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CASE REPORT

Mineral Trioxide Aggregate: An Alternative to Gutta-percha

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ABSTRACT

Mineral trioxide aggregate (MTA) has emerged as a reliable bioactive material with extended applications in endodontics that include the obturation of the root canal space. This article reports of a case where patient's offending teeth presented with an open apex and resorptive defect, and MTA was used as an alternative to gutta-percha as a canal-filling material.

Keywords: Apexification, Gutta-percha, Mineral trioxide aggregate, Obturation, Resorption.

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INTRODUCTION

The obturation of the prepared radicular space has been achieved by using a wide variety of materials like cements, pastes, plastics, or solids selected for their intrinsic properties and handling characteristics.[1] Gutta-percha, in its various forms, has remained the paragon as a root canal-filling material during the course of the last century. These filling materials are combined with sealers to provide an adequate obturation of the root canal space that prevents the emergence of endodontic disease and encourages periapical healing.[2] This process can only succeed if the sealed root canal space prevents further ingress of bacteria, entombs remaining microorganisms, and prevents their survival by obstructing the nutrient supply.[3]

The development of alternative obturation materials can be attributed to multiple studies demonstrating that gutta-percha is highly susceptible to microleakage. When gutta-percha canal obturations are tested *in vitro* by using dye penetration, fluid filtration, or bacterial leakage models, they show vulnerability.[4-7]

Mineral trioxide aggregate (MTA) is a biomaterial that has been investigated for endodontic applications and was first described in the Dental Scientific literature in 1993. It was introduced by Mahmoud Torabinejad and colleagues at Loma Linda University in 1993 and has been used on an experimental basis by endodontists for several years with anecdotally reported successes, some of it quite impressive. The material appears to be an improvement over other materials for some endodontic procedures that involve root repair and bone healing.[8,9]

The MTA has emerged as a reliable bioactive material with extended applications in endodontics that include direct pulp capping, repair of root, furcation perforations, apexification, and the obturation of the root canal space.[9,10] It possesses excellent antibacterial efficacy, sealing ability, biocompatibility, minimal toxicity, cementum growth, and dentinal bridge formation.[11]

This paper reports of a case where MTA was used in the treatment of an open apex and internal resorption.

CASE REPORT

A 26-year-old female patient reported to the outpatient department with a chief complaint of discolored upper front teeth. Detailed history revealed history of trauma 10 years back. Clinical examination revealed Ellis Class III Fracture in maxillary right central incisor along with discoloration in right and left maxillary central incisors. Radiographic examination revealed an open apex in tooth 11 (maxillary right central incisor) and resorption in tooth 21 (maxillary left central incisor) (Fig. 1). Single visit apexification using MTA was planned as treatment option for tooth 11 and obturation using MTA was planned for tooth 21.

After rubber dam isolation, access opening was done in relation to 11 and 21 and working length estimation was done (Fig. 2). Root canal system was cleaned with endodontic instruments. A 0.2% chlorexidiene gluconate (Dentsply) was used as the primary irrigant for tooth 11, while 5.25% sodium hypochlorite (Deepdent) was used in tooth 21. Final rinse of normal saline (API) was done in both teeth. Calcium hydroxide (Deepdent) was then placed in the root canal for 1 week to fully disinfect the

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Fig. 1: Preoperative intraoral periapical radiograph revealing open apex in tooth 11 and resorption in tooth 21

Fig. 2: Working length estimation

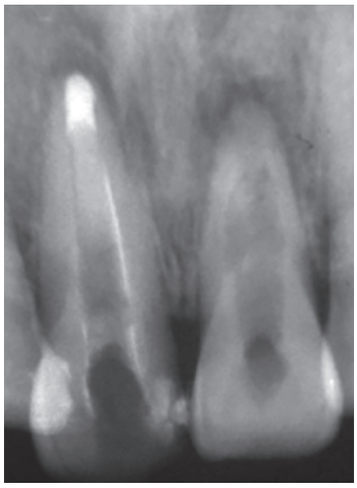

Fig. 3: Formation of a 4 mm apical plug using WMTA and bone graft in tooth 11

Fig. 4: Obturation done in tooth 11 using thermoplastic technique

root canal system. After 1 week, calcium hydroxide paste was removed from the root canal and the canal dried with paper points (Dentsply). ProRoot White MTA (WMTA) (Dentsply) was mixed as per manufacturer's guidelines and placed in the canal of tooth 11 and condensed to apical end of the root to create a 3 to 4 mm of apical plug. Radiographically, the extension and the quality of the fill were evaluated (Fig. 3). Remaining canal was obturated using thermoplastic technique (Fig. 4). Tooth 21 was obturated using ProRoot WMTA (Dentsply) (Fig. 5).

DISCUSSION

The obturation of the root canal system demands a material that provides a reliable and impervious hermetic seal. Furthermore, if an obturation material can offer additional properties that decrease bacterial survival and promote bioactive mechanisms necessary for regeneration and healing, then the material proves to be a boon for endodontic therapy.[1,10,12]

Fig. 5: Obturation done using WMTA in tooth 22

The MTA might become a viable alternative treatment option compared with gutta-percha-based materials and sealers. The MTA is sterile, radiopaque, resistant to

moisture, and nonshrinking and stimulates mechanisms responsible for the bioremineralization and resolution of periapical disease. The MTA can be considered the material of choice in preventing the extraction of involved teeth when some protocols might otherwise recommend unconventional alternatives.[13]

It has been shown that MTA has cementogenic properties, not only when used as a root-end filling material and in perforation repair, but also in the induction of root-end closures.[14] The MTA also induces the formation of apical calcific barriers and resolution of periapical disease of unformed apices in teeth with necrotic pulps, as demonstrated in numerous case reports.[15-23]

The MTA obturations in teeth with immature apices can induce apexogenesis by stimulating the mesenchymal stem cells from the apical papilla to promote complete root maturation in the presence of periapicalpathosis or abscesses.[24] In a clinical retrospective outcome study, MTA was used as an artificial barrier in teeth with immature apices.[25] By means of a periapical index score, 17 of 20 (85%) teeth showed healing. Also, when the MTA apexification procedure is compared against calcium hydroxide as a control, MTA demonstrated higher clinical and radiographic success at inducing root-end closure[26] making it a material of choice in such scenarios.

Complete or partial obturation of the root canal system by using MTA is a viable option for teeth that exhibit internal root resorption. Recent research has demonstrated that root canal-treated teeth obturated with MTA exhibit higher fracture resistance than their untreated counterparts.[27]

The MTA does present some disadvantages when used in canal obturation. Gray MTA can discolor teeth if the material is placed in the coronal structure or near the cementoenamel junction in anterior teeth.[28] This is not true with WMTA which was used in this case. Another potential problem with the material can be elective removal after placement and curing. Although removal can be accomplished with the aid of ultrasonics, MTA obturation in curved canals can pose a dilemma.[29] Another minor drawback is the slow setting time of ProRoot MTA. The material can take 2.5 to 4.0 hours for an initial set, but it requires 21 days for complete curing.[10] Setting time of MTA can be altered by incorporation of certain additives to it.[30]

CONCLUSION

Scientific investigations in root canal obturation using MTA have revealed the remarkable potential for this bioactive cement to stimulate the biologic mechanisms necessary for repair and retention of involved teeth making it a gold standard in management of a multitude of cases. The use of MTA as an obturation material might ultimately provide long-term benefits that enhance the prognosis and retention of the natural dentition due to its superior bioinductive properties, thereby, making the concept of conservative endodontics a reality.

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