Use of MTA in endodontic retro-filling

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Resumo

O Agregado de Trióxido Mineral (MTA) é um cimento obturador endodôntico que surgiu em 1998 no mercado mundial e se tornou o verdadeiro milagre da endodontia pelos resultados científicos comprovados. Por ser um material excelente para selamento, o MTA proporciona expansão de presa e integridade do selamento, pela baixa solubilidade e alta regeneração biológica, pois a ação de liberação de íons cálcio e propriedade antibacteriana são ótimas. Este caso ilustra a utilização do MTA para selamento de perfurações radiculares e como material retrobturador após apicectomia (tratamento cirúrgico complementar).

Palavras-chave: MTA. Cimento obturador endodôntico.

Abstract

The mineral trioxide aggregate (MTA) is an endodontic sealer that emerged in 1998 in the global market. Through proven scientific results it has became the true miracle of endodontics. Being an excellent sealing material, the MTA provides setting expansion and integrity of the sealing due the low solubility and high biological regeneration. The release of calcium ion and its antibacterial property are great. This case illustrates the use of MTA for sealing the root perforation and how the retrofilling material works after apicoectomy (additional surgery).

Keywords: MTA. Endodontic sealer.

1. Introduction

Mineral Trioxide Aggregate (MTA) is an endodontic filling cement that emerged in 1998 on the global market and has become the true miracle of Endodontics for its proven scientific results.

MTA is an excellent material for sealing, because its setting-time expansion and sealing integrity, due to low solubility, tissue biocompatibility, high biological regeneration, and release of calcium ions provides antibacterial activity.

Mineral Trioxide Aggregate (MTA) is an endodontic filling cement that emerged in 1998 on the global market and has become the true miracle of Endodontics for its proven scientific results.

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Its radiopacity is excellent, and it can be used for thermal condensation because its melting point is at 150° C.

It has a good capacity for adhesion to dentin, making it resistant to the forces of displacement (displacement resistance), and a greater sealing power than the other cements when tested to assess the bacteria infiltration quantity.

It is indicated for treatment of perforations in the furcation region, internal resorption, treatment of root perforations via surgery, when it is impossible or unsuccessful to treat the perforation via canal, in para-endodontic surgeries as a retrofilling material, direct pulpar protection, pulpotomy, apicigensis, and apicification.

2. Methodology

In the case reported in this paper, the care was performed on the patient who contacted the clinic of Universidade Tuiuti do Paraná, and through the intra-oral exam, the presence of a fistula was observed in the vestibular mucus membrane of tooth 11, which was proven by means of fistula tracing with a gutta percha cone and subsequent x-ray examination. This revealed the presence of an unsatisfactory endodontic treatment and periapical lesion of the patient who contacted the Dentistry clinic of Universidade Tuiuti do Paraná, because there was no success in the conventional endodontic treatment done previous at his own clinic.

To perform the surgery, it was done with local anesthesia by blocking the infraorbital nerves, with supplementary infiltrative anesthesia on the apex of the tooth, as well as nasopalatal nerve blocking. The anesthesia used was mepivacaine 3% with adrenaline 1:1000000.

The chosen flap was from a patient, the incision was made with a no. 15 scalpel blade, the flap was raised. Osteotomy was performed with a high rotation drill of the 700 series, to have access to the periapical region. The lesion was curetted with a short curette.

With the drill, an apicoectomy was done and 2 mm of the apex was removed. The cavity for retrofilling was prepared with a spherical drill, always under irrigation with saline solution, and then the retrofilling was done.

The retrofilling material used was MTA. After the condensation of the material in the cavity, the excess was removed with a periodontal curette.

Finally, the flap was repositioned and then sutured. One 750-mg pill of acetaminophen every 6 hours for two days was prescribed, and in seven days the suture was removed, and the patient reported an uncomplicated post-operatory period.

Control X-rays were taken, at 6 months and one year later, noting the perfect healing of the intra-oral tissues.

3. Literature Review

Mineral Trioxide Aggregate, or MTA, is a biocompatible material with numerous interesting clinical applications in endodontics. The studies were begun and used experimentally by Lee, Monsef.

