Endodontic reintervention with MTA apical plug: a case report

Ana Bárbara Marques das **VIRGENS**[1]
Rogério Vieira **SILVA**[2]
Renato Piai **PEREIRA**[3]
Eduardo **NUNES**[4]

DOI: http://dx.doi.org/10.14436/2358-2545.5.3.056-061.cre

ABSTRACT

Introduction: Chemical-mechanical preparation is of crucial importance to a successful endodontic treatment. Endodontic reintervention is indicated in cases of failure and unsuccessful outcomes. In this phase, teeth with external apical resorption require excellent care by the practitioner. In order to overcome these challenges, a biomaterial known as MTA (Mineral Trioxide Aggregate) was incorporated to the world dental market, presenting several indications, such as its use as apical plug. **Objective:** To report a clinical case of endodontic reintervention with indication of MTA apical plug. **Case report:** A Caucasian female patient reported sensitivity to palpation and presence of fistula for more than 15 days. Gingivitis and fistula were clinically observed at the bottom of the buccal sac of tooth #21. Radiographically, previous endodontic treatment was poor, presenting intraradicular metal core, external root resorption, and rarefying osteitis limited to the periapical region. Endodontic reintervention of tooth #21 was carried out. Treatment involved three visits for removal of the temporary crown, cast metal core and gutta-percha, in addition to application of intracanal dressing and the use of a MTA apical plug, as well as the application of warm gutta-percha. Thereafter, the patient was referred for definitive rehabilitating treatment. **Conclusion:** Clinical and radiographic follow-up after eight years revealed periapical repair and re-establishment of masticatory and esthetical functions by means of restorative procedure. Treatment was proven to be efficient in sealing the apical region of the root canal through the use of MTA apical plug; thus, showing the success and advantages of both material and therapeutic modality.

Keywords: Tooth apex. Endodontics. Root canal therapy.

How to cite this article: Virgens ABM, Silva RV, Pereira RP, Nunes E. Endodontic reintervention with MTA apical plug: a case report. Dental Press Endod. 2015 Sept-Dec;5(3):56-61. DOI: http://dx.doi.org/10.14436/2358-2545.5.3.056-061.cre

[1]Undergraduate student of Dentistry, Faculdade Independente do Nordeste (FAINOR), Vitória da Conquista, Bahia, Brazil.

[2]Assistant professor, Faculdade Independente do Nordeste (FAINOR), Undergraduate program of Dentistry, Vitória da Conquista, Bahia, Brazil.

[3]Assistant professor, Universidade Estadual do Sudoeste da Bahia (UESB), Undergraduate program of Dentistry, Itapetinga, Bahia, Brazil.

[4]Adjunct professor, Pontifícia Universidade Católica de Minas Gerais (PUC Minas), Undergraduate program of Dentistry, Belo Horizonte, Minas Gerais, Brazil.

» The authors report no commercial, proprietary or financial interest in the products or companies described in this article.

» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

Submitted: October 20, 2015. Revised and accepted: November 09, 2015.

Contact address: Rogério Vieira Silva
Faculdade Independente do Nordeste (FAINOR)
Av. Luís Eduardo Magalhães, 1305, Candeias – Vitória da Conquista/BA
CEP: 45.028-440 - Brazil
E-mail: roger.endo@hotmail.com

Introduction

The most frequent cause of apical periodontitis is the infiltration of bacteria resulting from carious lesions and/or crown-root fractures, since these microorganisms can invade the root canal system (RCS) and dentinal tubules. Microorganisms and their by-products are responsible for the establishment and/or maintenance of a periapical inflammatory process.[1]

Chemical-mechanical preparation of root canals is of crucial importance to a successful endodontic treatment, as it allows endodontic instruments to act in association with chemical substances. Sodium hypochlorite plays an important role not only in being a bactericidal agent, but also in removing debris and organic remnants as well as reducing the levels of microorganisms; thus, favoring periapical repair process.[2]

Complete sealing of the RCS is a challenge to be overcome during endodontic therapy, with the quality of filling being directly related to chemical-mechanical preparation which, in turn, aims at reaching anatomical irregularities, curvatures, isthmuses and ramifications. Filling complex anatomies is as difficult as cleaning them because one seeks to seal the entire endodontic cavity tridimensionally.[3]

Endodontic therapy can fail and produce unsuccessful outcomes in some situations, meaning that endodontic reintervention should be indicated to make the affected tooth functional again by allowing complete repair of the supporting structures. Many techniques have been employed for removal of gutta-percha in endodontic reinterventions. For instance, conventional manual endodontic instruments in association or not with solvents, rotary NiTi instruments associated with electric engine, and ultrasonic instruments and heat conductors can be indicated for such a procedure.[4]

