Endodontic treatment in anterior teeth after tooth trauma: apical sealing with MTA

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ABSTRACT

Introduction: Dental trauma is a common problem in childhood and may exert immense psychological impact on a child. Endodontic treatment of teeth with pulp necrosis and root resorption in the apical region can pose a major challenge to the dentist, especially at the stage of filling. Mineral trioxide aggregate (MTA) has been established in the literature as a material that allows placement of apical plugs, which mitigates the risk of leakage of filling material, thus reducing treatment time while stimulating tissue healing. **Methods:** This case report describes a successful root canal treatment after placement of an MTA plug on both maxillary central incisors after dental trauma and pulp necrosis. **Results:** Radiographs revealed successful treatment one year after root canal filling with MTA for apical sealing. **Conclusions:** Lack of an apical seal makes it difficult to obtain proper sealing of the root canal system, often resulting in apical surgery. The use of MTA as sealant in teeth with pulp necrosis and root resorption in non-circular canals in the apical region proved to be an effective alternative, given the physicochemical and biological properties of this material.

Keywords: Endodontics. Maxillofacial trauma. Root canal filling. Biocompatible material.

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Introduction

Dental trauma is a common issue in childhood, one that exerts a substantial impact on the quality of life of children.[1] The etiology of dental trauma is multifactorial, and the maxillary anterior region is the most affected in permanent dentition.[1,2]

Root canal treatment of teeth with a wide-open root apex poses a daunting challenge to the dentist, especially at the stage of filling. In teeth that present with apical root resorption due to inflammation after pulp necrosis, one might be faced with considerable difficulty performing a three-dimensional filling of the canal systems, especially due to the size of the pulp cavity in the apical portion.[3]

A wide range of material is available to perform apical sealing procedures. Among which calcium hydroxide features properties that cannot be found concurrently in any other material. For example, a high pH, anti-inflammatory properties and the ability to form hard tissue. Difficulty performing successive changes of medication, long treatment time, in addition to the degradation of collagen fibers may increase the likelihood of root fracture during treatment. These are the disadvantages of calcium hydroxide.[4,5,6]

Mineral trioxide aggregate (MTA) is a cement formed by mineral oxides that features a highly alkaline pH, ease of handling, good marginal adaptation and biocompatibility, besides stimulating osteogenesis and cementogenesis. Its chief indications are for the repair of root perforations, root resorption, retrofilling, pulp capping and apexification (root end closure). In teeth with divergent apical anatomy, applying MTA has technical limitations, as it may experience extrusion.[7,8]

The aim of this case report is to demonstrate the use of MTA as a sealing material in the apical region in maxillary central incisors after trauma and pulp necrosis.

Case report

A 9-year-old male patient sought the dental clinic after trauma, presenting with a horizontal fracture on the crowns of teeth #11 and #21. Pulp exposure[21] and lack of mobility were observed upon clinical examination. Pulp capping was performed with MTA in an attempt to circumvent root canal treatment. The patient was followed up both clinically and radiographically for three weeks. During follow-up appointments, he reported suffering new trauma in the region of maxillary incisors while playing ball. Pulp vitality test revealed pulp necrosis of teeth #11 and #21.

Radiographic examination showed a radiopaque image in the crown region of teeth #11 and #21, compatible with composite resin. Wide-open root canals were observed as well as no apical foramen closure.

The patient was offered endodontic treatment of teeth #11 and #21. It consisted of apical sealing with MTA due to his age and the fact that, radiographically, the root apex was not yet fully formed (Fig 1A). For endodontic treatment of tooth #21, the pulp chamber was accessed with a 1557 drill (KG Sorensen, São Paulo, Brazil), and the remaining ceiling removed with E7D and E6D ultrasound tips (Helse, São Paulo, Brazil). Root canal preparation was accomplished with manual K-files implementing the Oregon technique; i.e., with each new file, the canal was irrigated with sodium hypochlorite