However, approval of its use in humans by the American Dental Federation came in 1998. (TORABINEJAD, et al 1993), MTA powder is made up of fine hydrophilic particles which set in the presence of moisture. (LEE et al 1993)

MTA is composed primarily of tricalcium silicate, tricalcium aluminate, tricalcium oxide, and silicate oxide, as well as a small quantity of other mineral oxides and the addition of bismuth oxide, which is responsible for the material's radiopacity. The principal molecules present in MTA are calcium and phosphorus ions, which are also the main components of the dental tissues, giving MTA excellent biocompatibility when in contact with cells and tissues. (TORABINEJAD et al 1995)

The experimental material known as MTA has been investigated as an alternative material in Endodontics, and can be used in retrofilling of root canals. Although the retrofilling material is very important, good sealing of the suitable apex is made for this purpose. According to ASSIS et al. (2003), many techniques and instruments have been recommended for carrying out the apical preparations.

Both brands of MTA were significantly evaluated and no other material had a result as progressive as MTA. (ARAÚJO et al., 2004)

According to POZZA et al. (2005), the use of MTA in cavity walls, unlike other materials, is what has the best sealing result against infiltrations.

Different materials have been used to seal the paths connecting the root canal and the para-endodontic tissues. However, none of them had results as promising as MTA, and various studies have proven that MTA is the best on the market today. (KUBO; GOMES; MANCINI, 2005).

To BERNABÉ et al. (2005), in some cases, the conventional endodontic treatment is not enough to resolve such cases and para-endodontic surgery is required to intervene and to get a good result. The filling material must not be toxic, mutagenic, and has to be biocompatible and insoluble. MTA has the best result specifically for sealing between tooth and external surface.

Endodontic treatment has become more practical thanks to the new methods and techniques, with the emergence of materials with excellent physical and biological properties. The literature deals with various materials used in retrofilling, but generally speaking, these materials do not have all the desirable properties, such as: biocompatibility, radiopacity, insolubility in periapical fluids, easy compounding, not staining the peri-radicular tissues, good adaptation and sealing

capacity, in order to be able to remain in the cavity. (TERUYA, 2007).

Which distinguishes a good para-endodontic surgery from a bad one is the material used in the retrofilling. With the proposal of replacing amalgam with an ideal material, this should offer adhesion, promote hermetic sealing, be biocompatible, radiopaque, and easy to compound, and provide for an environment favorable to tissue regeneration. (HELLWIG et al., 2007).

Also according to HELLWIG et al. (2007), para-endodontic surgeries expose and remove dental apexes, promote retrocavitations along the axis of the root canals, and retrofill them with materials that promote their sealing.

Para-endodontic surgery is an excellent option for preservative treatment for teeth with chronic periapical lesions, and treatment by the conventional method is impractical in some cases. (LODI et al., 2007).

According to JACOBOVITZ, PAPPEN, and LIMA (2009), treatment of inflammatory resorptions must be directed at fighting endodontic infection. In certain cases, clinical resolution using conventional endodontic treatment can become unfeasible due to the difficulties of performing instrumentation and adequate filling of the apical region. In these situations, alternative techniques for preparation of the root canal and the filling may be necessary, in addition to the institution of supplementary surgical treatment.

Some cases may be treated with the use of a laser, but it does not change the pattern of microfiltration of retrofillings with MTA. (AUN, 2008).

According to LEAL (2009), MTA cement has effective sealing capacity.

Para-endodontic surgeries have various procedural methods that aim to resolve failures or accidents which occur in conventional endodontic treatments. (MOTA et al., 2010).

To GIRARDI et al. (2010), apicoectomy is a method of para-endodontic surgery that consists in the separation of the apical portion from the root. It is performed when there is no regression of the apical lesion after the alternatives of conventional endodontic therapy have been exhausted, in the attempt to eliminate the apical microorganisms and their toxic products. - Influence of the radicular cutting angle on apical microleakage, comparing two apicoectomy techniques in para-endodontic surgery.

The use of a better-quality retrofilling material is indispensable; if an inferior-quality material is used, an increase of apical infiltration may occur, since the permeability of the dentinal tubules is more exposed by cutting angles, which in important at the time of applying the filling material. (POST et al., 2010).

According to OLIVEIRA et al. (2011), in an apicoectomy surgery with retrofilling using MTA, with monitoring after five years, it was observed that teeth with a persistent periapical fistula lesion, after having been submitted to a suitable endodontic treatment, the surgical retreatment with retrofilling may be an efficient option in the resolution of the infection and repair of the periapical tissues.

The literature affirms that MTA presents excellent physical/chemical and biological properties, which justified it as the material of choice in treatment of radicular resorptions. It is a material that, when compared to the other restorative materials, has less microleakage and is capable of inducing the formation of mineralized tissues such as bone, dentin, and cement, due to reaching the pH plateau of around 12.5 in three hours.