Immature teeth with incomplete root formation or extensive external root resorption to be endodontically treated need special attention, since the apical anatomy of these teeth is characterized by a broader apical portion, which makes it difficult for the practitioner to determine the working length correctly.[5,6] In addition, thin dentinal walls make the tooth more susceptible to fracture. In these cases, it is necessary to induce complete formation of the apex by means of an apical barrier, so as to allow condensation of the filling material and to promote sealing of the apical region of the root canal.[7]

In order to overcome these challenges, in 1990, the world dental market incorporated an experimental material developed by Dr. Mahmoud Torabinejad from Loma Linda University (CA, USA),[13] known as MTA (Mineral Trioxide Aggregate), which comprises tricalcium silicate, tricalcium aluminate, tricalcium oxide and silicate oxide as the main components. Also, there are other oxides accounting for the chemical and physical properties of MTA, such as bismuth oxide, which provides radiopacity to the material. The main molecules found in MTA are calcium ions and phosphorus, and because these are also the main components of dental tissues, they make MTA biocompatible when in contact with cells and tissues.[8] MTA has emerged as a promising and adequate endodontic sealer for apexification, yielding better results than other materials used for the same purpose.[9]

Based on these assumptions, the objective of this study was to report a clinical case of endodontic reintervention of a maxillary left central incisor in which MTA was used as apical plug in association with thermoplastic filling.

Clinical case report

A Caucasian female patient was referred to the graduate endodontic clinic of Associação Brasileira de Odontologia (ABO), in the city of Vitória da Conquista, Bahia, Brazil, for endodontic evaluation of her maxillary left central incisor. The main complaint reported by the patient was mild sensitivity to palpation and the presence of a wound not healing over the last 15 days. Intraoral examination showed metal-ceramic crown with failure in marginal adaptation, gingivitis at the cervical region, resulting from accumulation of bacterial biofilm, and fistula at the bottom of the buccal sac of tooth #21 (Fig 1). Radiographic examination revealed intraradicular metal core, poor endodontic treatment, external root resorption and rarefying osteitis limited to the periapical region. Radiographic tracing was performed as a diagnostic maneuver by inserting a gutta-percha cone into the fistula and positioning it towards the periapical region of tooth #21 (Fig 2). Endodontic reintervention of tooth #21 was established as treatment planning.

In the first visit, the metal-ceramic crown serving as temporary crown and the cast metal core were both removed by means of an ultrasonic tip (Enac ST09, Osada, Tokyo, Japan), whereas gutta-percha was removed by means of manual K-files of 2nd and 3rd series (Maillefer,

Ballaigues, Switzerland), with a working length 2 mm short from the external apical resorption, in association with orange peel oil – a natural solvent (Lenza Farmacêutica, Belo Horizonte, Brazil) and 5.25% sodium hypochlorite (Lenza Farmacêutica, Belo Horizonte, Brazil) as irrigant. Instrumentation was carried out by means of the crown-down technique up to K-file #120 (Maillefer, Ballaigues, Switzerland). The ultrasonic tip (Enac ST21, Osada, Tokyo, Japan) was activated in association with 17% EDTA (Fórmula & Ação, São Paulo, Brazil) for three minutes in the root canal, with 5.25% sodium hypochlorite (Lenza Farmacêutica, Belo Horizonte, Brazil) being used for final irrigation. The root canal was dried with absorbent paper points before application of intracanal dressing with calcium hydroxide PA (Lenza Farmacêutica, Belo Horizonte, Brazil) (Fig 3) and propylene glycol (Lenza Farmacêutica, Belo Horizonte, Brazil). Subsequently, temporary sealing of the intraradicular core was performed and a temporary crown was placed for 30 days.

In the second visit, the patient still felt uncomfortable to apical palpation, but the fistula had already regressed and ultrasonic activation was again proceeded (Enac ST21, Osada, Tokyo, Japan) in association with chemical substances. Intracanal dressing was removed and apical patency was achieved by means of a K-file #40 (Maillefer, Ballaigues, Switzerland). A K-file #120 was then introduced throughout the working length. Subsequently, new medication was applied as described above and kept for 60 days.

