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Repair of Furcal Perforation with Mineral Trioxide Aggregate

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Abstract

Furcal perforation is usually an undesired complication that can occur during preparation of endodontic access cavities or exploring canal orifice of multirooted teeth. Inadequacy of the repair materials has been a contributing factor to the poor outcome of repair procedures. On the basis of the recent physical and biologic property studies of the relatively new introduced mineral trioxide aggregate, this material may be suitable for closing the communication between the pulp chamber and the underlying periodontal tissues. There are few reports on repair of furcal perforation with MTA in molar teeth. The perforations were cleaned with NaOCl and saline solution and sealed with MTA without internal matrix. Finally, the teeth were endodontically treated and coronally restored with composite resin and ceramic veneer crown and bridge. The purpose of this case report was to describe the treatment of two furcal perforation using MTA in molar teeth.

Keywords: Perforation, mineral trioxide aggregate, microscope

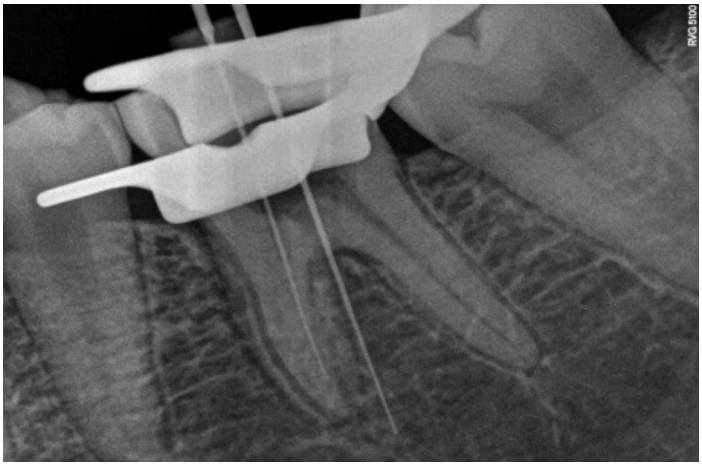
The Mineral Trioxide Aggregate was developed by Dr. Torbinejad at Loma Linda University in the year 1993. The chemical composition of MTA was determined by Torabinejad et al, which consisted of fine hydrophilic particles, and the main components were tricalcium silicate, tricalcium aluminate,tricalcium oxide, and silicate oxide. Bismuth oxide acted as a radioopacifier. They declared that calcium and phosphorus were the main ions in MTA. Microscopic examinations of periodontal tissues after perforations in the furcal area and subsequent sealing with MTA demonstrated repair of the periodontium and new cementum formation over the material[1,2].

The physico-chemical properties of MTA, studies addressing the properties of Portland cement have been employed as a reference, since the manufacturer of MTA has confirmed that Portland cement is one of the components.[3,4] In addition, some studies have demonstrated that both MTA and Portland cement have the same composition and mechanism of action. Portland cement type II is a construction cement with great similarity to MTA, which might offer significant economic advantages if applicable to biological systems. Holland et al. (2001) evaluated the reaction of subcutaneous tissue in rats to implantation of dentin tubes filled with mineral trioxide aggregate, Portland cement or calcium hydroxide. The results were similar for all the materials analyzed. [5]

Furcal perforation is usually an undesired complication that can occur during preparation of endodontic access cavities or exploring canal orifice of multirooted teeth.[6,7] These undesirable situations such as excess removal of tooth structure or perforation occur during attempts to locate canals or as a direct result of failing to achieve

straight line access to the canals. In the process of searching for canal orifices, perforations of the crown can occur, either peripherally through the sides of the crown or through the floor of the chamber into the furcation.[8] Such perforation are managed surgically or nonsurgically.[9] Various materials have been used in repairing perforations including zinc oxide-eugenol, amalgam, calcium hydroxide, composite resin, glass ionomer and resin-modified glass ionomer.[10]

The high biocompatibility of MTA makes it a suitable material for the treatment of root perforations with the goal of regenerating periodontal attachment, and inducing osteogenesis and cementogenesis.[11,12] In many studies the main challenge of laboratory-based leakage testing models is to develop experimental setups that can provide reproducible results and clear-cut conclusions regarding the sealing ability of either the tested materials or techniques. Moreover, it is also important to be able to evaluate laboratory findings in a real clinical setting. Thus, it is crucial to adopt a standardized, reliable, and reproducible method. The aim of this long-term follow-up case report is to present a successful treatment of iatrogenic furcal perforation by MTA. In this case report MTA was used to repair furcation perforation and the potential benefits of MTA and its relative case of use for management of perforation at easily accessed sites.



