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Case Report

Use of mineral trioxide aggregate in the open apex of a maxillary first premolar

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Abstract: Mineral trioxide aggregate (MTA) has shown potential as a root-end filling material. This clinical case describes the successful treatment of a premolar with an open apex using MTA and the warm gutta-percha technique. The results suggested that MTA may be used as an apical filling material in permanent teeth with multiple canals. (J. Oral Sci. 50, 355-358, 2008)

Keywords: mineral trioxide aggregate; open apex; multiple canals; premolar.

Introduction

In teeth with incomplete root development as a consequence of pulp necrosis due to caries or trauma, the absence of a natural constriction at the end of the root canal makes it difficult to control filling materials (1). An apical barrier such as calcium hydroxide can be placed to establish an environment that facilitates the closure of the apical opening (2).

Mineral trioxide aggregate (MTA; Pro-Root®, Dentsply Tulsa, Tulsa, OK, USA) has shown potential as a root-end filling material (2,3). MTA may be used as a root canal obturating material, repair material for root perforation and pulpotomy medicament because of its excellent sealing ability in the presence of moisture (4-6).

There have been few reports on the use of MTA placed via an orthograde approach in permanent teeth with multiple canals for apical closure (7). In this case report, MTA was placed in the palatal canal of an upper first premolar as an apical barrier and the apex of the buccal canal was filled using the warm gutta-percha technique.

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Case Report

An 11-year-old female with swelling and a sinus tract in the apical region of the upper left first premolar was seen at a private clinic (Seoul Eun Dental Clinic, Gunpo-si, Korea). The patient had a non-contributory medical history. The tooth did not respond to sensitivity testing with cold or an electric pulp tester (Parkell, Farmingdal, NY, USA). Radiographic examination demonstrated radiolucency at the periradicular area of the upper left first premolar (Fig. 1). Another radiograph was taken with a gutta-percha cone inserted to trace the source of drainage (Fig. 2). Clinical and radiographic examination indicated pulp necrosis with chronic apical periodontitis originating from dental caries. The patient was given a detailed explanation concerning the treatment procedure and prognosis.

The tooth was isolated with a rubber dam. A conventional access cavity was prepared in the occlusal surface of the first premolar with a 330-carbide bur and the cavity was widened with an Endo-Z bur (Dentsply Maillefer) to enhance the visibility of the root canal. The canals were irrigated several times with 5% sodium hypochlorite and the last irrigation solution was left in the canal for 30 minutes. The access cavity and pulp chamber were temporarily filled with calcium hydroxide, cotton and zinc oxide eugenol (Sultan, Seoul, Korea). One week later, the working length was determined using an electronic apex locator (Root ZX®, J Morita Corporation, Kyoto, Japan) and radiograph (Fig. 3).

The canal was irrigated with 5% sodium hypochlorite, and calcium hydroxide was applied twice within an interval of one week. The sinus tract disappeared and no other symptoms were observed after the third application of calcium hydroxide. The canals were then enlarged using nickel-titanium rotary instruments (Profile, Dentsply Tulsa). The buccal and palatal canal preparation was completed to an apical size of #45 and #130, respectively. The canals were then filled, even though the palatal canal could not be perfectly dried. MTA was prepared and applied to the apical portion of the palatal canal with a small plugger and the back end of sterilized paper points. The thickness of the MTA was approximately 3 to 4 mm. A moist cotton pellet was inserted in the canal over the MTA apical plug to aid in its setting, then the remaining palatal canal and all of the buccal canals were back-filled with injection-molded thermoplastic gutta-percha (Obtura, Obtura Corporation, Fenton, MO, USA) and sealer (AH26, Dentsplay, Konstanz, Germany) at a subsequent appointment (Fig. 4). An amalgam core was added and the treated tooth was restored with a porcelain-fused metal bond crown. The tooth has been asymptomatic since the obturation.

A follow-up radiograph taken 12 months after treatment with MTA (Fig. 5) revealed that the apical radiolucency at the first premolar was reduced and almost unnoticeable. A two-year follow-up radiographic examination demonstrated complete regeneration of the periradicular tissue (Fig. 6).