In the third visit, the patient was asymptomatic and the root canal was filled. White MTA plug (Ângelus, Londrina, Brazil) was applied by means of an insertion spatula and Schilder #4 and #5 condensers, with 5-mm thickness in the apical third, and complemented with warm gutta-percha (Fig 4) with the aid of Obtura II device (Obtura Spatan Corporation, Fenton, USA). Endodontic sealer was not used in the cervical and middle thirds. Next, both intraradicular core and temporary crown were temporarily cemented before the patient was referred for definitive restorative treatment. Follow-up clinical and radiographic examinations (Figs 5 and 6) after eight years showed repair of the periapical region, as well as re-establishment of masticatory and esthetical functions by means of restorative procedure.

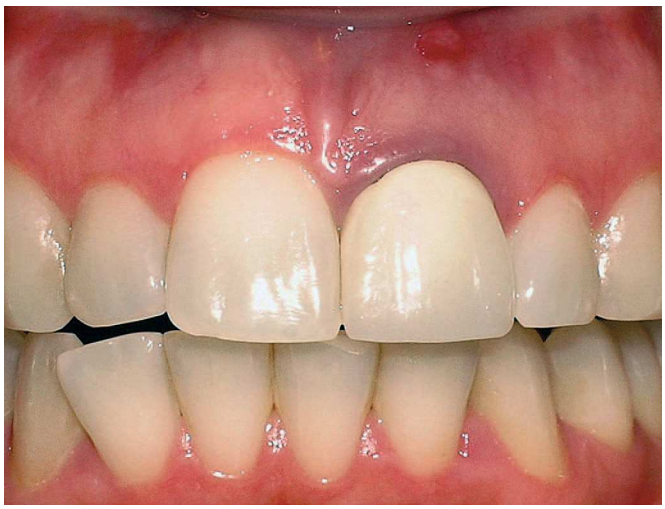

Figure 1. Initial clinical evaluation.

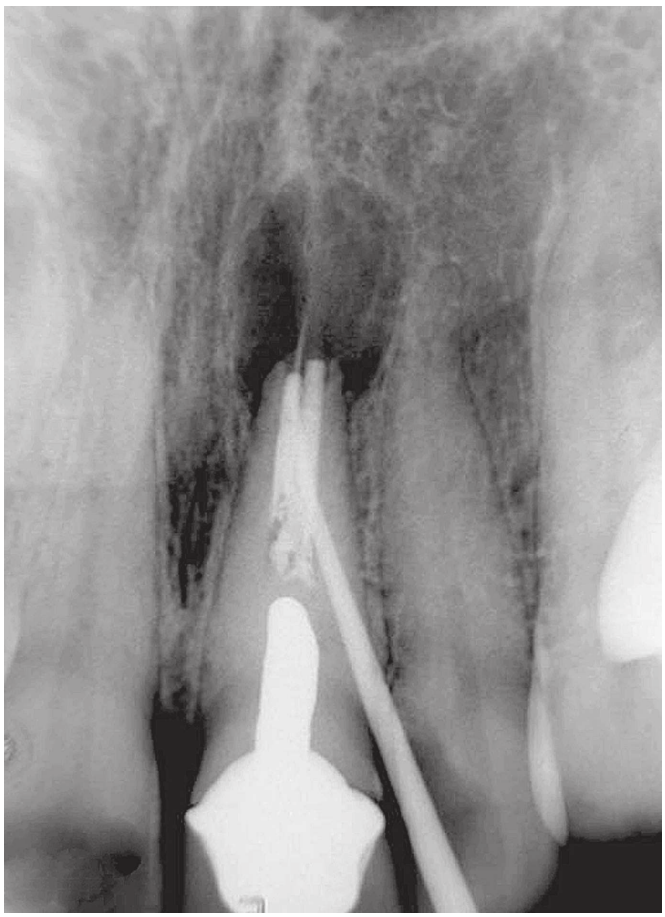

Figure 2. Preoperative and screening periapical radiograph.

