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Case Report

Single-session use of mineral trioxide aggregate as an apical barrier in a case of external root resorption

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Abstract: **External root resorption may occur as a consequence of trauma, orthodontic treatment, bacterial infection or incomplete sealing of the root canal system (bacterial re-infection), and lead to crater formation on the resorbed apex. This would deform the root apex surface, and cause loss of apical constriction. Depending on the extent of the resorptive process, different treatment regimens have been proposed. A 34-year-old male patient presented with an intra-radicular retainer and an inadequate filling on tooth #21, as well as a radiographic image suggesting periapical bone rarefaction. After root canal retreatment, the defect was accessed coronally. The resorption area was chemo-mechanically debrided and since the apical end was very wide, a calcium sulphate matrix was made. Mineral trioxide aggregate (MTA) was used to fill the resorptive defect, and the coronal access was temporarily sealed. After 24 h, the quality of the apical seal was evaluated with the aid of an operating microscope, and then the root canal system was filled. A 12-month follow-up radiograph showed adequate repair of the resorption. Clinically, the tooth was asymptomatic. We concluded that MTA can be successfully used to avoid overextension of the filling material when treating a tooth with external resorption. (J Oral Sci 52, 325-328, 2010)**

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Introduction

Root resorption can be classified as internal or external, depending on the radiographic aspect. Internal resorption is characterized by resorption of the pre-dentin and root dentin adjacent to the granulation tissue produced by the pulp. Although there are several theories regarding the origin of this pulpal granulation tissue observed in resorption cases, the most logical explanation is that inflammation develops in the pulpal tissue due to infection of the coronal pulp, or as a result of trauma (1).

In the case of external resorption, the root cementum and dentin are resorbed, and bone resorption follows (1). There is crater formation on the resorbed apex, deforming the root apex surface, and consequently, loss of apical constriction. Trauma, orthodontic treatment (2), bacterial infection or incomplete sealing of the root canal system (bacterial re-infection) can lead to this process of apical resorption.

Due to the wide nature of the apical foramen, MTA may be inserted in the apical portion of the root to allow the formation of an artificial barrier in the root apex (3). This is an alternative treatment (4) that avoids overextension of the filling material, allows good apical sealing, and reduces treatment time, thereby avoiding fracture of the tooth and microleakage between sessions (5). Furthermore, MTA exhibits good biological properties and stimulates repair (6).

When used on dog teeth with incomplete root formation and with contaminated canals, MTA induced the formation

Fig. 1 Preoperative diagnostic radiograph.

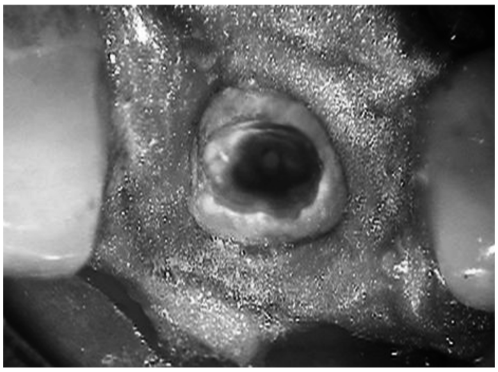

Fig. 2 Preoperative image showing a wide apical foramen due to external resorption (×12.5 magnification).

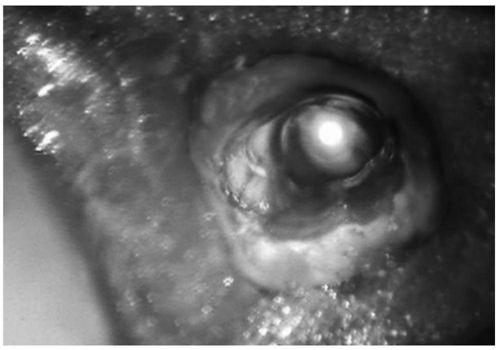

Fig. 3 Insertion of white MTA-Angelus over the calcium sulphate matrix as an apical barrier of approximately 3-mm thickness (×20 magnification).

of an apical barrier of hard tissue (4).

The aim of this article was to describe immediate endodontic treatment of tooth #21, using an apical barrier of MTA.

Case Report

The patient, a 34-year-old man, was referred for endodontic treatment of tooth #21. During clinical and radiographic examination, the presence of a complete prosthetic crown, an intra-radicular retainer and faulty obturation was observed. A radiographic image suggesting periapical bone rarefaction was also observed (Fig. 1).

