Received: 20th September 2015 *Accepted: 12th October 2015* *Conflicts of Interest: None*

Source of Support: Nil

Case Report

Re-treatment of Improperly Placed Mineral Trioxide Aggregate in an Anterior Tooth

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How to cite the article:

Al-Klayb S, Almohy A, Mohammed Y, Pani SC. Re-treatment of improperly placed mineral trioxide aggregate in an anterior tooth. J Int Oral Health 2016;8(2):283-286.

Abstract:

Since the introduction of mineral trioxide aggregate (MTA) by Torbinejad in 1993, the material has been hailed as a gold standard in pulpal treatment. In the past decade, the use of MTA for the treatment of young permanent tooth has become popular across the world. However, the material remains technique sensitive. The physical properties of the material make handling of the material difficult. Closure of a tooth with an immature apex requires complete debridement of the canal and complete orthograde plug placement. There have been recent case reports of successful apical barrier formation after incomplete orthograde filling with MTA. However, this approach is susceptible to risks of flare-up. This case report highlights the case of a 12-year-old patient with an incomplete orthograde filling of MTA which resulted in flare-up and required re-treatment. This case highlights the risks of improper placement of MTA in the canal. Despite its documented pulp regenerative properties, MTA can still not prevent re-infection in an improperly instrumented canal. The hard nature of MTA makes removal and re-treatment both complicated and expensive. It is, therefore, essential to ensure that MTA is only placed in the canal when the dentist is competent to ensure complete obturation.

Key Words: Apexification, apical seal, mineral trioxide aggregate, retreatment

Introduction

Since the introduction of mineral trioxide aggregate (MTA) by Torbinejad in 1993, the material has been hailed as the gold standard in pulpal treatment.[1,2] It has emerged as a dependable bioactive material with comprehensive applications in endodontics due to its superior physiochemical characteristics. In addition to being sterile, radiopaque, and dimensionally stable; insensitivity of the material to moisture and blood contamination is an added merit. MTA not only facilitates an efficient seal against dentin and cementum it also encourages biologic repair and regeneration of the periodontal ligament. Biocompatibility of this material has been confirmed by clinical studies along with a hard tissue inductive effect. These agreeable properties provide MTA to be an appropriate material for the treatment of tissue injury. Since, perforation repairs, induction of the root end, fillings of the root end are indispensable forms of partial canal obturation, the subsequent rational sequence in the evolutionary application of MTA, is thought to be orthograde filling of the entire root canal system with the same.[3]

In the past decade, the use of MTA for the treatment of young permanent tooth has become popular across the world. However, the material remains technique sensitive. The physical properties of the material have made handling of the material difficult. In addition to that, closure of a tooth with an immature apex requires complete debridement of the canal and complete orthograde plug placement. There have been recent case reports of successful apical barrier formation after incomplete orthograde filling with MTA. However, this approach is susceptible to risks of flare-up. This case report highlights the case of a 12-year-old patient with an incomplete orthograde filling of MTA which resulted in flare-up and required re-treatment.

Case Report

A 12-year-old boy reported to the dental clinic with a history of pain in upper front tooth region since 10 days. The pain was mild to moderate, radiating in nature, aggravated on biting hard food and relieved after removal of the stimulus, occasionally there was swelling with purulent discharge from the same area. There was a history of previous endodontic treatment on tooth number 21, and clinical examination revealed a tooth colored restoration on the palatal aspect of the tooth. The tooth was tender on percussion.

A periapical radiograph showed single rooted fractured right central incisor partially filled with radiopaque root canal material, with the loss of lamina dura and hazy radiolucency at the periapical area indicating preapical abscess due to improper root canal treatment (Figure 1a and b). When the access cavity was reopened, it was observed that the canal was filled with a hard material that was difficult to remove with conventional endodontic techniques, suggesting the material to be MTA.

The material was removed with ultrasonic instruments using an endodontic microscope for better visualization (Figure 1c and d). The removal of the MTA revealed purulent discharge in the canal. The canal was filled with calcium hydroxide paste (Metapaste™) to control the infected canal. After controlling the infection in the canal, the tooth was obturated with gutta-percha. A fiber post was placed for retention and restored with composite resin. The tooth showed the positive response of healing after proper re-treatment (Figures 2a-d, 3a-c and 4a-f).