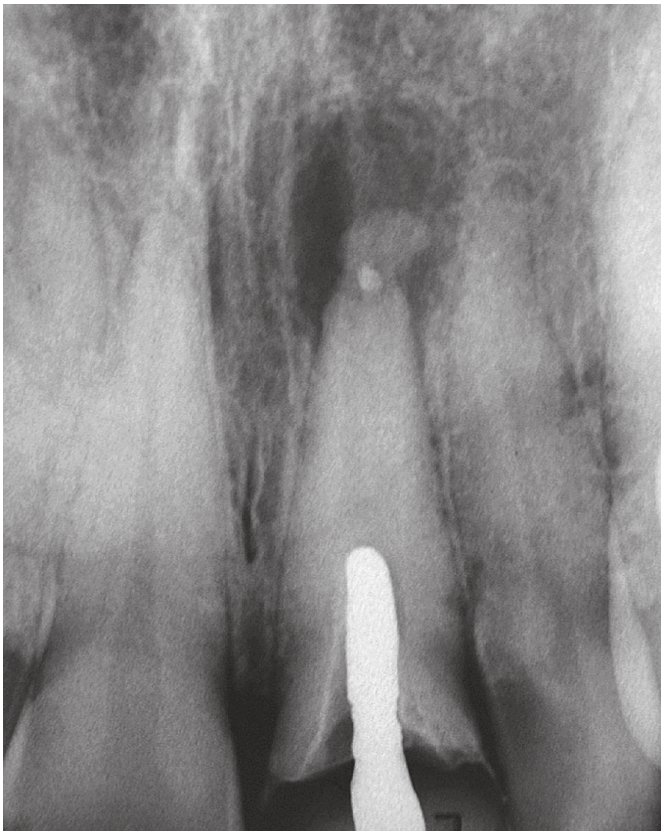

Figure 3. Periapical radiograph with intracanal dressing.

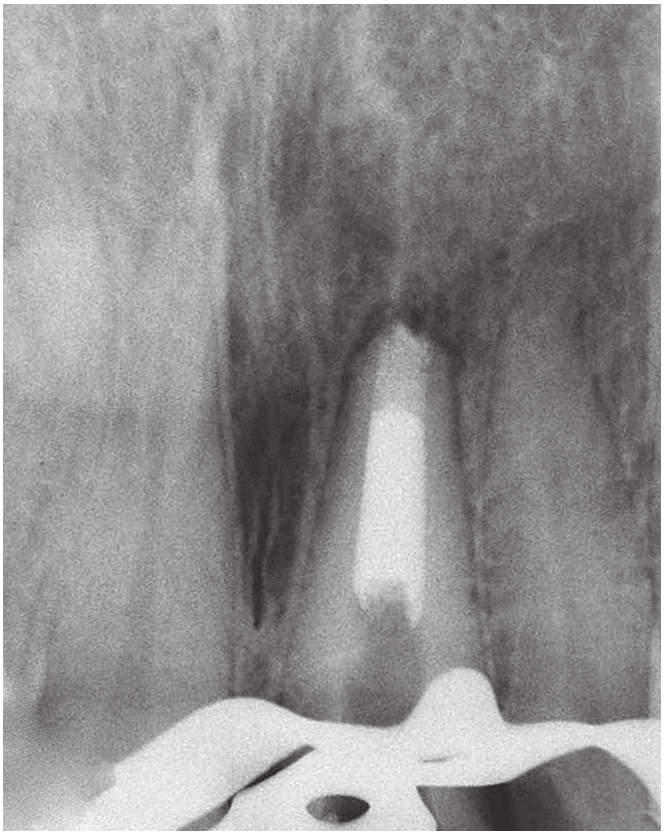

Figure 4. Periapical radiograph with MTA apical plug and thermoplastic filling.

Figure 5. Clinical evaluation after eight years.

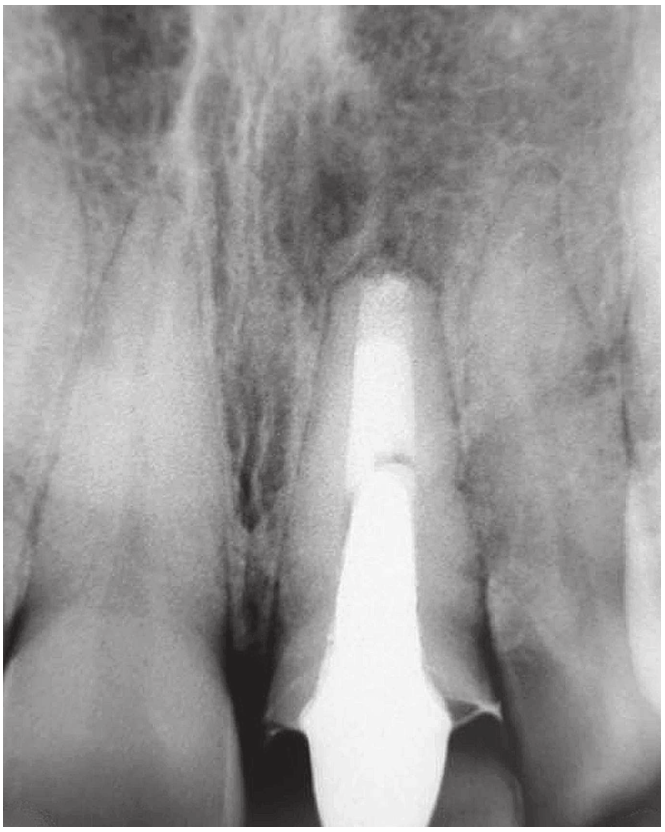

Figure 6. Follow-up periapical radiograph after eight years.