solution (2.5% Lenzafarm, Belo Horizonte, Brazil). The root canal was then dried and dressed with Callen paste (S.S. White, Rio de Janeiro, Brazil) (Fig 1B). Fifteen days later, a MTA plug (Angelus, Paraná, Brazil) was placed as a protective barrier for the filling material (Fig 1C). The root canal was then filled by the Shilder technique with AH Plus acrylic resin cement (Dentsply, Konstanz, Germany) (Fig 1D). The exact same method was employed for the endodontic treatment of tooth #11 (Fig 1E). Both teeth were restored with composite resin and the patient remained under observation for one year (Fig 1F).

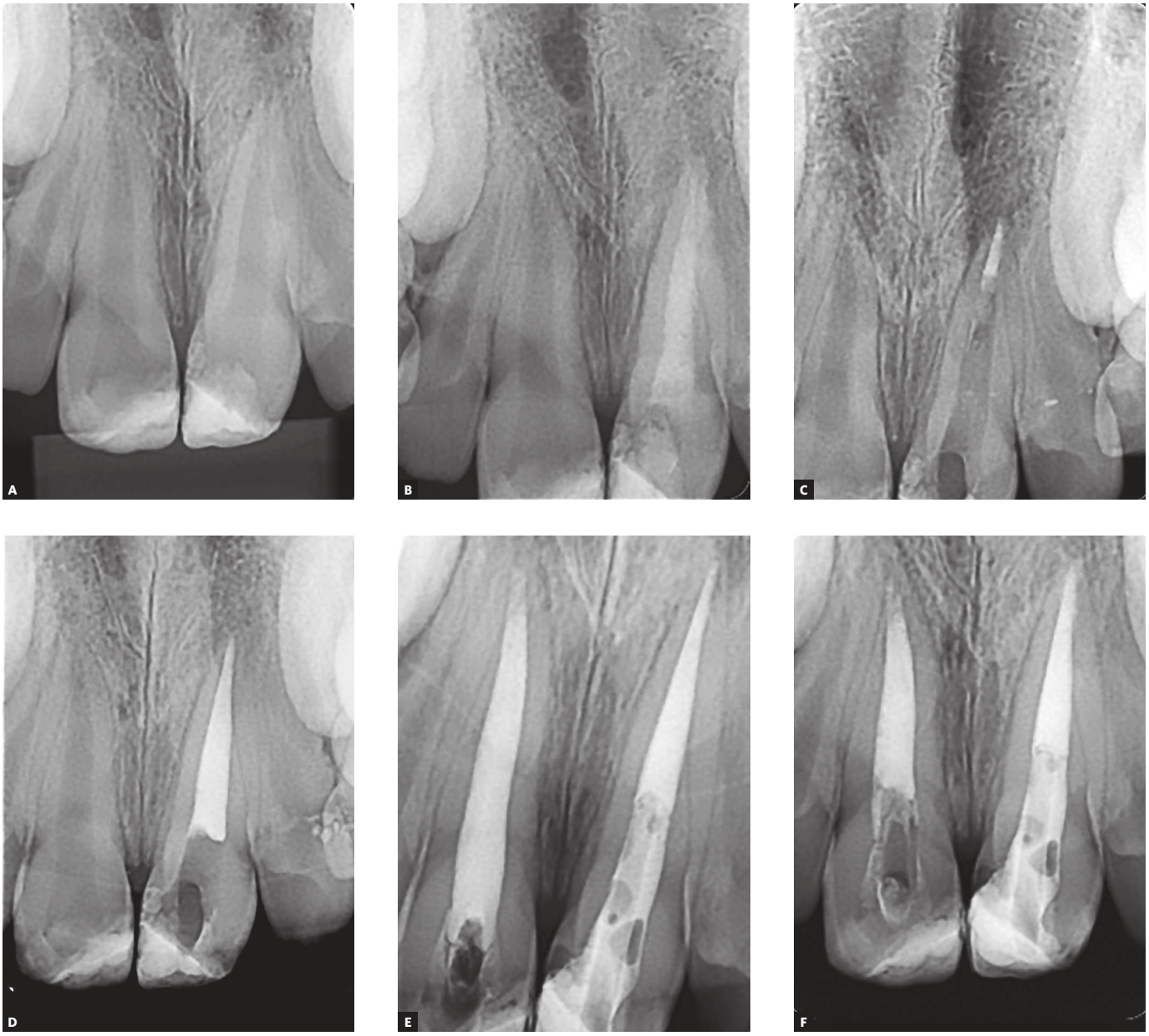

Figure 1. A) Periapical radiograph of maxillary central incisors with an open apex. **B**) Calcium hydroxide dressing in tooth #21. **C**) MTA plug in tooth #21. **D**) Final filling + MTA plug in tooth #21. **E**) Final filling + MTA plug in teeth #11 and #21. **F**) Radiographic control one year later.

Discussion

The incomplete formation of the root apex in young patients can pose a major challenge to dentists during endodontic treatment, chiefly due to difficulties in the control of extravasation of sealers and apical sealing.

In a study of three clinical cases, maxillary central incisors had experienced some sort of trauma, presenting with clinical and radiographic signs of pulp necrosis and apical periodontitis. In all three reports, the teeth presented with an incompletely formed apex. Treatment with MTA was then provided, an apical plug was placed and radiographic follow-up conducted for six months to a year. All three cases were successful after placement of the MTA apical plug. Apical periodontitis healed and there was formation of lamina dura in the affected apical area. According to the authors, MTA proved to be a material with good sealing properties, featuring good marginal adaptation, high degree of compatibility, and reasonable hardening time. Therefore, it can be employed in apical sealing.[10] Its application results in predictable apical closure, reduced treatment time, fewer appointments and X-rays, while stimulating tissue repair in the periapical region.[11] In the clinical case described herein, good marginal adaptation of material, formation of lamina dura and reduced working time were observed.

