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Apexification in a traumatized tooth with mineral trioxide aggregate: an interesting case report of root formation

Apicificação em dente traumatizado com agregado trióxido mineral: relato de um interessante caso de formação radicular

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ABSTRACT

Mineral trioxide aggregate (MTA) has been indicated for apexification because it has desirable properties such as excellent biocompatibility, low solubility and dimensional stability. This procedure consists of inducing root apex formation in teeth with incomplete root formation. This article reports a case of trauma in a young dental element, with necrotic pulp and incomplete root formation. For its treatment, apexification with white MTA was performed, which showed excellent results in inducing the continuity of root formation with mineralized tissue in the apical portion. Therefore, MTA is a viable option for apexification, bringing as its main advantage, faster treatment and immediate coronary rehabilitation of the dental element.

Indexing terms: Dentistry. Endodontics. Tooth injuries.

RESUMO

O agregado trióxido mineral (do inglês, mineral trioxide agregatte - MTA) por possuir propriedades desejáveis como ótima biocompatibilidade, baixa solubilidade e estabilidade dimensional pode ser utilizado para apicificação. Este procedimento consiste na indução da formação do ápice radicular em dentes com rizogênese incompleta. Esse artigo relata um caso de trauma em um elemento dental jovem, com polpa necrosada e rizogênese incompleta. Para seu tratamento, realizou-se a apicificação com MTA branco, que demonstrou excelente resultado ao induzir a continuidade de formação da raiz com tecido mineralizado na porção apical. Portanto, o MTA é uma opção viável para a apicificação, trazendo como principal vantagem, um rápido tratamento e a possibilidade de restauração coronária imediata do dente.

Termos de indexação: *Odontologia. Endodontia. Traumatismos dentários.*

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INTRODUCTION

The main etiologic factor of pulp necrosis is caries disease. However, epidemiological data have shown an increase in the occurrence of dental trauma [1,2]. Dental trauma most often affects maxillary central incisors in young patients and when the trauma affects dental elements still in root formation, it compromises the blood supply, can cause pulp necrosis and interrupts the process of dentin formation and root growth is interrupted. Thus, these affected teeth remain with short roots and very fragile walls, thus generating an increased risk of fracture [1-5]. Therefore, it becomes a challenge for conventional endodontic treatment [1-5]. The main function of Hertwig's epithelial sheat this to determine root formation by dentin deposition. [6]. It can be sensitive to trauma, but due to its abundant vascularization and cellularity close to the apex, it can proceed with root formation, regardless of the presence of inflammation or necrosis. Due to its important role, every effort must be made to maintain its viability [7].

When the root apex is still opened and the root is not fully formed, inductive-forming endodontic therapy [6] is necessary to induce the artificial closure of the apical foramen in immature necrotic teeth [8] or its continuous apical development [9] and the repair of the periapical tissues [10]. Thus, apexification is an attempt to keep the dental element in the oral cavity [6].

There are three options for this treatment: revascularization, traditional apexification with successive exchanges of calcium hydroxide or a MTA apical plug (apexification) [11]. Revascularization is also a treatment option and consists of inducing bleeding in the periapical tissues for the formation of an intracanal blood clot that will serve as a scaffold [1,12]. Concerning apexification with calcium hydroxide, we can mention some disadvantages: a long period of treatment; several visits to the office, requiring patient cooperation and increased clinical costs, in addition to the risk of tooth fracture [2,13,14]. Torabinejad et al. [15] recommended the use of MTA as an artificial apical barrier, making it the material of choice for this procedure [7].

MTA is considered the gold standard for the single-visit apexification technique. It has excellent biocompatibility, low solubility, and dimensional stability with great sealing capability. It has antimicrobial activity and is more predictable in periradicular regeneration. In addition, MTA minimizes sessions, reduces clinical costs, improves patient adherence to treatment, and reduces the risk of vertical or oblique root fractures [2,16,17].

In this context, the aim of this article was to report a case of apexification of an immature traumatized tooth with necrotic pulp using white MTA.

CASE REPORT

This case report integrates project research previously approved by Ethics Committee (3.040.554/2018). Female patient R.S.M., 10 years old, without any systemic involvement, came to the office for a dental evaluation of tooth 21. During the anamnesis, the patient complained about the aesthetic of this tooth, due to discoloration, which was related to dental trauma, according to the patient. Clinically, the tooth presented enamel and dentin fracture. Cold pulp testing was performed using a refrigerant spray (Endo Ice, Maquira-Maringá, PR, Brazil) at -50° C and radiographic examination with film (E-Speed Carestream, São José dos Campos, SP, Brazil) was performed, diagnosing pulp necrosis without periapical periodontitis. Radiographically, tooth 21 had incomplete root formation, a wide canal and thin dentin walls (Figure 1).