Discussion

For many years, the use of calcium hydroxide was supported with the aim to induce the formation of mineralized tissue for apexification.[10] However, this biomaterial has drawbacks, such as temporal instability of treatment, ranging from 9 to 12 months on average,[11] and the need for several changes for long periods of time, which increases the chances of reinfection, as the tooth is sealed with temporary material,[10] in addition to enhancing the susceptibility to dental fracture.[12]

Therefore, a simpler, quicker and more effective therapeutic method was used in the present clinical case, that is, a barrier using MTA to form an apical plug in order to work as a protection for the filling material.[5,6]

MTA is commercially available in two forms: grey and white, with the former being created due to the high color-changing potential found in the latter.[13,14] This property was of crucial importance in the selection of the present clinical case.

MTA is a biomaterial capable of providing good sealing even in the presence of humidity; thus, reducing the time of treatment.[15] In addition to inducing cementogenesis, dentinogenesis and osteogenesis, it plays an antimicrobial role and promotes adequate marginal sealing.[16] Because MTA is a hydrophilic material, it is capable of converting itself into a colloidal gel and crystallize in the presence of humidity or blood; thus, preventing microleakage. Also, MTA can provide marginal sealing; thus, serving as an apical plug, which is an advantage in relation to calcium hydroxide, as this agent becomes soluble in the presence of humidity.[9] All these properties supported the indication of this biomaterial for the present clinical case; thus, decisively contributing to the success of the proposed treatment planning.

Cleaning and filling processes become difficult with the absence of an apical barrier,[17,18] including determination of the working length.[5,6] Therefore, the creation of an apical barrier to allow condensation of filling material within the root canal and to promote apical sealing[7,31] was of great importance to our clinical case.

In the present clinical case, endodontic reintervention was indicated due to its function of recovering periapical tissues following inefficient treatment or reinfection of filled root canals because of either coronal or apical leakage. Therefore, it is necessary to obtain access to remove the filling material from the defective root canal, clean it and then fill it again.[19]

Orange peel oil is excellent to dissolve gutta-percha compared to other potentially toxic solvents.[20] In fact, the use of essential oils in Endodontics has increased because they are proven to be safe, biocompatible and noncarcinogenic.[21] For this reason, gutta-percha was removed with orange peel oil in the present clinical case. Additionally, 5.25% sodium hypochlorite was used as irrigating solution and manual K-files of 2nd and 3rd series were used.

The recommended irrigation protocols include sodium hypochlorite, either alone or combined with ethylenediaminetetraacetic acid (EDTA),[22] highlighting the importance of ensuring that the irrigating solution penetrates into the entire root canal.[23] Thus, ultrasonic techniques have been proposed to enhance the distribution of the irrigating solutions inside the root canal.[24] Therefore, the above-described technology was used in the present clinical case.

The use of MTA for filling the root canal of a central incisor tooth with incomplete root formation was also demonstrated elsewhere.[30] It has been shown that calcium hydroxide interrupted the process of external inflammatory resorption within one year, but did not induce the formation of an adequate apical barrier within the root canal. Because of the degree of external root resorption and absence of an apical barrier, MTA was used, and an 865-day follow-up demonstrated the success of the proposed therapy.[25] With this in mind, the use of calcium hydroxide as intracanal dressing in the present clinical case was of great worth, since it interrupts external inflammatory resorption within a sufficiently shorter period of time. Thereafter, a definitive MTA apical plug was indicated.

Therefore, MTA yields favorable results when used as retrofilling material, allowing the formation of mineralized tissue[32,33] and presenting no inflammation. For instance, MTA can be used in the pulpectomy of both deciduous and permanent teeth or as an apical barrier in teeth with pulp necrosis and open apices, with or without previous treatment with sodium hydroxide.[26-29] These results corroborated the indication of MTA for clinical use and treatment of teeth requiring apical barrier.

Conclusion

Endodontic reintervention with MTA apical plug is a protocol of major importance already established in the literature. Clinical and radiographic follow-up of the present case after eight years revealed periapical repair and re-establishment of masticatory and esthetical functions by means of restorative procedure; thus, evidencing the success and advantages of both material and therapeutic modality.

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