To COSTA et al. (2012), analyzing the clinical application of MTA in relation to radicular resorption, it is observed that, in cases where radicular resorption is minimal, the canal is filled with calcium hydroxide to stimulate the repair, closing the access cavity with zinc oxide and eugenol.

Among the various advantages that MTA has, there is minimal radiopacity, which proves to be an important criteria and contributes to the best choice by the dental surgeon in relation to the biomaterial to be used in para-endodontic surgery. (ALMEIDA et al., 2011).

According to BARROS E ARAÚJO FILHO (2012), MTA has been used successfully in filling the apical space of the root canal. In addition to its excellent sealing capacity, it has biocompatibility with the peri-radicular tissues and induces the formation of cementoblasts and osteoblasts.

4. Case Study

Black male patient, 51 years old, married, contacted Universidade Tuiuti do Paraná on 02/19/2013 for filling of tooth 11, complaining of a hole in the gum above the element, from which a large quantity of purulent discharge was draining.

In the X-ray exam, an extensive radiolucid area was observed, noting a fistula, periapcal lesion, involving

the periapical region of the tooth in question.

During the endodontic treatment, the secretion present in the tooth could not be controlled, even 23 days after treatment, with changes in the intracanal medication, the fistula returned, but exudate drainage via canal persisted. Then definitive sealing of the root perforation was opted for, utilizing MTA and continuation with changes of calcium hydroxide in the root canal.

Due to the persistence of the exudate via canal, it was decided to perform endodontic filling, followed by supplementary surgical treatment (apicoectomy) with retrofilling with MTA.

Then, apicoectomy with trans-surgical endodontic treatment was chosen, with MTA as a filling cement. A careful apicoectomy was performed, thereby conserving the dental structure as much as possible.

In the seven-day post-operatory control, the patient had no symptoms incompatible with the surgery performed, and the healing appeared normal. These circumstances held for the full monitoring period, over the course of a year, since the X-ray one year after treatment revealed bone neoformation in the region, proving the success of the case.

At the end of the surgical treatment, the patient was referred for prosthetic treatment.

This case illustrates the use of MTA for sealing of a root perforation and as a retrofilling material after apicoectomy.

5. Discussion

According to TORABINEJAD et al. (1993), MTA has a series of advantages over other retrofilling materials: ease of compounding, insertion in the prepared cavity, and adaptation to the dentinal walls, requiring less condensation force, being associated with small degrees of apical infiltration.

PITT FORD et al. (1996) affirms that the materials used to retrofill are determinants in the success of the para-endodontic surgery. Thus, many studies have been conducted with the objective of finding a material that offers adhesion, promotes hermetic sealing, is biocompatible, radiopaque, and easy to compound, and enables an environment favorable to tissue regeneration. And MTA fits all of these aspects.

According to GIRARDI et al. (2010), the advance of conventional endodontic techniques has provided high success rates in resolving endodontic problems, being directly reflected in the reduction of cases for para-endodontics. However, the technique must be followed carefully to obtain a good result. It is also known that, as will every procedure, the technique a susceptible to errors and subject to failures due to microbiological factors of an extrinsic and intrinsic nature, which cannot always be resolved with only endodontic treatment.

Given the above, we note the importance of para-endodontic surgery in case where even with the use of all the treatment alternatives of conventional endodontics, there is no regression of periapical lesions.

Para-endodontic surgery aims to resolve problems created by or not resolvable by endodontic treatment. Thus, it was the treatment option chosen in the case described in this work, since it is a tooth with a chronic periapical lesion and endodontic retreatment was unfeasible.

Although calcium hydroxide is capable of helping repair apical and periapical tissues, even with deposition of mineralized tissue, other materials, such as MTA, also have such properties, with the advantage of enabling the completion of the treatment with a lower number of sessions.

MTA has biological characteristics, composition, and properties that make it an ideal material for sealing of root canals, with a special emphasis on its osteoconductive, osteoinductive, and cementoconductive conditions.

According to COSTA et al. (2012) regarding the action mechanism, the effect of MTA induces the formation of a layer of crystalline structures. This effect is caused by the reaction of the calcium oxide with the tissue fluids and the calcium hydroxide, which reacts with the CO2 from the bloodstream, forming calcium carbonate. An extracellular matrix rich in fibronectin is secreted in close contact with these products, initiating the formation of hard tissue. Histologically, what is observed is the stimulus to the deposition of this tissue, through calcite granules, around which there is much condensation of fibronectin, which provides adhesion and cell differentiation.

