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Apexification using mineral trioxide aggregate (MTA): A case report

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Abstract

The process by which a nonvital, immature, permanent tooth that has lost capacity for further root development is induced to form a calcified barrier at root terminus is called Apexification. The main aim of Apexification is to close the open root apex by forming a hard barrier. This permits the root canal to be sealed in a better way.

Mineral trioxide aggregate (MTA) was manufactured to be used as a dental root repair material by Mahmoud Torabinejad. It is produced from commercial Portland cement, combined with bismuth oxide powder for radio-opacity. Originally, MTA was dark gray in color, but white versions have been on the market since 2002.

Introduction

The process by which a nonvital, immature, permanent tooth that has lost capacity for further root development is induced to form a calcified barrier at root terminus is called Apexification.[1] Against this calcific barrier root canal filling or restorative material can be condensed. Normally, teeth have cone shaped roots and contain root canals that taper from the crown to the root end of the tooth. These root canals can usually be treated with conventional methods.[2] However, in some cases there are some teeth with canals that do not close at the root end of the tooth resulting in an "open apex." It leads to complications in root canal therapy by making it difficult to seal the root canals with routine methods. Endodontists

are specially and specifically trained to treat these difficult situations through apexification.[3] Forming a hard barrier at the end of a root with an open apex, is the goal of Apexification.[4] This leads to the sealing of root canal in a more normal manner. Procedure is commenced with root canal preparation and cleaning procedure involving pulp extirpation. When it is determined, through radiographs, that a root end barrier has formed, the root canal therapy will be accomplished.[5] The most commonly preferred medicament is calcium hydroxide.[6] Kaiser introduced Calcium Hydroxide in 1964 and proposed that this material mixed with camphorated para chlorophenol (CMCP) would inculcate the formation of a calcified barrier across the open apex.[7] Recently, interest has aimed on the use of mineral trioxide aggregate (MTA) for apexification. It has been preferred in both surgical and non-surgical applications.[8]

Mineral trioxide aggregate (MTA) has been put forward as a material worthy for single visit apexification , reason being, its biocompatibility, bacteriostatic activity, favorable sealing ability and as root end filling material.[9,10]

Case Report

Patient complains of pain in upper front tooth region since 3-4 days. Pain was dull, intermittent ,aggravates only on taking hot and cold food/ drink and on chewing food(mastication). Intraoral and extraoral examination was done. Patient complaints of fractured upper anterior tooth with a history of trauma 7 years ago. Clinical examination revealed Ellis class II fracture in maxillary left central incisor and discoloration (Fig.1). Tooth responded normally to percussion, palpation and had normal periodontal probing. Radiographic examination demonstrated the presence of open apex and bone loss (Fig.2). The tooth did not respond to the pulp vitality tests. The available treatment options were discussed with the patient and root canal therapy using MTA as an apical barrier was selected in relation to 21.

Figure 1

Figure 2

Access opening was done with round bur. Deroofing was done with the help of taper fissure bur. Working length was determined 18 mm(Fig.3). Cleaning and shaping done till 80 # k file.

Figure 3

After completion of BMP tooth was properly irrigated with3% sodium hypochlorite and saline. Final irrigation was done with 2% chlorhexidine. Closed dressing was given along with calcium hydroxide intracanal medicament. Patient was recalled after 7 days and evaluation of the root canal was done. Root canal was irrigated with chlorhexidine and dried with paper points. Root Canal was found completely dry. MTA was mixed with distilled water and placed inside canal with carrier and finger plugger (Fig.4). Radiograph was taken to evaluate the apical plug formed by MTA (Fig.5). A moist cotton pellet was placed inside the canal for setting of MTA, and sealed with Cavit. Patient was recalled for post obturation. Thermoplastisized obturation was done (Fig.6). Root canal post Obturaton was completed. Non surgical approach was used. Patient was recalled after 6 months for follow up and radiograph was taken. Radiograph revealed the absence of radiolucency and presence of healing (Fig.7)

