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Achieving Root End Closure in a Non Vital Immature Tooth Using MTA: A Case Report

Satish Gangaramani[1], Naveen Chhabra[2], Krupa Desai[3], Kritika Gupta[4]
[1](Department Of Conservative Dentistry and Endodontics, K. M. Shah Dental College and Hospital / Sumandeep Vidyapeeth, India)
[2](Department Of Conservative Dentistry and Endodontics, K. M. Shah Dental College and Hospital / Sumandeep Vidyapeeth, India)
[3](Department Of Conservative Dentistry and Endodontics, K. M. Shah Dental College and Hospital / Sumandeep Vidyapeeth, India)
[4](Department Of Conservative Dentistry and Endodontics, K. M. Shah Dental College and Hospital / Sumandeep Vidyapeeth, India)

Abstract: *Apexification using Mineral trioxide aggregate (MTA) is proven to be more advantageous when compared to the conventional calcium hydroxide (Ca(OH)2) technique owing to the fewer visits required for the treatment and also MTA causing no significant mechanical harm to dentin properties. Limited literature is available on the outcome of MTA apexification. The present case report illustrates successful root closure of a necrotic immature tooth where MTA was used as an apexification material. The current case depicts an immature left maxillary central incisor that underwent pulpal necrosis due to trauma 12 years back. A conventional root canal treatment was initiated with placement of MTA apical plug followed by gutta percha obturation. Initiation of root apex formation was seen after 3 months and a complete root closure was achieved after 12 months.*

Keywords: *Apexification, Mineral trioxide aggregate*

I. Introduction

Young patients are often vulnerable to traumatic injuries which consequently terminate the development of the partially formed roots. Endodontic management of such teeth with wide canals and open apices may perhaps prove to be a significantly challenging to the clinicians.[1]

The main setback in root canal therapy of an immature teeth with necrotic pulp and wide open apices, is achieving an optimal seal of the root-canal system.[1]The primary objective of the treatment aims to encourage the formation of a hard tissue barrier at the root apex, the process called as apexification. The prime focus of this procedure is to limit the microbial infection and build an environment that promotes root end formation in an immature tooth by inducing a mineralized tissue barrier. Traditionally, calcium hydroxide was used for this purpose; however, it requires prolonged period to form the apical barrier and the treated teeth are prone to fracture in the long run.[2] The introduction of newer bioactive materials has led to diminished use of calcium hydroxide as apexification material.

Mineral trioxide aggregate (MTA), has been projected as a promising material to build an apical stop at the root end, thus preventing the extrusion of filling materials.[3] MTA, in the field of endodontics, has been potentially used for a variety of purposes, including that as a root canal filling material.[4] Studies have confirmed the regeneration potential of MTA which promotes the growth of periradicular tissues, like periodontal ligament, bone and cementum.[4] Also, the superior biocompatibility of MTA with periradicular tissues[5,6], its exceptional sealing ability in the moist environment[7,8] and its excellent mechanical properties as an apical sealing material provide additional benefit.[9] Owing to these encouraging properties, MTA has been used as suitable substitute for calcium hydroxide for apexification procedure. The present case report demonstrates the satisfactory formation of an apical barrier in permanent immature tooth where MTA was used as apical plug.

II. Case Report

A 22-year-old female patient reported to the Department of Conservative Dentistry and Endodontics at K M Shah Dental College and Hospital, Vadodara with a chief complaint of spacing and proclination in upper front teeth region. The patient had been asymptomatic during this period and gave history of fall injury 14 years back. The patient's medical and dental history was noncontributory and family history was insignificant. An Elli's Class II fracture along with discoloration was observed in relation to upper left central incisor (21). There was absence of tenderness on percussion, sinus tract was absent with no signs of bleeding on probing and periodontal pockets.. Midline diastema was present between upper right and left central incisors (11 and 21). Patient presented with an Angle's Class II occlusion with deep bite.

2.1 Investigation:

An intraoral periapical radiograph was taken which demonstrated an incomplete root formation with an open apex along with PDL widening in relation to upper left central incisor. Electric pulp testing for 21 showed a negative response for 21 and positive for 11, 12, 22. 21 was non-responsive on cold test. Based on clinical and radiographic findings, the diagnosis of pulp necrosis and asymptomatic apical periodontitis with 21 was made.

2.2 Treatment:

Root canal therapy was initiated under local anesthesia and rubber dam isolation of 21. Access cavity preparation was done and working length was confirmed radiographically with a size 80 K file at 18mm. Biomechanical preparation was done by circumferential filing with a size 80 K file along with copious irrigation with 0.5% sodium hypochlorite (NaOCl). After biomechanical preparation, the root canal was dried and filled with calcium hydroxide (RC- Cal). The access cavity was sealed with temporary restorative material (Cavit). After 1 week, the calcium hydroxide was removed by repeated rinsing with 0.5% NaOCl. The canal was dried with sterile paper points. In left central incisor, an MTA mixture (ProRoot MTA; Dentsply Tulsa Dental Specialties, Tulsa, OK, USA) was made and placed with an MTA carrier, under the dental operating microscope at 16x magnification (Labomed) in the apical portion of the canal (5 mm) to create an apical plug. After the positioning of the MTA apical plug, the mixture was adapted to the canal walls using a hand plugger, proportional to the apical gauge. To verify the correct position of the MTA mixture, a confirmatory x-ray was taken. A cotton pellet soaked with sterile water was then placed in the pulp chamber and the access cavity was sealed with cavit. After 3 days, the cavit and cotton pellet were removed and the set of the MTA was tested by gently touching it with a hand file. The rest of the canal was obturated with gutta-percha by warm vertical technique in association with a canal sealer (AH-Plus; Dentsply Tulsa Dental Specialties). The coronal access was later sealed with composite resin. At the 3 month follow-up examination, the patient was asymptomatic and healing of the periapical lesion was noted radiographically. The radiographic follow up at 12 months revealed apical closure of the open apex of the left central incisor.