So it can be seen that MTA is a retrofilling material considered satisfactory as an apical sealant in para-endodontic surgeries.

6. Conclusion

According to the methodology used in this work,

and considering its results, it can be concluded that the MTA material used proved to be efficient in the neoformation of mineralized tissue barrier, completely sealing the apical portion of the canal.

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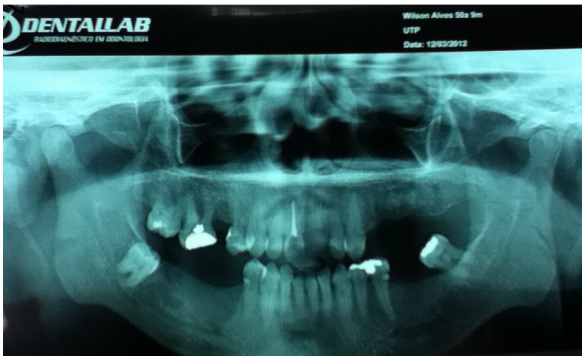
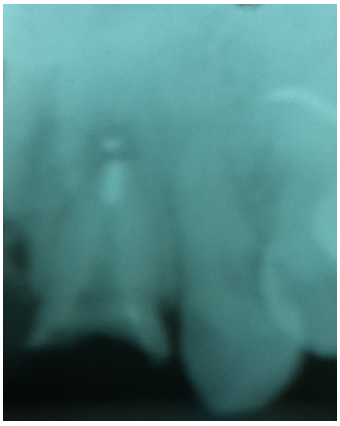
Panoramic X-ray

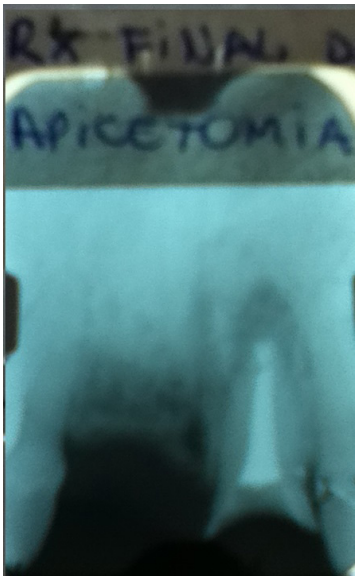


Periapical X-ray, of the apex with the presence of fistula



Periapical X-Ray, of the endodontic retreatment

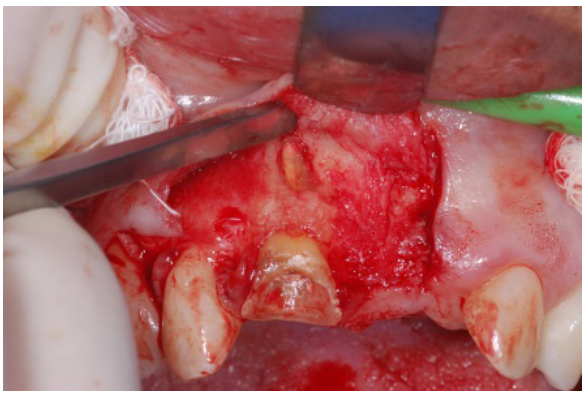
Final X-ray of the apicoectomy



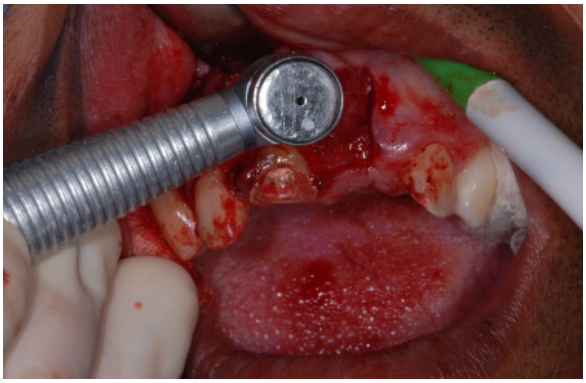
Instruments for endodontic retrofilling surgery