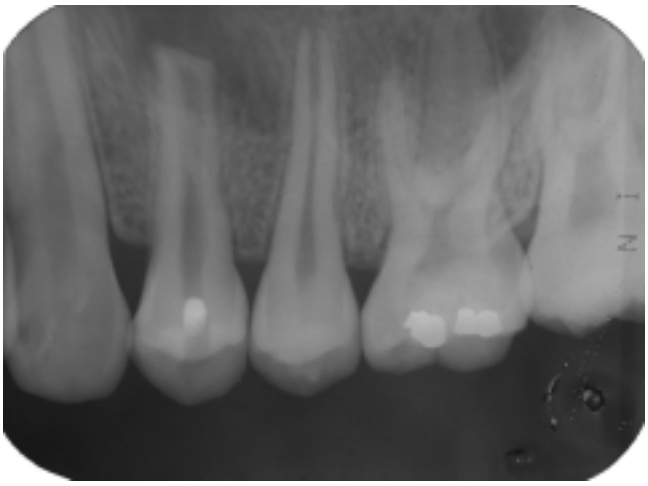

Fig. 1 Preoperative radiograph of the upper left first premolar with a wide-open apex and periapical radiolucent lesion.

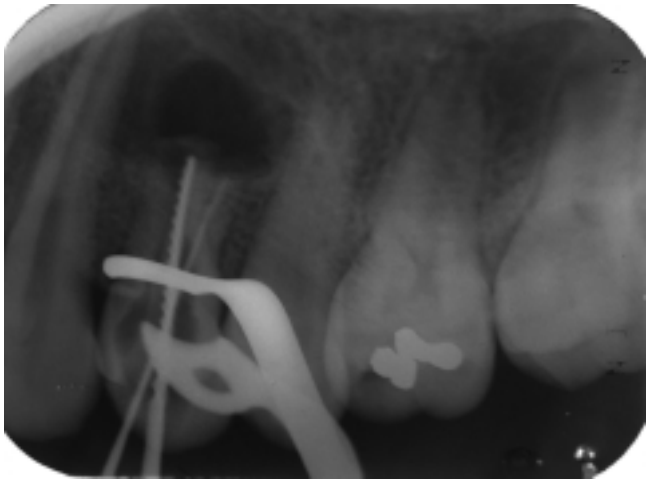

Fig. 3 Working length radiograph.

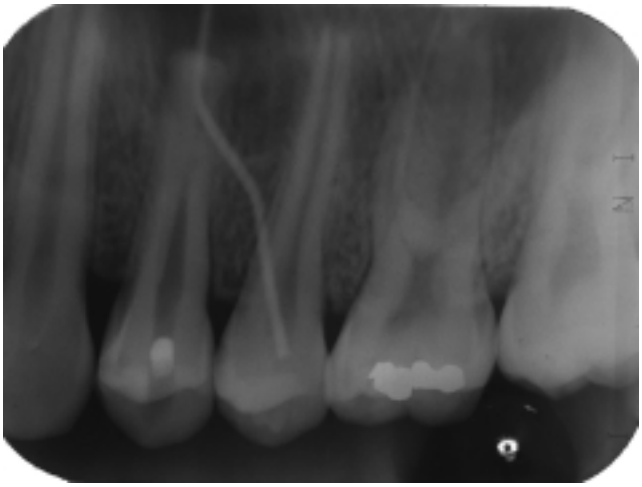

Fig. 2 Radiograph of the upper left first premolar with gutta-percha cone tracing.

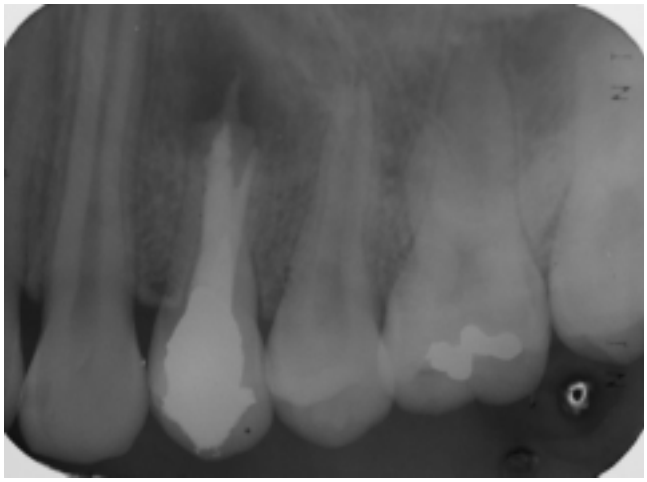

Fig. 4 Radiograph of the upper left first premolar filled with MTA and warm gutta-percha technique.

Discussion

From a practical point of view, MTA can be used in the presence of moisture in the root canal (8). This property is important in teeth with necrotic pulps and inflamed periapical lesions, because these cases may include the presence of an exudate at the apex of the root (8). Calcium hydroxide and 5% sodium hypochlorite were repeatedly applied in this case to limit bacterial infection (9). The symptoms resolved after the repeated applications of calcium hydroxide, but the canal could not be perfectly dried after the final rinse with sterile water. Nonetheless, the properties of MTA allowed the canal to be filled, leading to a shorter treatment period.