Case Report: 1

A 34-yr-old female patient reported to the Department of Conservative Dentistry and Endodontics, with the chief complain of pain in her lower left back region of the jaw since one month. Patient gave history of incomplete root canal treatment; Clinical examination showed temporary dressing with tooth no. 36, there was pain on percussion. The mean probing pocket depth was within normal level. The temporary restorative material was removed and the perforation area was detected clinically and radiographically.(Fig 1,2) Haemotasis was achieved with 1:80,000 adrenaline containing 2% local anaesthesia . Blockage was determined in the mesial canals. The working length was determined radiographically.(Fig 3) The mesial and the distal canals were cleaned and shaped using ProTaper Rotary File Systems(Dentsply, Maillefer, Switzerland) in a crown –down technique and copious irrigation with 5.25% sodium hypochlorite and final rinse with 2% Chlorhexidine(Dentochlor, Ammdent). Master Cone selection was done(Fig 4) and the root canals were then obturated with gutta-percha points and AH Plus(Dentsply, DeTray Konstanz, Germany) using lateral condensation technique. The perforation was sealed with mineral trioxide aggregate- sterile saline paste ProRoot MTA(Dental Tulsa; Dentsply, DeTrey Konstanz, Germany) mixed in a 3:1 proportion.(Fig 5) In this appointment, which MTA was applied with the help of a MTA carrier, a damp cotton pellet was then placed in the pulp chamber to produce a humid ambient for the MTAwith the aim of achieving solidification, and the tooth was temporary filled with Cavit temporary restoration material(Cavit-G, 3M ESPE, St. Paul, Minnesota,USA. The patient was recalled after 24 hours to the department with no symptoms or signs. Temporary sealing materials and wet cotton pellet were removed and the hardness of the MTA was gently tested with an operator explorer. In this appointment, permanent restoration was done with the help of Type GIC (GC Corporation,Tokya,Jpan).(Fig 6,7)Later a full metal crown was advised.

Case 2

A 30-year-old woman presented with accidental furcal perforation, which had occurred during access preparation for root canal treatment of tooth 46. Several treatment options were discussed with the patient, who opted for root canal treatment along with repair of the perforation with MTA. The furcal perforation was confirmed by periapical radiography of tooth 46, which revealed osseous breakdown at the furcation (**Fig. 2a**). The root canal treatment was completed, and the pulpal chamber was then irrigated with 1% sodium hypochloride to control hemorrhage and to allow visualization of the perforation. White MTA-Angelus was applied in a manner similar to that described for case 1. The final radiograph obtained at the time of treatment showed evidence that the perforation had been sealed (**Fig. 2b**). Ten days later, the patient was asymptomatic. At the 6-month follow-up, bone formation was evident on radiography(Fig.2c). A radiograph obtained 5 years after treatment showed that the osseous repair had persisted.