Initially, the full crown was removed with the aid of a tapered trunk carbide bur No. 1557 (KG, Sorensen, São Paulo, SP, Brazil), at high speed, and an ultrasound insert 5AE (Gnatus, Ribeirão Preto, SP, Brazil). Then, the post was worn with a tapered trunk bur No. 1557 and, with the purpose of exposing the cement line close to the root remnant, in the most cervical portion of the root, a one-half spherical carbide bur was used. A 5AE ultrasound insert was again applied to all aspects of the core, thus producing microfragmentation of the cement and removal of the post.

Cleansing of the root canal system began with removal of the obturation material present. Debridement was performed using the crown-down technique with Flexofile files (Dentsply/Maillefer, Ballágues, Switzerland) and 2.5% sodium hypochlorite (Fórmula & Ação, Brasil, São Paulo, SP, Brazil) was used as irrigant solution. The working length was determined with the aid of an apex locator (ROOT ZX II, J. Morita, Kyoto, Japan).

Due to the apical deformity resulting from the external resorption, the apical end was found to be very wide (Fig. 2). Thus, we decided to make a calcium sulphate matrix as a protection to prevent exaggerated extravasation of the white Angelus MTA that was inserted over this matrix as an apical barrier of approximately 3-mm (Figs. 3 and 4). The MTA was introduced with the aid of a Dovgan 1.6-mm MTA holder (Quality Aspirators, Duncanville, TX, USA) and adapted with a No. 1 vertical condenser in the apical portion of the canal. This procedure was performed with the aid of an operating microscope (DF Vasconcelos, São Paulo, SP, Brazil). Because of the long setting time of MTA, the tooth was sealed with a paper cone dampened with Z350 composite resin (3M, Sumaré, SP, Brazil). The next day, the quality of the apical seal was evaluated with the aid of an operating microscope and, then the canal was filled with main non-standardized gutta-percha cones and AH Plus cement (Dentsply/Maillefer, Ballágues, Switzerland) using the lateral condensation technique. The full crown was rebased and used at this stage of endodontic re-treatment as a provisional crown. Next, a new ceramic core and crown were made.

The case was followed-up after 12 months, and there were no further signs or symptoms (Fig. 5).

Discussion

When periodontal ligament and cementum are traumatized by, for example, intrusion, luxation, or exfoliation, external resorption may result. The origin of this process lies then not within the pulp as with internal resorption, but rather with the periodontal ligament. The process inflammation within the injured tissue now directly contacts the cementum and external resorption can ensue (3). It is important to consider that external resorption may not only be a sequela of acute trauma, but, as Andreasen stated, may also follow injury to the periodontal ligament which is related to orthodontic, periodontic, pedodontic, or endodontic procedures. In the apical area, early necrosis of the pulp tissue or incomplete root formation and external resorption may each show a blunted or shortened root with an open foramen. However, these conditions may be differentiated by the shape and size of the canal system and the appearance of the apex. With early pulpal death or incomplete root formation, the canal system is large with parallel or divergent walls, and the apex may be blunderbuss-like in appearance. This contrasts with apical external resorption where the canal size will generally be smaller, and the walls will converge apically (2).

In the present case, owing to a faulty initial endodontic treatment, with incomplete sealing of the root canal system, bacterial re-infection is likely to have occurred, leading to apical resorption. Endodontic re-treatment was therefore indicated. As a result of this apical resorption, the tooth presented a wide apical foramen, with morphologic deformities, making it difficult to obtain a good apical seal, as is also the case of teeth with incomplete root formation. We therefore decided to perform an alternative treatment, as opposed to the treatment in which successive changes of calcium hydroxide dressings are placed for several months (7). Because the foraminal diameter was a concern, while aiming for a hermetic seal of the canal and avoiding overextension of the filling material, a 3-mm apical MTA barrier was made, after a calcium sulphate protection was placed. This would avoid prolonged treatment, and consequently, fracturing of the tooth and coronal microleakage between sessions (7).

Al-Kahtani et al. (8) recommended placement of a 5-mm apical barrier of MTA in cases of apexification, as this allows for an excellent seal, and because sufficient material thickness is obtained to prevent it from being displaced. In this same study, they obtained a relative success index of 81% of the cases studied *in vivo*. The root was not so narrow and the foramen was not as wide as in the cases of apexification, and preparation was required to place an intra-radicular retainer; therefore, a 3-mm apical barrier was chosen in the present case.