Longer placement of intracanal calcium hydroxide might have promoted root-end closure and allowed easier obturation (10), but this was not attempted because the treatment required full cooperation from the patient. During apexification, the root canal is susceptible to reinfection because it is covered with a temporary seal and may fracture during treatment (9).

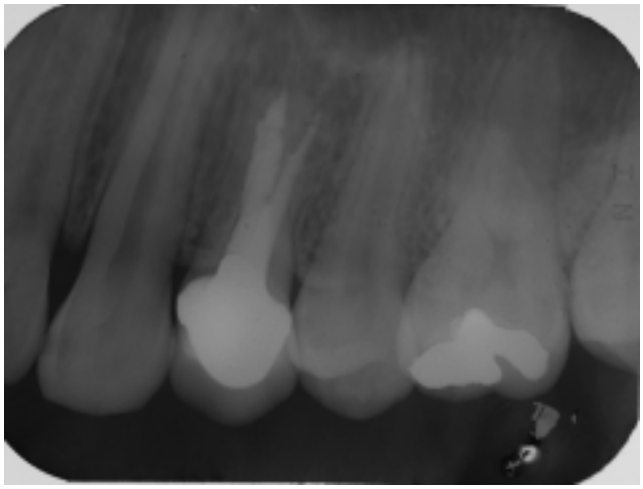

Fig. 5 One-year postoperative radiograph confirming healing of the periapical region.

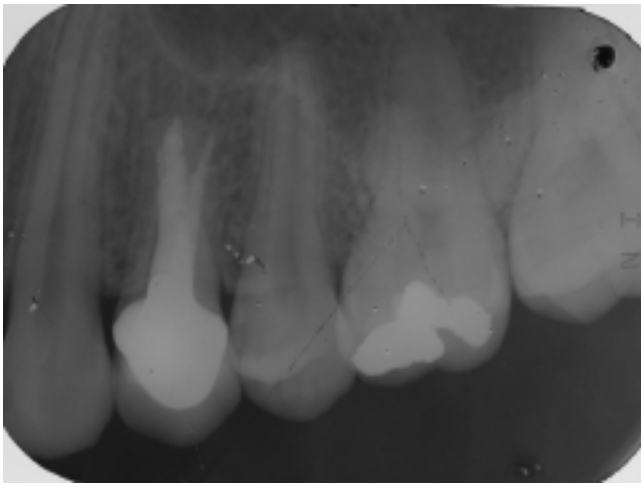

Fig. 6 Two-year postoperative radiograph showing complete healing.

Irregular dentinal walls and divergent apices make the adaptation of MTA more difficult. In this case, the access cavity was widened to enhance the visibility of the root and provide straight access to the apices of the tooth. The procedure should be done with caution. The orthograde placement of the apical plug is more sensitive than the retrograde method. Hachmeister et al. also found that the sealing ability of MTA is superior when used as an orthograde apical plug (4). Aminoshariae et al. reported that hand condensation resulted in better adaptation and fewer voids than the ultrasonic method (11). In the present case, the MTA mixture was applied with a small plugger to the wall of the root-canal system to prevent extrusion of the material and the final adjustment was done with light force using the back end of sterilized paper points with the aid of the radiograph.

de Leimburg et al. reported that an adequate seal against bacterial infiltration can be achieved regardless of the thickness of the apical plug of MTA (12). However, Hachmeister et al. emphasized that the apical plug thickness may only have a significant impact on displacement resistance (8). In the present case report, the thickness of the MTA apical plug was 3 to 4 mm, and the subsequent filling of the more superficial portion of the canal was done with a thermoplastic gutta-percha technique and amalgam.

In the present case, two different filling materials were used because MTA is more suitable for large and infected canals and in periapical periodontitis with inadequate apical constriction (9,13). The extruded material seen in Fig. 4 may be the sealer material, considering the difference in radiopacity. A resin-based sealer used in conjunction with gutta-percha is reported to perform very well as a root canal sealer (14). The one-year postoperative radiograph shows resorption of the extruded material and healing of the periapical region.

The clinical case reported here demonstrates that MTA can be used as an apical plug in teeth with nectrotic pulp and immature apices, and the canal can be effectively sealed. Both clinical and radiographic follow-up showed healing of the chronic apical periodontitis lesion and new hard tissue formation in the apical area of the affected tooth.

In conclusion, MTA may serve as an apical filling material in permanent teeth with multiple canals.

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