcium silicate, dicalcium silicate, tricalcium aluminate, calcium sulphate dehydrate and bismuth oxide. The setting of grey MTA is 3-4 hr, and compressive strength after the setting is 70MPa.[17]

MTA has a better antibacterial property, less leakage, high marginal adaptation, short setting time (4h) and a pH of 12.5 and of course, is more biocompatible. It provides hard tissue formation with scaffoldings. It stimulates the production of interleukins and cytokine production, which enables it to form a hard tissue barrier. As it can set in a moist environment, it can be used in pulp necrosis and inflamed periapical lesions. But, there are some shortcomings which we face using MTA like higher cost, difficult handling properties. So, further research is required to search for better material for these apexification cases.

CONCLUSION

The clinician should be aware of these root anomalies like open apex and should know how to manage them. This particular case of open apex may be a challenge for the dental operators who do not have proper diagnostic aids and lack in the proper knowledge of root development. Pre-operative radiological assessment from different angles, clinical evaluation of root canal number and morphology using various diagnostic methodologies, proper access preparation and thorough examination of pulp to locate and debride all canals is important. So thorough knowledge of root development and awareness make treatment

more successful, and if the dental operator exhibits proper skills, these cases can be done with ease.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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