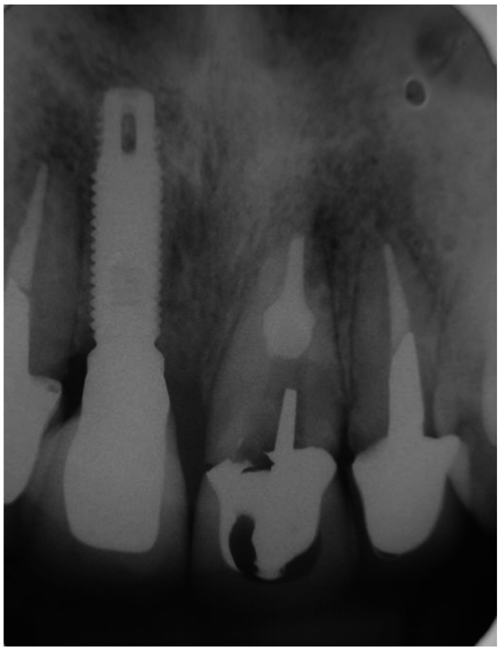

Fig. 4 MTA introduced and adapted to the apical portion of the canal.

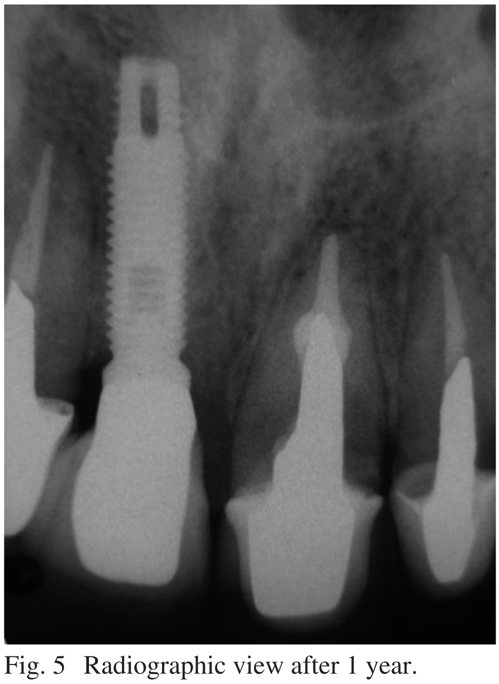

Fig. 5 Radiographic view after 1 year.

Magnification with an operating microscope enabled visualizing the entire length of the canal up to the apical foramen. It also allowed the entire process of inserting the

MTA as an apical barrier to be perfectly supervised, thus enabling confirmation that a correct apical seal was achieved (3).

Although thermo-plasticization techniques have been commonly used (5), we used the lateral condensation technique with non-standardized cones because of the possibility of filling material extravasation.

In addition to avoiding possible tooth fracture (5), the act of filling the canal and cementing a temporary prosthetic crown, and then manufacturing the intra-radicular post and definitive crown immediately afterwards, allows immediate coronal sealing, which is considered a key factor in preserving the treatment in the long run (7).

Inserting MTA in the apical portion of the root after canal preparation favors the establishment of a healthy periodontal ligament as well as the new formation of bone and cementum. Due to its favorable histologic response, MTA has been considered a material that is effective as an apical barrier in cases of incomplete root formation. Its application results in predictable apical closing, reduced treatment time and a reduced number of radiographs taken (7).

We decided not to place calcium hydroxide before the MTA, in accordance with the study by Holland et al. (9), in which the authors observed that placing calcium hydroxide paste for two weeks in a contaminated perforated area in dog teeth before sealing with MTA, histologically, brought no benefits to the repair process when compared to MTA insertion without previously placing the calcium hydroxide medication.

Follow up of the case is of utmost importance to observe the success of the treatment. Orstavik (10), from his research, recommended that follow up should be performed for a minimum of 1 year. Ghaziani et al. (11) reported 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% sodium hypochlorite. 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 resolution of the periapical lesions. At 2 years, although the left post was lost and the periapical lesion of the left central incisor had subsequently deteriorated, the right central incisor had healed successfully. The authors concluded 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 improved. This would allow long term apexification to be replaced by apical plugging with MTA, thus reducing the treatment time.

Based on the results of the present investigation, placement of an apical barrier using MTA is an alternative to conventional long-term calcium hydroxide therapy. Future studies focusing on an improved placement technique to enhance the sealing ability of MTA as an apical plug would help to support this treatment modality.

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