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CASE REPORT

Treatment of an Open Apex with One-visit Apexification using Mineral Trioxide Aggregate

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ABSTRACT

A tooth with an open apex can pose an enigma to the most skilled practitioners. The lack of an apical stop complicates the obturation and achievement of good apical seal. Also these teeth tend to be more fragile due to thin walls. Calcium hydroxide has been routinely used in the past for apexification. But the disadvantages of long treatment time, fracture of teeth, and incomplete calcification of apical bridge have led to the development of newer biocompatible materials which can complete apexification in a single visit. One-visit apexification has been defined as the nonsurgical condensation of a biocompatible material into the apical end of root canal. Although different materials are available, because of its superior clinical properties and demonstrated clinical success, mineral trioxide aggregate (MTA) remains the material of choice for forming an immediate apical barrier. This case report highlights the use of MTA for formation of apical barrier in a nonvital maxillary central incisor with open apex and obturation with custom-made gutta–percha.

Keywords: Apexification, Apical plug, Immature tooth, Mineral trioxide aggregate.

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INTRODUCTION

A traumatized nonvital immature tooth presents a number of difficulties for adequate endodontic therapy.[1] Trauma causes cessation of root development.[2] The canal is often wider apically than coronally, since the apex is extremely wide and no barrier exists to stop the filling material from moving into and traumatizing the apical peridontal tissues.

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Also, the lack of an apical stop and extrusion of material might result in a canal that is susceptible to leakage. An additional problem in immature teeth with thin dentinal walls is their susceptibility to fracture both during and after treatment.[1] Above all these disadvantages, these types of cases are frequently associated with periapical pathologies.[3] Thus, selection of material to treat these types of cases has to be done very conscientiously.

The material that is going to treat this type of cases should have few properties like, it should be bioactive in nature, should be able to create a fluid tight seal, should reinforce the root dentin, and should also be antibacterial.[4] Earlier, various materials like calcium hydroxide powder mixed with different vehicles, collagen calcium phosphate, osteogenic protein, bone growth factor, and oxidized cellulose have been tried to achieve successful treatment, but none of these materials seem to achieve their desired goal efficiently within convenient timeframe.[5,6]

To overdrive this time-consuming apexification technique, many alternatives have been suggested that has been aimed mainly at the development of one-step procedure (single-visit apexification). This includes creating a nonresorbable apical barrier with mineral trioxide aggregate (MTA).[3]

Mineral trioxide aggregate provides a scaffolding for the formation of hard tissues and the potential of a better biological seal. It is a hydrophilic material that has a 3-hour setting time in the presence of moisture. Mineral trioxide aggregate advantages include excellent sealing ability, good compressive strength, a good biocompatibility, and cementum and periodontal ligament regeneration.[7]

The aim of this case report is to highlight the management of an open apex of a nonvital immature permanent tooth using single-visit apexification with MTA to form apical barrier.

CASE REPORT

A 15-year-old female patient reported to 32 dental clinic, with a complaint of pain in the upper incisors and a history of trauma 4 years before. There was no significant medical history. Also there was a history of attempted root canal treatment 1 week before. Clinical examination revealed a fractured incisal edge with 11 and an access cavity made on the palatal aspect which was blocked with cotton. Mild vestibular tenderness was present in relation

to 11 at the root apex and the subjected tooth was mild tender on percussion.

Intraoral periapical radiograph demonstrated presence of a radiolucent periapical lesion with blunderbuss canal, in relation to 11 (Fig. 1). Nonsurgical endodontic apexification with MTA apical plug was planned for 11. An appropriate access cavity was prepared to allow the debridement of the necrotic pulp. Working length was determined 2 mm short of the apex, in order to not injure the apical tissue (Fig. 2). Gentle circumferential filing had been performed with minimal dentin removal using #80 H file. Saline and 2.5% sodium hypochlorite were used as irrigating solutions. Calcium hydroxide paste was placed in the canals for 1 week for disinfection. During the second appointment, calcium hydroxide was eliminated by mechanical instrumentation and rinsed out of root canals by means of sterile water irrigation. The canals were dried using sterile paper points. Mineral trioxide aggregate (White MTA, Angelus) was mixed with provided liquid by the manufacturer and introduced inside the canal with a plastic filling instrument. Preselected pluggers (Fig. 3) were used to gently condense MTA into the canal to create a plug of 5 mm. After checking apical plug of MTA with radiograph (Fig. 4), a moist cotton pellet was introduced inside the canal to hydrate the material. After 24 hours, temporary restoration was removed and

