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MINERAL TRIOXIDE AGGREGATE FOR APEXIFICATION IN NON-VITAL MAXILLARY CENTRAL INCISOR: A CASE REPORT

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ABSTRACT

Treating traumatic dental injuries is often a challenging task for pediatric dentists. Apexification is the process of inducing the apical closure on immature, young, non-vital permanent teeth using a root end filling material. The traditional material of choice for apexif ication of developing permanent teeth was calcium hydroxide; however the developmentof M TA has showed exceptional potential as a substitute. This case report presents the management of a traumatized immature maxillary central incisor with Ellis and Davey's class IV fracture with MTA specification followed by aesthetic composite restoration.

INTRODUCTION

Injuries to the anterior teeth caused by trauma to the oral and maxillofacial region are prevalent. An oral injury accounts for around 5% of all physical injuries, and it is 17% more common in preschoolers..[3]The most frequently affected traumatic injuries occur in the maxillary central incisors. In these, complex crown fractures involving the pulp account for

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roughly 16% of the injuries[1] and children experience 1-3% trauma to their primary and permanent teeth, with a consistent incidence of 20-30%.[4] Serious traumatic injuries cause pulpal inflammation, which later develops into necrosis.[2] Trauma disrupts the development of dentinal walls at the apical end of the roots of developing permanent teeth, creating blunderbuss canals.[1] Hence, apexification or closing the root end is the treatment of choice which has grown incredibly popular over time.[3] According to the American academy of Endodontics, Apexification is the process of creating a hard tissue barrier in a root that has an incomplete apex or continuing the growth of a tooth's apex in the presence of pulp necrosis.[4] Calcium Hydroxide has been used extensively for this, however, it has a number of drawbacks, including a prolonged course of treatment, a challenging patient recall system, and a higher risk of tooth breakage when calcium hydroxide dressings are kept in root canal systems for an extended period of time,[3] due of these factors, MTA was used instead.

Apexification could now be accomplished in one or two appointments as a result of MTA, wh ich solved the issue of multiple visits as required in calcium hydroxide.[5] MTA is a blend of tricalcium oxide, tricalcium silicate, and silicate oxide particles dispersed as a thin powder in a hydrophilic media. When applied to the open apices of roots, it exhibits high bioc ompatibility, antibacterial action, and superior ability to close.[6] Low toxicity, setting ability u naffected by moisture, impact on odontoblastic induction, and hard barrier creation are furthe r characteristics.[7]

This article presents the treatment of a case of immature, non-vital anterior teeth utilising MTA for apexification, followed by their aesthetic rehabilitation with Composite resin restoration.

Case Report:

A 10-year-old patient presented to the Paediatric and Preventive Dentistry Department with the chief complaint of stained anterior teeth in the upper arch. The patient had no relevant medical history. He met with an accident while riding his bicycle and traumatised the maxillary incisors two years ago but no treatment was sought. Upon intraoral inspection, the right and left central incisors with an Ellis class IV fracture was seen. (Figure 1). Wide root canals, an incompletely developed root apex, and periapical radiolucency were revealed by intraoral periapical radiographic imaging. After injecting Local anaesthesia with adrenaline as apexification was performed under rubber dam isolation, lingual access and biomechanical preparation were carried out on 11 and 21. As an intracanal medication, calcium hydroxide

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was administered in the canals using the syringe method and kept for three weeks to avoid any periapical complications as the tooth was open to infections for two years. In the second appointment, the canals were mechanically instrumented and dried using sterile paper points and 21 was obturated using Gutta Percha. MTA was prepared as per the manufacturer's instructions, inserted using a manual plugger, the MTA carrier was compacted into a 3 to 4 mm apical plug. was confirmed radiographically with 11, and both the cavities(11 and 21) were sealed with glass ionomer cement restoration after inserting a moistened cotton pellet. After two days, the canal was filled with Gutta percha followed by composite buildup with 11 was completed. The patient was recalled and post-and-core procedure followed by CAD-CAM crown placement with 21 was done in the following appointment.