Supraperiosteal Anesthesia

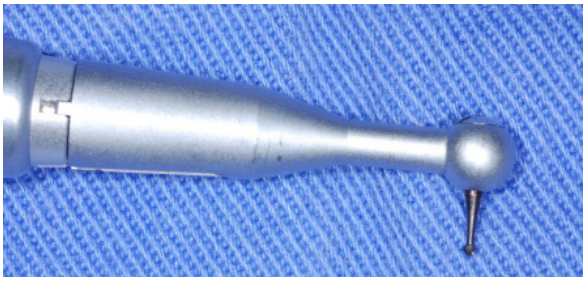
Detachment of the flap



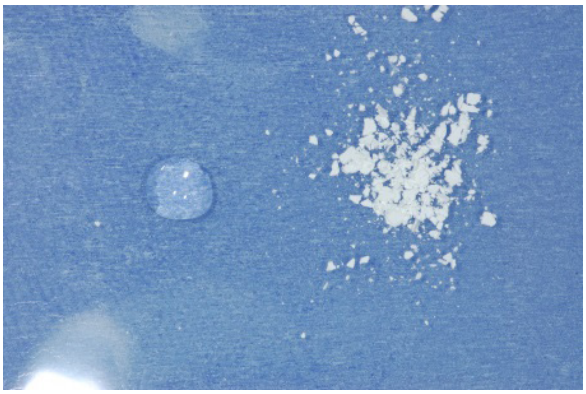
Cut of the root apex with high drill of the 700 series



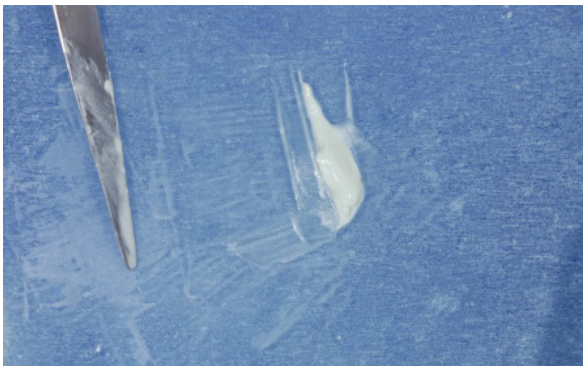
Mini handpiece for preparation of the apex



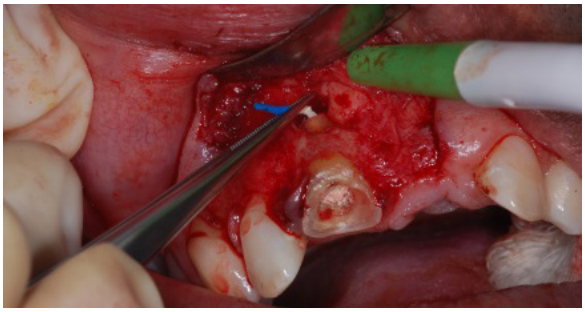
MTA restorative material, powder and liquid



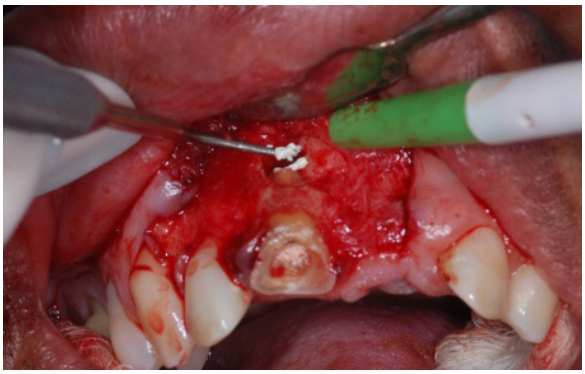
Compounded MTA



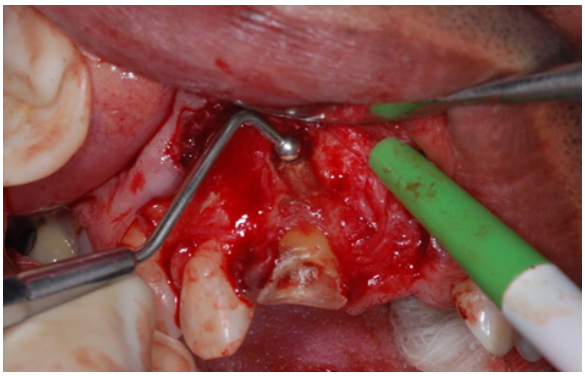
Removal of the extra, pre-existing cones



Placement of the MTA material



Condensation of the MTA in the canal



Suture with 4.0 silk thread