

Case Report

Endodontic treatment with MTA apical plugs: a case report

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Abstract: Apexification with calcium hydroxide is associated with certain difficulties, such as the very long treatment time required, the possibility of tooth fracture, and incomplete calcification of the bridge. Use of an apical plug is an alternative treatment for open apices, and this has gained popularity in recent years, employing mineral trioxide aggregate (MTA) for optimal results. Here we report the successful treatment of two maxillary central incisors that had open apices and periapical lesions using MTA apical plugs after the root canals had been debrided and rinsed with 2.5% NaOCl. Calcium hydroxide paste was then placed in the canals for 1 week, before the apical portion of the canals (5 mm) was filled with the MTA plug. The remaining portion of the root canal was then sealed with a post and crown. After 6 months of follow-up, the clinical and radiographic appearance of the teeth showed a decrease of the periapical lesions. At 2 years, although the left post had been lost and the periapical lesion of the left central incisor had subsequently deteriorated, the right central incisor had healed successfully. Considering the importance of a coronal seal, the use of MTA for apical plugging appears to be a valid option. (*J. Oral Sci.* 49, 325-329, 2007)

Keywords: apexification; MTA; apical plug.

Introduction

A major problem associated with the endodontic treatment of teeth that contain pulpal necrosis with open

apices is achieving an acceptable seal in the apical area. In the past, the main goal was creating a barrier with hard tissue at the end of the root, a procedure known as apexification (1), in order to limit bacterial infection and establish a suitable environment for the induction of calcified tissue in the apical area. Calcium hydroxide is currently the most widely accepted material for this purpose (2).

Apexification is associated with a number of clinical problems, such as the long period – sometimes years – required for treatment, which necessitates the patient's absolute cooperation. During the apexification phase, due to the thin walls of the root, the tooth is very susceptible to fracture, which might necessitate extraction of the tooth (3). Another disadvantage of this technique is the nature of the barrier, which although apparently calcified, is actually porous and is sometimes even found to contain small amounts of soft tissue (4).

In recent years, researchers have been investigating materials capable of being applied permanently at the ends of tooth roots to create an artificial barrier in order to compress the process of treatment into one or two visits. Coviello and Brilliant introduced tricalcium phosphate for this purpose in 1979, and considered that the degree of success achieved was comparable with apexification (5). In 1993, Schumacher and Rutledge suggested calcium hydroxide as a permanent apical barrier (6). In 1999 Torabinejad and Chivian introduced the use of mineral trioxide aggregate (MTA) as an apical plug (7). MTA is a powder containing hydrophilic particles, and hardens in less than four hours upon contact with moisture. The main components of MTA include tricalcium silicate, tricalcium aluminate, tricalcium oxide and silicate oxide (7). In this article we report the clinical application of MTA as an apical plug.

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Case Report and Results

The patient was an 18-year-old male who had fractured the two maxillary central incisors due to trauma about 10 years prior to presentation. At that time, the affected teeth had been inappropriately treated and restored, and within two years the crown restorations had been destroyed and the patient had neglected to consult a dentist. Consequently, the crowns had become badly decayed and both teeth had developed apical lesions (Figs. 1, 2).

Clinical examination revealed that the gutta-percha in the root canals was exposed to oral flora, and a minor swelling was found lateral to the left central incisor (Fig. 1). Radiographic examination revealed two large periapical lesions, particularly on the left side, and wide open apices with incomplete canal obturation with gutta-percha.



Fig. 1 Clinical photograph of the patient's maxillary central incisors.



Fig. 2 Preoperative diagnostic radiograph.

Mobility of the teeth was within normal limits, and the patient had no discomfort apart from esthetic concerns. Primary investigation revealed an estimated tooth length of 18 mm, and therefore the patient was referred to a prosthodontist, who proposed that the minimum length needed for a post was between 13 and 14 mm, although the only available space for an apical plug was between 4 and 5 mm.

In consideration of these circumstances, it was decided to treat the teeth with MTA apical plugs. A rubber dam was used, gutta-percha was removed with a Hedstrum file



Fig. 3 Determination of working length.



Fig. 4 Radiographic view after dressing the canals with Ca(OH)_2 .