Figures

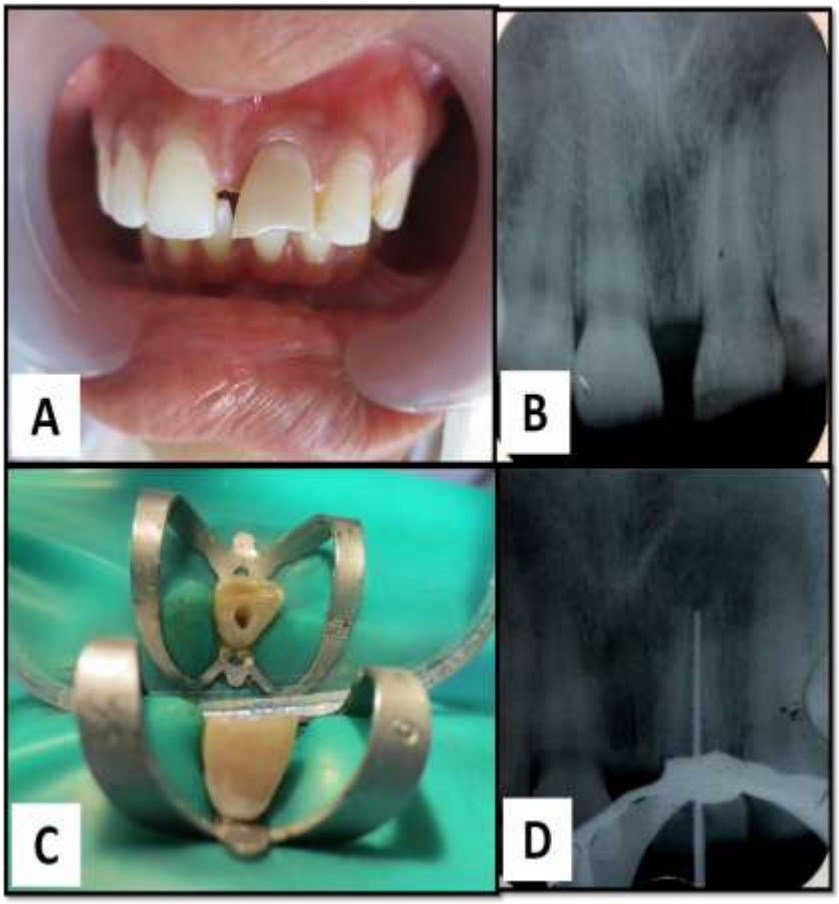

Fig 1: a) pre-operative clinical photograph b) pre-operative radiograph c) access opening done d) working length radiograph

fig 2: a) 5mm apical plug of MTA b) obturation using gutta percha c) 3 months follow up after apexification d) 12 months follow up after apexification

Fig 3: final results. a) pre-operative radiograph b) complete root closure after 12 months

III. Discussion

The prime concern in management of a nonvital tooth is complete eradication of the bacteria from the radicular system. It becomes relatively challenging in cases of open apex where conventional instrumentation of root canal cannot be done and cleaning and disinfection of the root canals enormously depend on the antimicrobial action of NaOCl as an irrigant and calcium hydroxide as an intracanal dressing.[14] 0.5% NaOCl was used in this case as it is known to be highly toxic to the periradicular tissues, when used in high concentrations. Also there is great chance of extrusion of the irrigating solution beyond the apical foramen.[15] Calcium hydroxide was applied as an intracanal medicament owing to its excellent antimicrobial activity due to high pH.[16]

Calcium hydroxide, used as an apexification material produces optimum surroundings to initiate the formation of hard tissue at the root ends. However, the major considerable crisis associated with traditional apexification using calcium hydroxide is the long duration of treatment required, that is around 3 to 21 months.[2] Also there is increased chances of re-infection as the coronal seal is achieved using temporary cement. Moreover, teeth treated with calcium hydroxide apexification have been reported with an increased risk of cervical fracture.[17]

On the other hand, MTA has been the material of interest in recent times owing to its various applications. When compared to calcium hydroxide, MTA has resulted in a considerably higher frequency and superior quality of dentin bridge formation with lesser pulp inflammation.[16,18,19,20] MTA has found to promote the proliferation of undifferentiated cells to form a dentinal bridge.[21] A study conducted by Paranjpe A et al. has found that MTA, when applied in direct contact with the human dental pulp cells (DPCs), differentiated them into odontoblast-like cells.[22] An in vitro experiment have proved that MTA increases the expression of type I collagen and osteocalcin in osteoblasts cells after 24 hours.[23,24] Studies have also support the role of MTA in stimulating the proliferation of the cementoblasts, fibroblasts, and osteoblasts.[25] Moreover MTA also encourages the attachment and growth of the cementoblasts as well as the production of mineralized matrix gene and protein expression.[26] In the present case complete closure of the root apex was seen radiographically after 1 year of MTA placement. Moreover MTA placement reduces the risk of re-infection as it offer the luxury of providing permanent restoration within same visit or to the most in the subsequent visit.

IV. Conclusion

To conclude, MTA can be considered as a viable option for apexification in immature teeth owing to its effective root closure with the added advantage of speed of completion of therapy, However long-term follow up is needed for better evaluation.

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