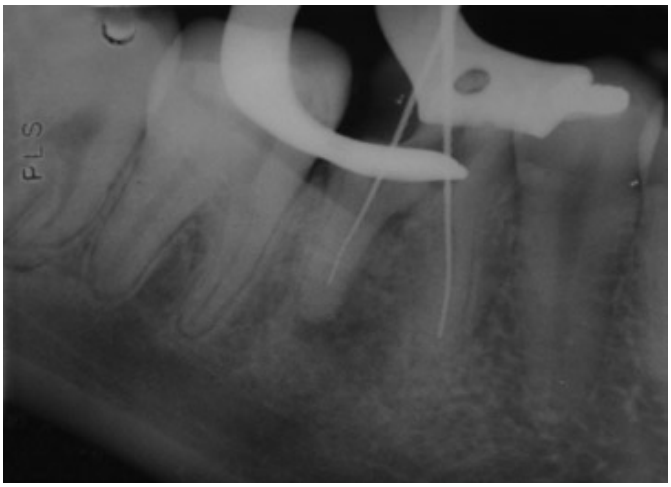


Fig. 2.a

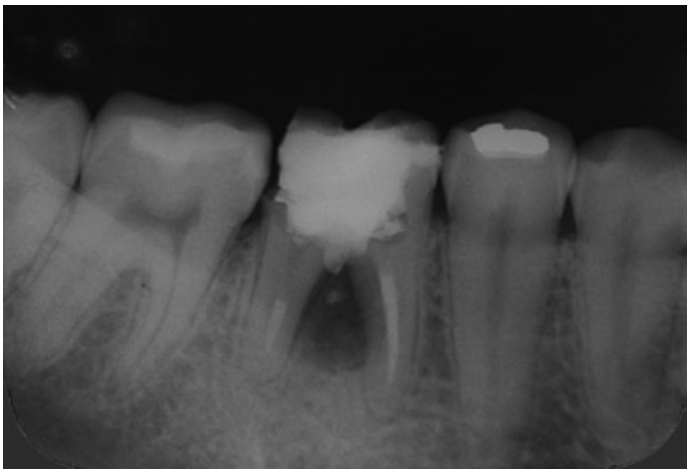


Fig. 2.b

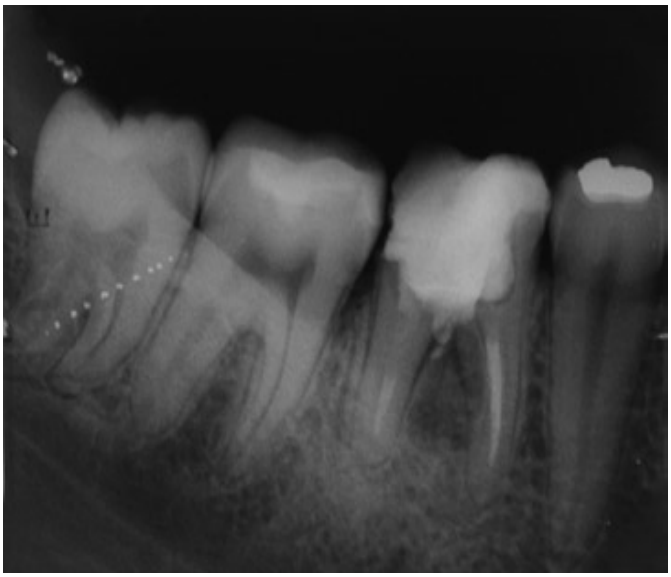


Fig .2.c

Discussion

Perforation of the pulpal floor of a tooth causes damage to the periodontal ligament with a subsequent inflammatory reaction. If the perforated region is exposed to bacterial contaminants from the oral environment for a substantial period, a downward proliferation of epithelium may occur. This can result in breakdown of boneand, ultimately, loss of the tooth. However, it has been shown that if the perforation is repaired without delay, the prognosis is greatly improved [5,6]. The main goal in management of perforations is to arrest the inflammatory process and the subsequent loss of tissue attachment by preserving healthy tissues at the site of heperforation. If a lesion is already present, it is important to restore tissue reattachment. Until the advent of MTA, repair materials had not been able to achieve this regenerative process.[10]

MTA is difficult to manipulate because of its granular consistency, slow setting time and looseness. Pro-RootMTA contains fewer large particles and fewer small particles than MTA-Angelus. Generally speaking, white MTA contains smaller particles than grey MTA, with a narrower distribution of sizes. MTA-Angelus particles have relatively low sphericity and a wide size distribution, and they are less homogeneous than Pro-Root MTA. The main disadvantage of Pro-Root MTA may be its long setting time. MTA-Angelus contains no calcium sulphate, which reduces its setting time to 10 minutes. Contamination of the blood should be avoided when using this type of material, as such contamination can reduce the retention capacity of the MTA. Previous authors have stated that contact with adjacent tissues may increase the sealant capacity of MTA, since an acidic environment (such as tissue) may increase this property. In the cases presented here, sealing of the lesions could be observed, with some extrusion of the material. To prevent overfilling or underfilling, a resorbable collagen matrix can be

applied before placing the MTA,but use of a matrix depends on the size of the lesion. Success has been reported both with26 and without27 the matrix. At present, there is no size classification for furcal lesions to determine appropriate treatment and prognosis; therefore, all options are considered to have a guarded prognosis.[1,7] In the 2 cases presented here, the lesions were of different sizes. In case 1, the lesion was larger, with irregular limits, characteristic of a V-shaped caries. As shown in **Fig. 1a**, the lesion affected almost the complete dimension of the furcal region, but did not affect the internal walls of the roots; this limited the lesion overall and indicated a lateral boundary against which to place the material. If the lesion had been larger, it would have been necessary to apply a matrix base before placing the MTA.

Although MTA is one of the most researched materials in dentistry, showing remarkable results, the majority of the published data are based on in vitro and animal studies. Research must be continued to evaluate clinical outcomes in human subjects. The importance of clinical data is substantiated by recent trends in evidence-based dentistry. In this article, we present a series of

cases that have demonstrated consistent healing with the use of MTA as a perforation repair material. The availability of this material may require re-evaluation of previous guidelines regarding prognosis of perforated teeth.

The prognosis of perforations depends on the location, size and time of contamination of the lesion. The location of furcal perforations at the level of the epithelial attachment and crestal bone suggested a guarded prognosis.[10] Secondly, the size of a perforation represents another important factor in determining the success of the repair procedure; some authors suggest the use of internal matrix to avoid the extrusion of the sealing material and consequent periradicular tissue inflammation.[13] In our cases, furcal perforations were small, with a low risk of filling material extrusion. Finally, interval between perforation and repair is one of the critical factors for success.[2,3] Immediate sealing of perforations enhances the repair process due to reduce the possibility of bacterial contamination of the defect. Perez et al[4] shown that the lateral root perforations sealed with MTA after contamination presented worse repair than the noncontaminated, immediately sealed perforations

Conclusion

MTA has the potential as a material for repair of furcal perforation. However, MTA should be further tested for response to occlusal forces and research about the materials that can be used with MTA should be designed.

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