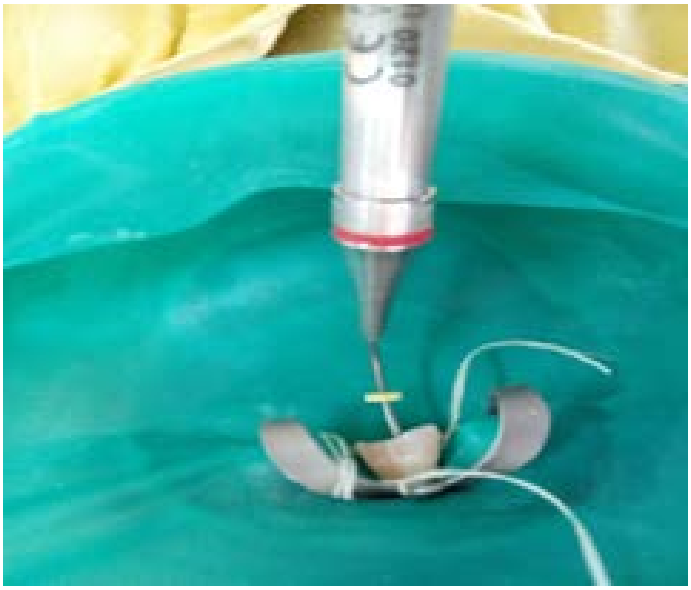

Figure 4

Figure 5

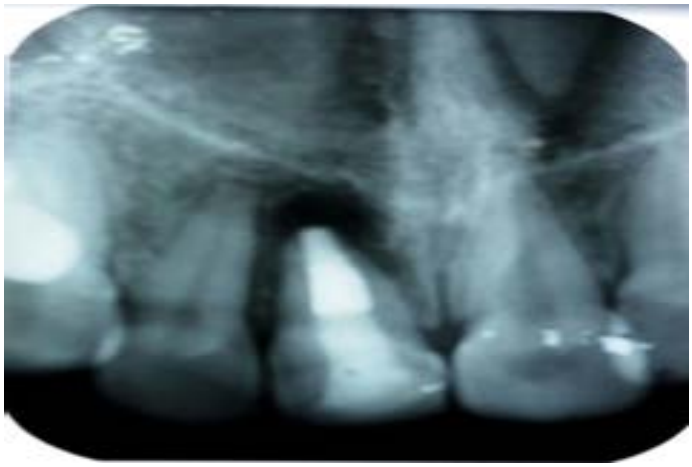

Figure 6

Figure 7

Discussion

The primary aim of apexification is to obtain an apical barrier to prevent the path and movement of toxins and bacteria into periapical tissues from root canal.[11] The use of various materials for apexification, such as calcium hydroxide in combination with sterile water, saline, local anesthetic, CMCP, zinc oxide paste with cresol and iodoform, polyantibiotic paste and tricalcium phosphate has been documented in literature.[12,13,14] Calcium hydroxide is one of the major medicaments used in treatment of pulp conditions and apical periodontitis.[15] CaOH used for apical barrier formation has shown promising results. Because of its increased success rate, easy availability for the clinician and affordability for patients, it has gained widest acceptance in the literature.[16] Some of the suggested mechanisms of CaOH are as follows:

1. The activity of calcium dependent pyrophosphatase is enhanced by the presence of high calcium concentration.
2. It has a Direct effect on the apical and periapical soft-tissue.
3. CaOH has high pH, which may activate or trigger alkaline phosphatase activity.
4. CaOH has antibacterial activity.[17]

MTA was developed by Torabinejad and coworkers in 1990 at Loma Linda University. It is available in two forms, as grey and white MTA.[18] The material is constituted of tricalcium silicate, tricalcium aluminate, tetracalcium aluminoferrite, and calcium sulphate dihydrate and silicate oxide. bismuth oxide makes is added for radiopacity.[19] pH of the material is 12.5 at three hours. The compressive strength of MTA is comparable to IRM and Super EBA and it reaches its maximum compressive strength in 72 hours. Because of this reason, obturation was done after 72 hours as maximum strength of MTA was attained in this time period.

Adaptation of MTA is challenging in teeth with necrotic pulps and divergent open apices. Aminoshariae et al. (2003) assessed placement of MTA using hand and ultrasonic condensation and concluded that hand condensation resulted in better adaptation and fewer voids than ultrasonic condensation. In accordance to this study, hand condensation was used to compact MTA at the apex, in these cases.[20]

A total of 5 mm barrier significantly was more stronger and showed less leakage than 2 mm barrier in the present case, MTA was placed for around 6 mm in the apical region.[11,20]

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