The effectiveness of MTA, which also affords a more favorable prognosis for the treatment of teeth with incomplete root formation, was observed when MTA had more than 4 mm. It improved sealing and retention in the apical region.[12] Moreover, MTA plugs, each 4-mm thick, were placed in this clinical case aiming at improved retention and apical sealing. A key advantage of a given material that promotes immediate formation of an apical plug, and which retains the ability to induce tissue repair over time, is the fact that it enables immediate and final root filling with the filling material, thereby reducing endodontic treatment failure.[11]

The application of apical MTA plugs induces periapical healing, irrespective of the prior use of calcium hydroxide paste.[11] The use of Callen paste in this clinical case aimed at disinfecting the root canal and promoting anti-inflammatory action in the periapical region, while inducing mineralized tissue formation at the root apex. It has been suggested that calcium hydroxide possesses mechanisms of action that justify its anti-inflammatory effects, such as a hygroscopic action, formation of calcium proteinate bridges and the inhibition of phospholipase.[13] The antibacterial effect of calcium hydroxide occurs due to its pH of 12.8, since most bacteria in the root canal are sensitive to its effects and, therefore, eliminated within a short period of time when in direct contact with this substance.[14]

The fact that calcium hydroxide requires frequent replacement, in addition to the extended time it remains inside the root canals, can encourage bacterial contamination, patient's dissatisfaction and treatment dropouts, whereas the degradation of collagen fibers may favor root fracture in the course of treatment.[15,16]

Conclusions

Root resorption in the apical region due to an inflammatory process resulting from pulp necrosis may render it difficult to obtain a proper sealing of the root canal system. Thus, it is paramount that an optimum apical sealing be achieved in order to induce tissue repair and bone formation.

Given its properties, such as sealing capabilities and marginal adaptation, high degree of compatibility, low cytotoxicity, moisture (wet field) resistance, besides stimulating tissue repair, being bacteriostatic and having an alkaline pH, MTA has proven to be the material of choice for apical sealing procedures.

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