In the same session, infiltrative anesthesia was performed with 2% lidocaine with 1:100,000 epinephrine (Alphacaine DFL, Rio de Janeiro, RJ, Brazil) followed by cavity access and rubber dam isolation. The pulp chamber was irrigated abundantly with 2.5% sodium hypochlorite (Lenza Farm, Belo Horizonte, MG, Brazil). Progressive shaping was performed with K-files (Dentsply Maillefer, Ballaigues, Switzerland) of 2nd and 3rd series and canal exploration with K-file #80. Apparent tooth length was obtained using radiography. To remove necrotic pulp remnants and bacterial

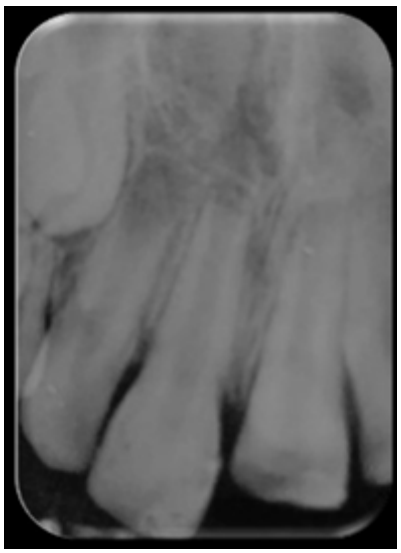

Figure 1. Tooth 21 with pulp necrosis, incomplete root formation; and short root with thin walls.

products from the interior of the root canal, larger diameter K-files (Dentsply, Maillefer, Ballaigues, Switzerland) (up to #120 file) were used. At this stage, the root canal was copiously irrigated with 2.5% sodium hypochlorite (Lenza Farm, Belo Horizonte, MG, Brazil). Drying was performed with Capillary Tips (Ultradent Products Inc., Indaiatuba, SP, Brazil) and absorbent paper points of large diameter (Tanari Plus, Manacapuru, AM, Brazil). The canal was then filled with a calcium Hydroxide paste based on calcium hydroxide (Quimidrol, Joinville, SC, Brazil) and glycerin (Farmax, Divinópolis, MG, Brazil). A sterile cotton pellet was inserted into the pulp chamber and provisional sealing with glass ionomer cement (Maxxion R, Dentscare Ltda, Joinvile, SC, Brazil) was performed.

The patient returned to the office after 21 days. After anesthesia, complete rubber dam isolation and removal of the intracanal dressing as in the previous session, the calcium hydroxide paste was removed with abundant irrigation with 2.5% hypochlorite (Lenza Farm, Belo Horizonte, MG Brazil) and K-files (Dentsply, Maillefer, Ballaigues, Switzerland). After drying the canal with Capillary Tips (Ultradent products Inc., Indaiatuba, SP, Brazil) and absorbent paper cones (Tanari Plus, Manacapuru, Amazonas, Brazil), the apical plug with white powder/liquid MTA (Angelus, Londrina, PR), Brazil) was made. Previously, Schilder Pluggers Condensers numbers 2, 3 and 4 (Odous de Deus, Belo Horizonte, MG, Brazil) were selected. Plugger n°. 2 was calibrated in working length (WL) of 16mm. Plugger n°. 3 within 2 mm below the WL (14mm) and n°. 4 within 4 mm below the WL (12mm). With the #2 plugger, a collagen hemostatic sponge (Hemospon-Maquira, Maringá, PR, Brazil) was inserted at the working length. MTA was manipulated according to the manufacturer's recommendation and inserted in small portions into the canal with the MTA carrier (Angelus, Londrina, PR, Brazil). It was condensed with the #3 plugger to the previously established length. In the same way, a new increment of MTA was inserted and now condensed with the #4 plugger, thus obtaining 4 mm of MTA inside the root canal. An additional 4 mm of the canal was filled with injectable gutta-percha (VDW, München, Germany) and AH Plus cement (Dentsply, Konstanz, Germany). Space was left for fiberglass post (figure 2).

A fiberglass post (Reforpost Angelus, Londrina, PR, Brazil) with dual-cure resin cement (Relyx Ultimate - 3M, Sumaré, SP, Brazil) was used and a restoration was done in Tetric Ceramic composite resin (Ivoclar Vivadent, Barueri, SP, Brazil). Finally, occlusal adjustment was performed. After 11 years, the patient returned to the office for control and showed no clinical signs or symptoms. On radiographic examination follow-up (EzSensor Classic, Vatech, Hwaseong-si, Gyeonggi, Korea), it was possible to observe the formation of the root with mineralized tissue in the apex (figure 3), in addition to the absence of apical radiolucency.

