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Mineral trioxide aggregate in treatment of permanent teeth with open apex and endo-perio lesions. A case report

ABSTRACT

Background *Mineral trioxide aggregate (MTA), one of the latest materials applied in dentistry, has a variety of potential uses. Numerous studies emphasise its biocompatibility with periodontal and hard tissues, as well as excellent sealing and regeneration abilities.*
Case report *This article describes the successful therapy of immature mandibular premolars with large open apex, resorption, and endo-perio lesions. In the presented case, the canal was filled with the MTA material. At present, the treated tooth is asymptomatic, and a three-year follow-up radiographic examination demonstrated the dramatic regeneration of periradicular tissues and the new hard tissue formation in the area of the affected teeth.*

Keywords *Endo-perio diseases; Mineral trioxide aggregate; Open apex.*

Introduction

Endodontic treatment of permanent teeth with incomplete root apex development, apical periodontitis and bone loss poses a challenge to the dentist [Andreasen et al., 2002; Felippe et al., 2005]. For many years, multi-appointment therapy has been performed using calcium hydroxide dressings. Such a treatment is however long-term and associated with the risk of root weakening and tooth fracture. Additionally, there is a fear that the patient will not see the dentist regularly to change temporary dressings [Andreasen et al., 2002]. In this situation, the application of mineral trioxide aggregate (MTA) seems to be a better treatment [Parirokh and Torabinejad, 2010]. MTA was developed in the early 90ties at the Loma Linda University in the USA, and in 1998 was introduced in the dental market as ProRoot MTA® (Dentsply Tulsa Dental Specialties, Tulsa, USA) [Torabinejad et al., 1994; Torabinejad et al., 1995]. Since that time, it has been successfully used in different clinical cases such as apexification of teeth with incomplete root development, direct pulp capping, pulpotomy and pulpectomy, repair of perforations of root and pulp chamber floor, treatment of tooth resorption, and retrograde canal filling during root resection [Roberts et al., 2008]. Numerous reports emphasise that MTA may improve the outcome of not only endodontic treatment but periodontal as well [Katsamakis et al., 2013; Srinivasan et al., 2009].

Report

A 12-year-old female patient was referred to the Endodontic Clinic of the Medical University of Lodz (Poland) to continue root canal treatment that had been started two years earlier at a private dental office. A medical history revealed that the girl suffered from asthma and received inhaled corticosteroids. On the basis of earlier treatment records it was found that after trephination of tooth #35, the calcium hydroxide dressing was inserted into the canal. Since then (1.5 year), no endodontic procedures were performed. On admission to the Endodontic Clinic, an extensive cavity within the tooth crown filled with a temporary dressing and a deep pathological pocket were visible. The dental radiograph showed the incompletely developed root apex with a very wide apical foramen, thin root wall, a bony pocket and chronic periradicular periodontitis around tooth #35 indicating an endo-perio lesion (Fig. 1). Due to a very bad condition of the tooth and a concomitant malocclusion, the patient was referred to the orthodontist for consultation whether tooth #35 should be treated or extracted for orthodontic reasons. The specialist diagnosed severe retrognathia and tooth

FIG. 1 Preoperative radiographic examination showing radiolucency at the apical and mesial area of tooth #35. The apex is clearly open.

FIG. 2 Postoperative radiograph showing the root canal filled with MTA.

FIG. 3 Follow-up after 1 year after therapy completion.

FIG. 4 Follow-up after 3 years after therapy completion.

abnormalities (crowding of upper teeth), and advised the endodontist to treat and retain tooth #35 as long as possible. The involved tooth was treated at the Endodontic Clinic using a dental operating microscope and a rubber dam for tooth isolation. After the removal of the dressing, a hemorrhagic exudate from the canal was observed. Approximate working length was established with an electronic apical locator and radiographs. The root canal was cleaned with 2.5% NaOCl and NaCl. Next, the canal was delicately dried with paper points and the calcium hydroxide dressing (Calxyl®, OCO Präparate), was placed for two weeks. At the first appointment, instructions on oral hygiene were given to the patient and rinsing of the oral cavity was recommended after each application of inhaled corticosteroids. The patient had in fact many teeth with fillings and carious lesions.

