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Single Visit Apexification Using Mta: A Case Report

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ABSTRACT: Trauma to the dentition during the period of root formation may cause incomplete development of root resulting in open apex. In order to eliminate infection from root canal endodontic treatment is a tooth-saving treatment modality. The absence of a natural apical constriction in a nonvital permanent tooth makes endodontic treatment a challenge. Therefore, it is necessary to induce or create an apical barrier against, which the obturating material can be condensed. Traditionally, calcium hydroxide is considered as the gold standard to induce apexification. Due to certain drawbacks such as very long treatment period, possibility of tooth fracture, and incomplete apical barrier formation, it is being replaced by materials, which have a more predictable outcome like mineral trioxide aggregate (MTA). One-step apexification with MTA reduces the treatment time when compared with traditional calcium hydroxide apexification, which requires an average time of 12–19 months. Also, MTA has various other superior properties compared to calcium hydroxide that are discussed below in detail along with successful treatment of an immature permanent tooth with open apex wherein MTA was used for one-step apexification.

KEYWORDS: Apexification, Calcium hydroxide, MTA, Open apex, Trauma

INTRODUCTION

Dental trauma injuries are responsible for 30% of pulpal necrosis in an immature permanent tooth. These injuries often result in subsequent incomplete development of root apices.[1] The completion of root development and closure of the root apex occurs up to 3 years after eruption of the tooth [2]. The treatment of pulpal injury during this period provides a significant challenge for the clinician. Depending upon the vitality of the affected pulp, two approaches are possible- apexogenesis or apexification. Apexogenesis is 'a vital pulp therapy procedure performed to encourage continued physiological development and formation of the root end' [3]. Apexification is defined as 'a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp' [3]. Amongst a variety of materials that have been proposed for induction of apical barrier formation, calcium hydroxide is the most popular. The use of calcium hydroxide was first introduced by Kaiser in 1964 who proposed that this material mixed with camphorated parachlorophenol (CMCP) would induce the formation of a calcified barrier across the apex. [4]

However, calcium hydroxide [Ca(OH)2] apexification may involve multiple monthly appointments to achieve elimination of the intracanal infection. It has several disadvantages like alteration of the mechanical properties of dentin making the teeth more susceptible to root fracture. Also, it takes 5 to 20 months to form a calcific barrier. The formed apical plug is not completely impervious due to increased porosities within the barrier.[5]

Although calcium hydroxide has been the material of choice for apexification, a number of authors have worked with other materials. In recent times interest has centered on the use of mineral trioxide aggregate (MTA) for one visit apexification. Morse et al. defines one-visit apexification as the non-surgical condensation of a biocompatible material into the apical end of the root canal. The rationale is to establish an apical stop that would enable the root canal to be filled immediately. [6]

MTA powder consists of fine hydrophilic particles of tricalcium silicate, tricalcium oxide and silicate oxide. It has low solubility and a radiopacity that is slightly greater than that of dentin [7]. This material has demonstrated good sealability and biocompatibility [8, 9]. MTA has a pH of 12.5 after setting which is similar to the pH of calcium hydroxide and it has been suggested that this may impart some antimicrobial properties [10]. It has been used in both surgical and non-surgical applications including root end fillings [8, 9, 11], direct pulp caps [12], perforation repairs in roots [13] or furcations [14, 15] and apexification [16, 17].

The clinical success of MTA for one-visit apexification procedure has been reported by many authors in the literature. The present case report narrates a successful treatment of an immature permanent tooth with open apex wherein MTA was used for one-step apexification.