Discussion

Apexification is intended to produce an environment to allow deposition of periodontal tissues to carry on root development. Traditionally, calcium hydroxide has been the choice material for apexogenesis and has yielded a high degree of success.[4-7] However, problems such as inconsistency in treatment duration, volatility of apical closure, cervical fracture, complexity in patient follow-up, failure in infection control, reappearance of infection, and amplified threat of root fracture are seen.[8,9]

Any management that needs several visits for a longer period of time poses the risk of patient attrition owing to patient exhaustion and geographic migration.[4] The relatively short setting time of the material and effective sealing of the open apex has meant that MTA has reduced the working time needed in apexification from months to a single visit. There have also been suggestions that the inductive nature of MTA makes it a better alternative to calcium hydroxide in apexogenesis as well. The physical properties of MTA mean that the dentist requires some skill to ensure the material (when placed orthograde) is carried all the way to the apex. The difficulty of this procedure, combined with the inherent inductive properties of MTA have led some authors to claim that incomplete orthograde filling with MTA may still be an acceptable treatment modality.[4-6] However, the case presented above shows, that in the absence of adequate disinfection, the placement of MTA has been shown to defy leakage to a better degree than the conventional obturating materials of gutta-percha and sealer in *in vitro* leakage studies. In accordance with histological studies, MTA is significantly enhanced at stimulating reparative peri radicular periodontal tissues.[7] To evade MTA seepage into the periapical tissues, the application of an extra radicular matrix of calcium sulfate or collagen type substances has been suggested.[8] In accordance with an investigation conducted by a scientific article about the eviction of MTA as an apical barrier substance in teeth with open apices, it has been noted that 4 mm thickness of the apical barrier provides considerably increased resistance to eviction than 1 mm thickness. This implies that the hardness, sealing ability, and displacement of MTA, when used as an apical barrier, is unswervingly affected by its thickness. Radiographic and microscopic study conducted by Aminoshariae *et al*. revealed that hand technique of placement and condensation of MTA emanated in improved adaptation with lesser voids than the ultrasonic technique.[9]

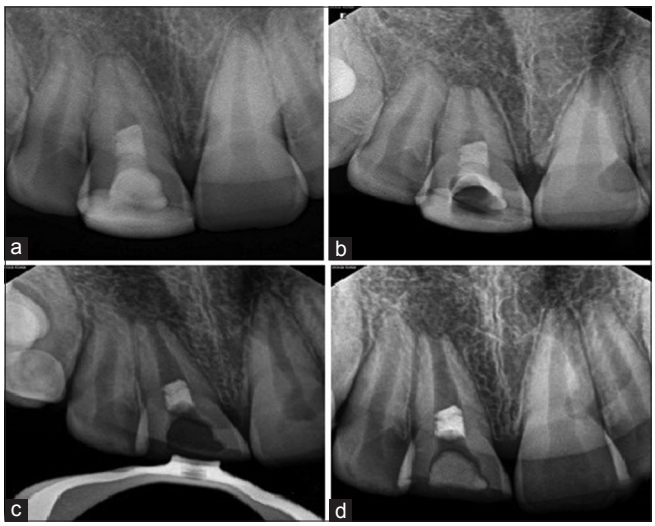

Figure 1: Pre-operative radiographs, (a) showing the partially filled canal with a radiopaque material, (b) attempt made to remove the mineral trioxide aggregate, (c) cleaning the canal with ultrasonic instruments using an endodontic microscope, (d) temporary restoration placement.

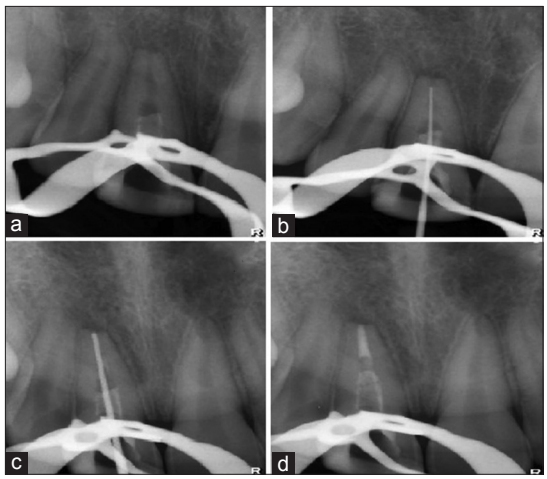

Figure 2: Operative radiographs, (a) cleaning the canal with ultrasonic instruments using an endodontic microscope, (b) working length determination, (c) master cone selection, and (d) apical seal.