After two weeks, the calcium hydroxide dressing was removed by instrumentation and irrigation with 2.5% NaOCl and 17% EDTA. Additionally, ultrasonic activation of a #25 K-file passively placed in the canal was carried out to improve canal debridement and Calxyl®. The canal was finally filled. At first, the periapical region of the canal was filled with small pieces of resorbable collagen sponge (Biokol®, Stalmed). Next, small portions of the MTA material were inserted into the canal and condensed vertically using pluggers. In this way, the entire canal was filled with MTA. In the region of the pericoronal canal orifice, a sterile cotton pellet saturated with physiological saline was placed on MTA (Fig. 2). A tight dressing (GC Fujii Triage®) was inserted into the crown. After two days, the cotton pellet was removed and the permanent filling (Tetric Evo Ceram® Ivoclar Vivadent®) was placed. Root canal retreatment of tooth #36 was also carried out. The patient visited the endodontist again after the following one and three years, despite the recommended earlier follow-ups. Clinical examination did not present any pathological changes in the tooth and the periodontal ligament. On the basis of the radiograph, bone regeneration and healing of apical periodontitis were observed (Fig. 3, 4).

Discussion

Modern endodontics offers different treatment possibilities, even in very complicated endo-perio lesions of immature teeth [Felippe et al., 2006; Kottoor and Velmurugan, 2013; Parirokh and Torabinejad, 2010]. In the presented case report, the incompletely developed root apex with a large open apical foramen, external root resorption, endo-perio lesions, extensive apical periodontitis involving the mesial side of the alveolar process along with the bony pocket were diagnosed. Additionally, a long time that had passed from the trephination to the final root canal filling was considered a poor prognostic factor. After preparing an access cavity to the tooth at the private dental office, a calcium hydroxide dressing was inserted into the canal and was left in the tooth for a period of 1.5 year. Long-term calcium hydroxide dressings weaken the root structure, possibly by naturalizing, denaturing, or dissolving the acidic components of dentine [Andreasen et al., 2002]. Moreover, the inadequate dressing within the tooth root and the crown undoubtedly contributed to ongoing bacterial infection. Despite such an unfavourable situation, the treatment was successful. Both, the root canal and periodontal treatment as well as canal filling with the MTA material were the factors which determined the success of therapy. Numerous studies emphasise very good biocompatibility, and antibacterial and antifungal activity of this material [Ferk et al., 2011; Al-Kahtani et al., 2005; Srinivasan et al., 2009]. MTA also possesses excellent sealing properties and the ability to harden in the presence of fluids including blood [Tang et al., 2002; Torabinajed et al., 1994]. MTA has low solubility in tissue fluids (less than 3%), therefore it does not undergo resorption [DaSilva et

al., 2010]. MTA induces proper growth and development of the new root, bone and periodontal cells including periodontal ligament [Guven et al., 2007; Katsamakis et al., 2013]. MTA has stimulated the expression of osteocalcin, alkaline phosphatase, collagen type 1, and bone sialoprotein in cementoblast cell cultures [Hakki et al., 2009; Hakki et al., 2012]. The research also indicated that after MTA application, the human periodontal fibroblasts presented attachment, normal growth, and functions [Hakki et al., 2009; Lin et al., 2004]. A great advantage of this material is its strong alkaline pH and pH-related beneficial therapeutic activity. While hardening, the pH of MTA equals 10.2 and increases up to 12.5 during the first hours [Torabinejad et al., 1994; Torabinejad et al., 1995]. Calcium hydroxide also possesses alkaline pH, however it should not remain in the canal longer than two weeks as this time is optimal for its antibacterial activity and drying of exudate. In the presented case, a short-term placement of calcium hydroxide was justified by the presence of a large amount of exudate and concomitant infection of the root canal and periodontal tissues. MTA filling is a quicker and more effective method than using calcium hydroxide. In the case of canals with an excessively widened apical foramen, it is recommended to create a barrier in the apical region with a resorbable collagen sponge and then to condensate small portions of MTA. This procedure prevents excessive extrusion of MTA outside the root to the periapical tissues and enables the material to be condensed [D'Arcangelo et al., 2007]. The root canal with incomplete development of the root and/or its external resorption can be filled with MTA entirely or in two stages, in which MTA is inserted into the periapical part, and the remaining canal is filled with gutta-percha and sealer (most frequently thermoplastic gutta-percha is used) [D'Arcangelo et al., 2007]. In our patient, the entire canal was filled with MTA because the root (and the canal) was very short and the root walls were thin. Due to the unfavourable ratio of the crown length to the root length, future prosthodontic reconstruction (post and core crown) was excluded. The cavity within the crown and the coronal part of the root were restored with light-cured composite, which strengthens the tooth tissues.

After filling the entire or part of the canal with MTA, radiological examination and follow-ups are recommended. MTA due to 20% bizmuth oxide content is radiopaque [Song et al., 2006].

Conclusion

To sum up, the application of MTA in the treatment of nonvital teeth with the incompletely developed root and/or its external resorption and apical periodontitis involving endo-perio lesions is an efficient method of treatment, resulting in a good state of the tooth retained in the oral cavity and healing of inflammatory lesions in the bone and periodontium. Short-term treatment is an additional advantage of the MTA material.

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