DISCUSSION

The achievement of an impermeable seal in the apical region of the tooth is essential for paediatric endodontic treatment to be successful. Endodontic treatment for young, non-vital permanent teeth affected by traumatic injury is difficult because these teeth have open apices with weak dentin walls, pulp necrosis, and diverging root canals.[8] The use of calcium hydroxide for apexification has grown in favour over time, however recent research suggests that the barrier created by this method is insufficient. The formation of a hard barrier is also lengthy (12–24 months).[9] these factors make MTA a popular choice as a material for apexification.[5]

At Loma Linda University, MTA was first used in 1993 as a substance for the apical closure of roots. (USA). It has successfully replaced calcium hydroxide in apexification because of its good Biocompatibility and the presence of calcium ions and phosphate ions encourage the accumulation of odontoblastic cells and foster an environment that is favourable for calcium deposition which can be accomplished in a single sitting visit. After setting, MTA has a pH of 12.5 in solution. This demonstrates a similarity to calcium hydroxide's pH value. This is thought to play a role in some of its antibacterial activities. Mineral trioxide aggregate functions as a monoblock when utilised as a material of choice for apexification. When MTA is in its maturity phase, interfacial deposits like apatite crystals are created. As a result, the gaps close up during the material's shrinkage phase, increasing the material's resistance to root canal walls.[2] Numerous investigations have demonstrated its beneficial qualities, including reduced solubility, the capacity to induce odontoblast development, expansion after setting, excellent radiopacity, and antibacterial action. MTA, osteogenic protein-1, and calcium hydroxide all demonstrated equivalent effectiveness as apexification agents in a

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study by Shababhang et al. In contrast to the other two groups, the MTA group's thickness of the apical barrier was more stable.[10] Apexification with MTA has drawbacks of its own, including as the need for specialised equipment like MTA carriers and pluggers to assist its insertion into the root canals. and the difficulty that can arise when dealing with large apical foramina in achieving proper adaptation within the ideal apical limit. [11] According to the guidelines by American Academy of Pediatric dentistry, An absorbable collagen wound dressing can be applied at the root end of a canal if complete closure cannot be achieved by MTA in those circumstances. This will allow MTA to be packed inside the canal area. The final portion of the canal is filled with gutta percha. Gutta percha can be substituted with MTA or composite resin in the canal space if the canal walls are thin, strengthening the tooth against fracture. [13] In a study by Lee et al., who evenly separated 40 necrotic, immature, open-apex incisors into several groups for an apexification investigation (calcium hydroxide and MTA with hand and ultrasonic filing). Two conclusions were drawn: teeth treated with calcium hydroxide elongated their roots better and required less time to do so for apical barrier in MTA apexification with ultrasonic filing.[14] In a systematic review and meta analysis, MTA when compared to EndoSequence Root Repair Material and calcium hydroxide, Although the success rates of the three materials were nearly comparable in terms of clinical symptoms, MTA and EndoSequence BCRRM are superior to calcium hydroxide due to their faster apical barrier formation times and one-visit treatments. However, there have been very few studies comparing these two materials, and more research is required in the future..[15]

CONCLUSION

MTA has a wide range of applications in endodontics. Its use as a tool for apexification has considerably increased. The establishment of an optimal apical seal, the reduction of appointments to one or two, and good biocompatibility are some of this material's most valuable benefits for the formation of an apical barrier. Although more research is necessary to identify MTA's indications, it can safely take the place of traditional calcium hydroxide as apexification materials.

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Figure 1: Pre operative image

Figure 2: Working length determination

Figure 3: After MTA apexification with 11 and obturation with 21

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Figure 4: Post obturation with 11

Figure 5: After composite restoration

Figure 6. Metal post placement with 21

Figure 7: Crown preparation with 21

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Figure 8. Post operative image