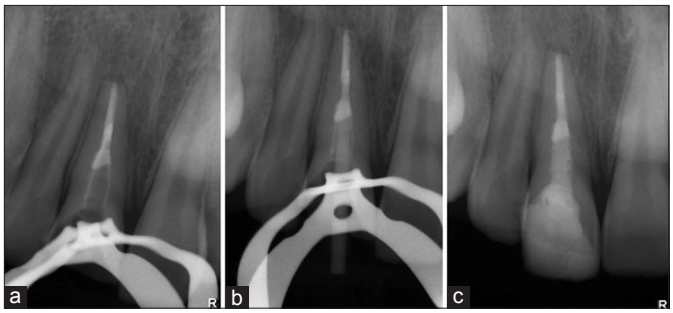

Figure 3: Post-endodontic radiographs, (a) apical seal with gutta-percha, (b) fiber post placement for retention (c) post endo restoration.

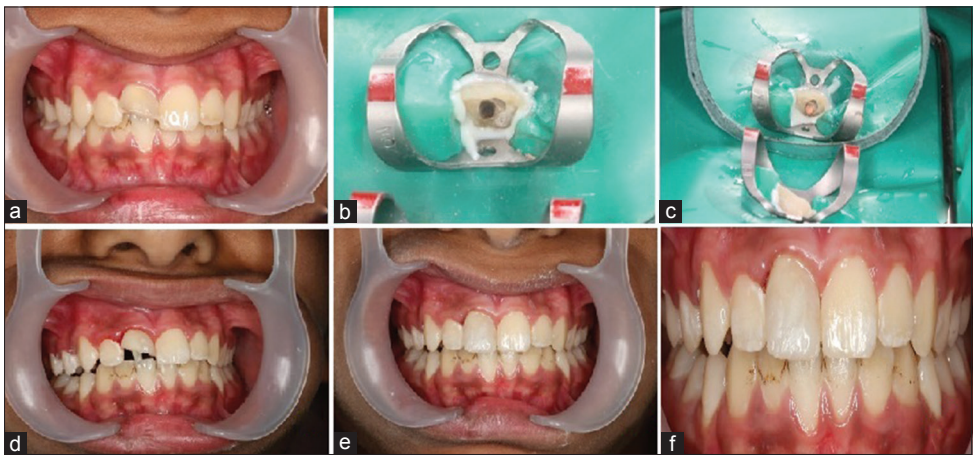

Figure 4: Clinical photographs, (a) before treatment, (b) cleaning and shaping, (c) placement of gutta-percha, (d) fiber post placement, (e) after composite restoration, (f) after treatment.

The delivery system of material into the root canal and placement of the MTA material at the apex with the MTA bendable applicators recommended by the manufacturer is difficult because of the thickness of the applicator, MTA could only be carried a few millimeters beyond the entrance of the root canal. The material should be carefully pushed down, and the remnants of it should be scrapped from the root canal walls. On occasions, dehydration of the mixed material may occur which make the placement of MTA difficult. The manufacturer suggests that the working time of MTA is approximately 5 min. For the creation of an apical barrier three to four applications are often required, making the procedure lengthier and difficult.[10-14] This may be the reason of failure in many cases and also in our case, but the use of magnification loops and microscopes with radiographs in endodontics has increased the visual accuracy of the operator significantly, and the operator needs to be familiar with the use of such equipment, which was used in our case for retreatment.[14]

The use of MTA in teeth with open apices has been viewed favorably by both pediatric dentists and endodontics.[11,12] Our case is an exception to this concept. This study highlights the dangers of both inadequate disinfection as well as the inadequate filling of MTA into the entire canal. The flare-up observed required secondary treatment, which because of the hard nature of the MTA had to be done with ultrasonic instruments and an endodontic microscope, both of which significantly increased the cost of retreatment.

Conclusion

This case highlights the risks of improper placement of MTA in the canal. Despite its documented pulp regenerative properties, MTA can still not prevent re-infection in an improperly instrumented canal. The hard nature of MTA makes removal and re-treatment both complicated and expensive. It is, therefore, essential to ensure that MTA is only placed in the canal when the dentist is competent to ensure complete obturation.

Acknowledgment

The authors wish to thank Dr. Darshan Devang Divakar, Researcher, Dental Biomaterials Research Chair, College of Applied Medical Sciences, King Saud University for his help in the final proof-reading and preparation of the manuscript.

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