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II. CASE REPORT

An eighteen year old female patient reported with the chief complaint of pain in upper front tooth in the past 5 days. There was a history of trauma to the same tooth 8 years back. The medical history of the patient was non-significant. Clinical examination revealed Ellis class IV fracture (Fig.1) and previously initiated root canal treatment in permanent maxillary right lateral incisor. The tooth demonstrated sensitivity to percussion. Both cold and electric sensibility tests failed to elicit any response. Periapical radiograph showed incomplete root development with open apex for the same tooth (Fig. 2). MTA apexification was planned as the treatment of choice. The tooth no. 12 was accessed and working length was determined radiographically (Fig 3). The canal was irrigated with saline. Biomechanical preparation was carried out using International Organization for Standardization (ISO) 60 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 (NaOCl) (Ammdent, India) and saline. A volume of 3 ml of 17% ethylene diamine tetra acetic acid (EDTA) solution (Prevest Denpro, India) was used for smear layer removal. Calcium hydroxide (ApexCal medicament paste, Ivoclar Vivadent AG Schaan, Liechtenstein) was placed in the root canal as a disinfectant material and access cavity was restored with Cavit (3 M ESPE, Seefeld, Germany). The patient was recalled after 7 days. At subsequent appointment, the root canal was irrigated with 2.5% NaOCl (Ammdent, India) and 2% chlorhexidine (Dentochlor, Ammdent, India) to remove any remnants of the calcium hydroxide medicament along with complete disinfection. The canal was dried with absorbent paper points (Meta BioMed, Korea) and White MTA Angelus (Angelus, Londrina, PR, Brazil) was mixed with distilled water according to the manufacturer's instructions and carried to the canal with an amalgam carrier. Apical plug of about 4 mm of MTA was placed and confirmed radiographically (Fig. 4). A sterile cotton pellet moistened with sterile water was placed over the canal orifice and the access cavity was sealed with Cavit (3 M ESPE, Seefeld, Germany). After 48 hours, the hard set of MTA was confirmed and the remainder of the root canal was obturated with gutta-percha (Meta BioMed, Korea) and AH-Plus root canal sealer (Dentsply Detrey GMBH, Germany) using lateral condensation technique (Fig. 5). The access cavity was sealed with glass ionomer cement (3M Espe Ketac Cem) followed by restoration of the tooth with microhybrid composite resin restoration (Dentsply, Spectrum). Post-operative 3 months follow-up radiograph shows reduced size of periapical radiolucency. (Fig. 6).

Fig.1

Fig.2

Fig.3

Fig.4

Fig.5

Fig.6

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III. DISCUSSION

In order to induce the formation of apical barrier to prevent the passage of toxins and bacteria into periapical tissues from root canal apexification is necessary.[18] For many years, calcium hydroxide paste was used to induce a calcified barrier followed by root canal procedure. However, due to the inherent disadvantages of Ca(OH)2 material such as prolonged treatment time, unpredictability of apical closure, difficulty in patient compliance, recurrence of infection, cervical fracture, and increased risk of root fracture,[19,16,20] single visit apexification using mineral trioxide aggregate (MTA) is a new boon in effective management of nonvital tooth with an open apex mainly because of its sealing properties and biocompatibility. MTA is a promising alternative to calcium hydroxide and it consists of fine hydrophilic particles of tricalcium silicate, silicate oxide and tricalcium oxide. The advantages of this material are (i) reduction in treatment time, (ii) immediate restoration of the tooth, (iii) no adverse effect on the mechanical properties of root dentin.[21] Several studies have demonstrated its capacity to induce odontoblastic differentiation, good radiopacity, low solubility, high pH, expansion after setting, and antimicrobial activity.[22,23] The mechanism of action of this Portland cement lies in releasing calcium ions that activate cell attachment and proliferation, and at the same time, the high pH creates an antibacterial environment.[24] In another study, MTA apexification showed a high prevalence of healing and apical closure.[25] Complete disinfection of the root canal is mandatory before obturation. In the present case report, disinfection of the canal was done using 2.5% NaOCl and calcium hydroxide dressing was given as intracanal medicament after cleaning and shaping. Placement of MTA was done and condensed using Endodontic pluggers, followed by obturation.[26] The thickness of MTA directly affects its hardness, sealing ability, and displacement when used as an apical barrier. In a study by Matt et al, a 5 mm thickness of MTA was found to be significantly stronger with less leakage than a 2 mm thickness.[27] A scientific article investigated displacement of MTA as an apical barrier material in teeth with open apices, showing that 4 mm thickness of the apical barrier offered significantly more resistance to displacement than 1 mm thickness.[28] Therefore, in accordance with the previous studies, 3-4 mm of MTA apical plug was placed in the present case series. Accordingly, in the present case reports MTA placement and condensation was done manually with endodontic pluggers as demonstrated by Aminoshariae et al. [29]. Kusgoz et al stated that MTA as a root end filling material is effective in immature necrotic pulpless teeth with shorter treatment time and better sealing ability.[26]

IV. CONCLUSION

Single visit apexification with a novel biocompatible material like MTA has shown promising results as a root end filling material for effective management of teeth with wide open apices. This innovative procedure is predictable and less time consuming with a high overall success rate and good patient compliance.

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