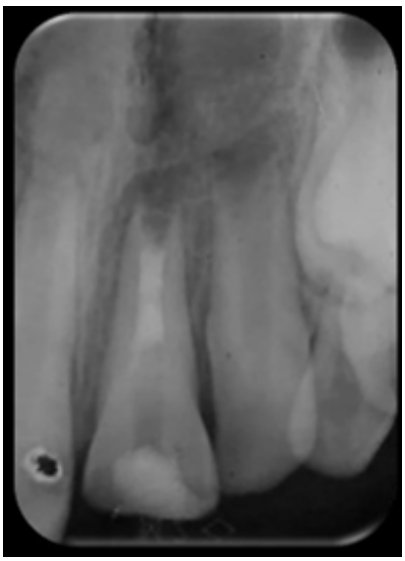

Figure 2. Root canal filled with MTA and gutta-percha. Space left for fiber post.

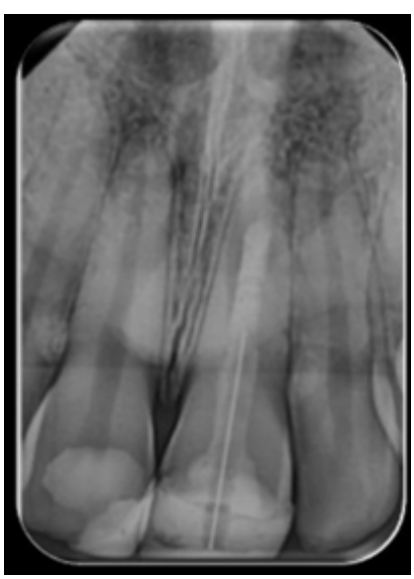

Figure 3. Complete root formation of tooth 21 with mineralized tissue at the apex.

DISCUSSION

The satisfactory characteristics of MTA make it an ideal material for various dental procedures, including apexification [11]. Duggal et al. [18] support the use of MTA followed by root canal filling as the treatment of choice in apexification.

Another option for the treatment of teeth with incomplete root formation is revascularization, which allows the development of roots and the apposition of hard tissue within the root canal [19] although was not well established when this treatment was done. Revascularization is based on the principle that vital stem cells can survive pulp necrosis

and can differentiate into secondary odontoblasts and contribute to root tissue conformation [20]. The main advantage of regenerative procedures is the continued development of the roots [21]. A study suggests that radiographic results between immature teeth undergoing apexification with MTA versus those undergoing revascularization were comparable, nevertheless, regenerative endodontic treatment produces a comparatively greater increase in length and root width [22].

In a systematic review, Chala et al. [17] concluded that calcium hydroxide and MTA could be suitable materials for the treatment of immature teeth. Lin et al. [23] in a meta-analysis, concluded that both materials provide similar success rates. However, the shorter treatment time with MTA may lead to higher success rates because of greater patient compliance. In another meta-analysis, Nicoloso et al. [10] concluded that MTA apical plugs appear to produce the best clinical and radiographic success rates among all available endodontic treatments (calcium hydroxide and regeneration) for immature necrotic permanent teeth. These three systematic reviews concluded that MTA showed better clinical and radiographic results, and the apical barrier was formed in a shorter time compared to the use of calcium hydroxide [10,17,23].

With the advent of bioceramic cements, some studies have compared their efficiency and success rate in relation MTA. However, both materials seem to show results that both MTA and bioceramic endodontic cement showed successful results in the apexification of immature permanent teeth [9].

The 4mm thickness of the MTA plug reported in this article is in accordance with the 3 to 5mm thickness recommended in the literature [14,24]. The protocol used in this reported case, as well as other published scientific studies, present a faster treatment option, using the MTA plug, a material with good physical and biological properties [25,26].

Effective irrigation is extremely important for further cleaning of the root canal system. The irrigating agent must reach areas inaccessible to instruments, in addition to having good antimicrobial properties to control the infection and get success. In a systematic review [27], among the possible final irrigating solutions, 2% chlorhexidine was shown the solution with the highest success rate although the association with the highest success rate is the use of 2.5% NaOCl as an irrigant during canal instrumentation due to its antimicrobial activity and tissue solvent capacity, combined with 17% EDTA to remove smear layer [27].

The use of MTA as an apical barrier allows the immediate accomplishment of the root canal filling and final restoration, probaly reducing the possibility of recontamination of the root canal system as well as the risk of tooth fracture, increasing the probability of obtaining favorable results [22-24].

CONCLUSION

Based on the clinical result achieved, it could be seen that the MTA apical plug was presented as an alternative for the treatment of necrotic teeth with incomplete root formation. MTA, therefore, is a viable option for apexification, bringing as its main advantage, a short period of treatment and the possibility of the tooth could be restored at an early stage.

Collaborators

MAGM Guimarães, writing - original draft (equal). HM Rodrigues, conceptualization (equal), methodology (equal), writing - review & editing (equal). SQ Tonelli and DS Pardini, writing - review & editing (equal). FF Silveira, supervision (equal), writing – review & editing (equal).

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