Apexification in non-vital tooth with open apex: A case report

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Abstract
Apexification is a technique for inducing closure of the non-vital permanent teeth at the apex. In apexification a mineralized barrier is induced with long-term calcium hydroxide (CH) or created artificially with mineral trioxide aggregate (MTA) plug.

Method: Two patients presented for evaluation of central incisor with discoloration with mild swelling and a non-traceable sinus tract. Both have a history of trauma. After intraoral examination and radiographic assessment a diagnosis of pulp necrosis with open apex was made. At the initial visit access cavity preparation and biomechanical preparation was done and calcium hydroxide dressing was placed. In the next appointment MTA plug was made and obturation was done after 72 hours and the tooth was build up with composites and a porcelain fused to metal crown was delivered. MTA is used for creating an apical plug, the functional goal of this procedure is to provide a hard tissue barrier that will provide an apical stop which will provide a platform for effective obturation of the canal allowing the patient to maintain the tooth.

Conclusion: MTA can be used effectively for creating a hard calcific barrier in cases of open apex. MTA also has low cytotoxic and superior biocompatibility as compared to calcium hydroxide used before.

Keywords: Apexification, MTA, open apex

Introduction
Root development is facilitated by the stimulation and differentiation of Hertwig’s Epithelial Root Sheath (HERS) and surrounding progenitor cells, which results in the continuous deposition of dentin and cementum. Interference in this development by trauma or infection can cause root development to be interrupted, resulting in a thin and fragile dentinal wall and a lack of natural apical constriction, which can lead to difficult clinical situations. The apical anatomy of these teeth is characterised by greater width at the apical portion compared to the cervical portion and the absence of apical constriction, which makes determining and staying within the working length difficult for the clinician. The tooth is susceptible to fracture due to the thin root dentin walls. In such cases, mineralized tissue must be used to close the apical foramen or an artificial apical barrier must be created to allow condensation of the root filling material and promote an apical seal. Apexification is a technique for creating a calcified barrier in an open apex root or continuing the apical development of an incompletely formed root in teeth with necrotic pulp. This procedure consists of removal of inflamed or necrotic pulp from the root canal, and disinfection of the canal to create an environment favorable for closure of the apex. The functional goal of this procedure is to provide a hard tissue barrier that will provide an apical stop which will create a platform for effective obturation of the canal allowing the patient to maintain the tooth. Mineral trioxide aggregate (MTA) has become a common alternative to traditional apexification treatment with calcium hydroxide. Current literature supports its efficacy in several procedures including apexification or as a root end filling material for root end closure of non-vital teeth with open apices. MTA is biocompatible, bactericidal, and able to set up in the presence of blood. It has good sealing properties and promotes periradicular tissue regeneration, including bone and cementum.
Case Report
A 25-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, Rama Dental College Hospital and Research Centre with a chief complaint of discolored teeth in the upper front region of the mouth with a history of trauma 11 years ago. Clinical examination revealed discoloration. Tooth responded normally to percussion, palpation and had normal periodontal probing. Radiographic examination demonstrated the presence of open apex and bone loss (Fig 1).

Fig 1: The presence of open apex and bone loss

Pulp vitality tests, including the cold test and an electric pulp testing elicited a negative response, which was suggestive of pulp necrosis. The available treatment options were discussed with the patient and root canal therapy using MTA as an apical barrier was selected.

Fig 2: Preoperative Radiograph

The tooth was isolated under rubber dam and access cavity prepared. Working length was established by radiograph. The canal was gently debrided with large H-files (DentsplyMaillefer, Ballaigues, Switzerland) by doing circumferential filling and copious amounts of 5% sodium hypochlorite. Calcium hydroxide intra canal medicament was placed for one week to disinfect the root canal (fig: - 3)

Fig 3: Calcium Hydroxide Placed

At the second appointment, calcium hydroxide was flushed with 5% sodium hypochlorite and rinsed with saline. Final irrigation was done with 2% chlorhexidine and the canal was dried with paper points. MTA (Dentsply, Tulsa Dental, and Johnson City, USA) was mixed according to the manufacturer’s instructions and carried to the canal with an amalgam carrier. Apical plug of 6 mm of thick paste of MTA was placed and confirmed radiographically (Fig 3). A sterile cotton pellet moistened with sterile water was placed over the canal orifice and the access cavity was sealed with Cavit (3M ESPE, Seefeld, Germany).

Fig 4: (MTA Apical Plug)

After 72 hours, the hard set of MTA was confirmed and the remainder of the root canal was obturated with cold lateral compaction and zinc oxide eugenol sealer (Fig 4). Followed with post endo restoration with composite.

Fig 5: Post operative radiograph

Discussion
In teeth with incompletely formed apices, induction of a calcified apical barrier with long-term intracanal calcium hydroxide medication, used to be the most common technique for inducing biological sealing [9, 10] Apexification is supposed to create an environment that allows periodontal tissues to deposit and root development to continue. However, the traditional apexification material Ca(OH)2 has a number of drawbacks, including treatment time variability, unpredictability of apical closure, difficulty in patient follow-up, failure to control infection, infection recurrence, cervical fracture, and an increased risk of root fracture [11, 12]. MTA has superior biocompatibility and is less cytotoxic, the presence of calcium and phosphate ions attracts blastic cells and promotes a favourable environment for cementum deposition [13, 14].
The major advantage of MTA is that unlike calcium hydroxide MTA doesn't require long treatment duration, and it has less leakage and better antibacterial properties with setting time of 3-4 hours with a Ph of 12.5. MTA acts by producing interleukins and cytokines release which leads to the formation of hard tissue [15,16]. Apexification with the MTA apical plug, on the other hand, necessitates specific facilities such as points and carriers to facilitate insertion, and correct adaptation within the ideal apical limit may be more difficult in extremely large foramina. Nonetheless, studies have shown that using passive ultrasonic vibration to place MTAs can improve the material's marginal adaptation [15]. Furthermore, the surgical microscope allows for better lighting and easier viewing and insertion of the MTA, though radiographic confirmation is still required at this stage.

Conclusion
MTA is used in endodontic therapy in a variety of ways, from apexification to pulpotomy. The primary advantages of this material as an apical barrier include development of proper apical seal and excellent biocompatibility. Single visit apexification with a novel biocompatible material like MTA is a new boon in effective management of teeth with open apexification to pulpotomy. The primary advantages of this conclusion is that unlike calcium hydroxide MTA doesn't require long treatment duration, and it has less leakage and better antibacterial properties with setting time of 3-4 hours with a Ph of 12.5. MTA acts by producing interleukins and cytokines release which leads to the formation of hard tissue [15,16]. Apexification with the MTA apical plug, on the other hand, necessitates specific facilities such as points and carriers to facilitate insertion, and correct adaptation within the ideal apical limit may be more difficult in extremely large foramina. Nonetheless, studies have shown that using passive ultrasonic vibration to place MTAs can improve the material's marginal adaptation [15]. Furthermore, the surgical microscope allows for better lighting and easier viewing and insertion of the MTA, though radiographic confirmation is still required at this stage.

References