Fig. 1: Preoperative intraoral periapical radiograph

Fig. 2: Determination of working length

Fig. 3: Plugger selection to condense

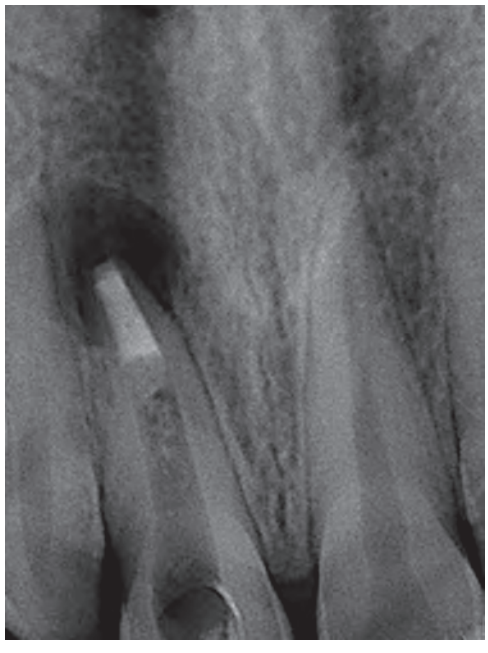

Fig. 4: Apical plug of MTA

Fig. 5: Postobturation

Fig. 6: Six-month follow-up

Fig. 7: One-year follow-up

Fig. 8: One-and-a-half year follow-up

MTA was checked for setting. Obturation was done using a customized gutta–percha cone (Fig. 5).

The tooth was restored with a light cured composite restoration. Follow-up radiographs at 6 months (Fig. 6), 1 year (Fig. 7), and one-and-a-half year (Fig. 8) demonstrate adequate healing of the periapical lesion.

DISCUSSION

Obtaining a good hermatic seal in teeth with necrotic pulp and wide-open apices is a challenge in endodontics. For more than 40 years, such cases are approached clinically with apexification using $Ca(OH)_2$, which acts as an initiator for the formation of osteoid or cementoid barrier over the apical foramen.[1,4] The traditional use of calcium hydroxide apical barriers has been associated with unpredictable apical closure, time taken for barrier formation, patient compliance, risks of re-infection resulting from the difficulty in creating long-term seals with provisional restorations, and susceptibility to root fractures arising from the presence of thin roots or prolonged exposure of the root dentin to $Ca(OH)_2$.[8] Thus, there is increasing popularity with one-visit apexification techniques.

Revascularization, which is a very conservative approach, is considered as a good alternative treatment

option for these types of cases. However, there are no randomized controlled clinical trials available till date for the success of these procedures on teeth with persistent periapical infection.[9]

Taking all these factors into consideration, it was decided to perform apexification using MTA plug, which will allow immediate apical closure, promotes apical healing, and strengthens the root dentin.

Mineral trioxide aggregate has come up as a very good alternative in treating these types of cases, where the material sets and creates an apical barrier readily. It has got a very good sealing ability, as the material immediately bonds with the roots and creates a monoblock. Its high pH helps to destroy the surrounding microorganisms and its bioactive nature stimulates blastic cells to create favorable environment for healing.[4,10] It also promotes cementum deposition on it.[11] Moreover, due to its fast setting time, fewer follow-up appointments are required to carry out this treatment.

Not only the selection of material, but also the thickness of apical MTA barrier has played a key role in clinical success. A 5 mm thick apical MTA barrier has proven to be significantly stronger with lesser leakage than a 2 mm thick barrier. In the present case, a condensed 5 mm apical MTA plug was made.[12,13]

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