(Maillefer, Ballaigues, Switzerland), and then both canals were carefully instrumented, irrigated with 2.5% sodium hypochlorite, and dried with paper points (Fig. 3). Calcium hydroxide with a firmness paste was replaced with lentulo in the canals, and then a temporary coronal seal was established with Cavit (Masterdent, NY, USA) (Figs. 4, 5).

After two weeks, the patient returned, and the temporary filling was removed. Calcium hydroxide was flushed out of the canal using plenty of 2.5% NaOCl and minor instrumentation, and then the canals were dried with paper points. A mixture of MTA powder (Dental Tulsa Densply, De Trey, Germany) and distilled water was then applied to the tooth canals with a fine-tipped MTA carrier. This procedure was repeated a number of times until the thickness of the MTA reached almost 5 mm. The plug's position in both canals was checked by radiography (Fig.



Fig. 5 Clinical photograph after the first appointment.



Fig. 6 Radiographic view of MTA apical plugs in the canals.

6). After placing a wet paper point over the plug, the crowns were sealed temporarily with Cavit (Masterdent, NY, USA). The patient was referred to the Department of Prosthodontics, where both teeth were restored with FRC posts and PFM crowns (Fig. 7). After two weeks, the swelling of the buccal vestibule was noticeably reduced and had disappeared completely after two months.

The size of the periapical lesions decreased significantly after six months, and the patient had no signs or symptoms (Fig. 8). At the two-year follow-up point, the periapical lesion of the right central incisor had healed completely, but the condition of the left one had deteriorated because of loss of its post and crown 8 months earlier (Figs. 9, 10).



Fig. 7 Clinical photograph after restoration with FRC post and PFM crowns (A, B).



Fig. 8 Radiographic view after six months.



Fig. 9 Clinical photograph after two years.



Fig. 10 Radiographic view after two years.

Discussion

The most significant problem associated with classical apexification using calcium hydroxide is the long period of treatment required, which may be between 3 and 21 months (8), depending on factors such as the diameters of the open apices, the degree of tooth displacement by trauma, and the method used for tooth repositioning. Calcium hydroxide can create a desirable environment to aid the formation of hard tissue, comprising osteocementum at the ends of the roots (9). During apexification, there is a possibility of canal reinfection because the crown is sealed with temporary materials. There is also the possibility of cervical fracture (10).

The importance of coronal sealing was established by Tronstad et al. (11), who demonstrated that if the canal is

sealed properly and restored perfectly, then the degree of success will improve dramatically; however, even if the endodontic treatment is suitable, the success rate will be reduced by 10% if the crown is not sealed properly.

Although studies have proved that MTA has high sealing ability (12), excellent marginal adaptation (13), a high degree of biocompatibility (14) and an acceptable setting time (about 4 h) (7), provision of a suitable coronal seal after use of an apical plug of MTA is very important (15). In our patient, we realized that periapical healing had occurred in the right central incisor with a good coronal seal, but failed in the left one because the coronal seal had been disturbed.

After canal disinfection with calcium hydroxide, the apical region can be blocked with a MTA plug in one visit. MTA can provide a safe artificial barrier for obturation materials (16). From a clinical viewpoint, MTA can be used effectively in the moist environment of the tooth canal (7). This is particularly important in necrotized teeth with apical lesions because it has often been noticed that after cleaning the canal, exudation from the lesion into the canal continues. However, before using MTA for a necrotized tooth with a periapical lesion, calcium hydroxide therapy needs to be done (7). It is recommended to apply MTA under microscopic observation, to ensure that the materials are properly placed in the canal, and it is advisable to prevent MTA from spreading into the periapical tissues. Our clinical follow-up of this case confirmed the suitability of this method, and the findings were similar to those in the cases reported by Torabinejad and Chivian (7), Giuliani et al. (17) and others.

Orthograde delivery of MTA can be considered a more sensitive technique. Placement must be verified by radiography versus direct visualization from a retrograde direction, and condensation is limited due to minimal resistance of the open apex. In addition to the difficulty in manipulating the material to the apex, the inherent irregularities and divergent nature of the tooth anatomy may affect its adaptation to the dentin walls, predisposing the material to marginal gaps at the dentin interface.

On the basis of our experience overall, we conclude that use of MTA as an apical plug in necrotized permanent teeth with open apices is a valuable method if the quality of coronal sealing can be enhanced. This should allow long-term apexification to be replaced by apical plugging with MTA, thus reducing the treatment time.

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