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Mineral Trioxide Aggregate Apexification in Traumatised Young Immature Central Incisors: A Clinical Case Report

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Abstract: Aim: *The aim of this article is to report a successful treatment of traumatised young immature central incisors.*

Background: *Root canal treatment in teeth with open apices along with periapical infection is difficult to treat. Apexification can be defined as a method to induce a calcified barrier in a root with an open apex or the continued apical development of teeth with incomplete roots and a necrotic pulp.*

Case description: *Here, a case of traumatized upper anterior teeth 11 and 21 in a 10 year old boy is presented. The radiographic evaluation revealed open apices with blunderbuss canals, the canals were cleaned using intracanal instruments and saline (0.9%w/v). To obtain canal disinfection slurry of triple antibiotic paste was temporized in the canal. In subsequent appointments, 4-5mm apical plug was created with MTA and allowed to set. Subsequently, the root canals were obturated. The patient was asymptomatic after 3 months follow up.*

Conclusion: *Managing a tooth with open apex with a biocompatible material MTA has become a single visit procedure. The primary advantages of this material as an apical barrier include development of proper apical seal and excellent biocompatibility. Single visit apexification with a novel biocompatible material like MTA is a new boon in effective management of teeth with open apex. This innovative procedure is predictable and less time consuming one.*

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I. Background

Root development is through the continuous deposition of dentin and cementum by stimulation and differentiation of Hertwig's Epithelial Root Sheath and surrounding undifferentiated progenitor cells.[1] Interference in this development by trauma or infection can lead to incomplete root development and the presence of an open apex and a wide funnel shaped canal.[2]

One of the aims of root canal treatment is to fill completely the root canal system in order to prevent re-infection. In teeth with incomplete root development as a consequence of pulp necrosis through trauma and caries, the absence of a natural constriction at the end of the root canal makes control of filling materials difficult. Because of the lack of an apical constriction, an alternative to standard root canal treatment, apexification or root-end-closure, has been advocated **(Seltzer 1988)**. Apexification can be defined as a method to induce a calcified barrier in a root with an open apex or the continued apical development of teeth with incomplete roots and a necrotic pulp. **(American Association of Endodontics 2003)**[3]

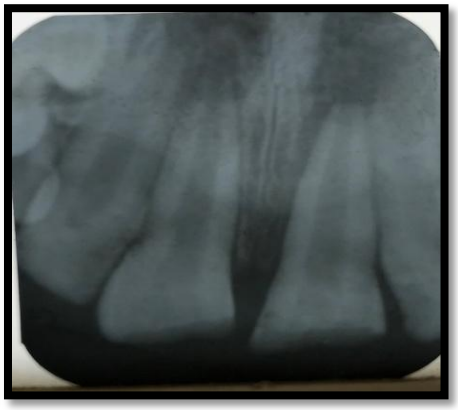
Calcium hydroxide has been widely used for the induction of hard tissue barrier. However this material requires 5-20 months to form the hard tissue barrier[4], and the number of dressings needed for complete closure of apex. It has also been shown that the use of calcium hydroxide weakens the resistance of the dentin to fracture.[5] In recent time, Mineral trioxide aggregrate (MTA) has gained widespread popularity for the apexification procedure. It produces apical hard tissue formation with significantly greater consistency than calcium hydroxide.[6] MTA has the advantages over the calcium hydroxide that it can be done in a single visit procedure. Apexification using MTA has several advantages as it neither gets resorbed nor weakens the root canal dentin and also sets in wet environment. MTA helps in the formation of cementum and osteiod – like tissue because of its alkaline pH and release of calcium and phosphorus ion.[7]

Thus, the present case report demonstrate the successful use of MTA to induce root end closure in traumatised young permanent central incisor.

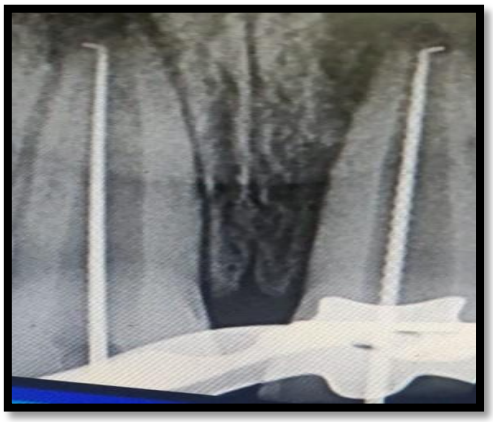
II. Case Description

A 10 years old male patient accompanied by his mother reported to Department of Pedodontics and Preventive dentistry, Himachal dental college Sundernagar, Himachal Pradesh with a chief complaint of pain and swelling in upper front teeth. Detailed history revealed that patient had fallen while playing at home, fracturing his upper right and left central incisors 3 months back **(Fig.1)**. On Clinical examination, it was found that there was crown fracture in relation to right and left maxillary central incisors (11 and 21) and left maxillary central incisor was associated with swelling. Radiographic examination showed an incompletely formed apex surrounded by a diffuse radiolucent lesion in relation to 11 and 21 **(Fig.2)**. The final diagnosis was pulpal necrosis with chronic apical periodontitis in relation to tooth 21 and 11 (Ellis Class IV). After detailed discussion with the patient's mother, we decided to perform MTA apexification procedure. Written consent was obtained from the patient's parents. After rubber dam isolation, access cavity was prepared and the working length radiograph was taken to bend the file at the tip (0.5-1mm) to 90^{o} angle using an endodontic gauge (Dentsply Maillefer) **(Fig.3)**. The canals were prepared with nickel titanium rotary files - Pro Taper Gold. The orifices and the coronal parts were prepared with S_X file and the canals were irrigated with saline (0.9%w/v). The canals were dried with sterile absorbent paper points and Triple antibiotic paste (containing minocycline, ciprofloxacin and metronidazole (1:1:1 ratio) with propylene glycol as the vehicle was placed for disinfection of root canals and the access cavity was sealed with Cavit. Patient was recalled after 2 weeks. On second visit, the triple antibiotic paste was removed with copious irrigation of normal saline and the apical portion of canals were prepared with F_1 and F_2 files. The canals were thoroughly dried with absorbent paper points. White MTA Angelus (Angelus, Londrina, PR, Brazil) was mixed according to manufacture's guidelines and was placed with MTA carrier in the apical portion of the canal, subsequent increments were condensed with minimal pressure using broad end of appropriate sized paper points till a thickness of 4-5mm **(Fig.4)**. Due to its hydrophilic nature, MTA adapts well to the periapical tissues. A check radiograph was obtained to evaluate the apical seal. A sterile cotton pellet moistened with sterile water was placed over the canal orifice and the access cavity was sealed with Cavit. The next appointment was scheduled after 24 hours wherein the hard set of MTA was confirmed and the remainder of the root canal was obturated using lateral condensation technique with F2 gutta percha cone with respect to 11 and 21 followed by composite build up **(Fig.5 & 6)**.

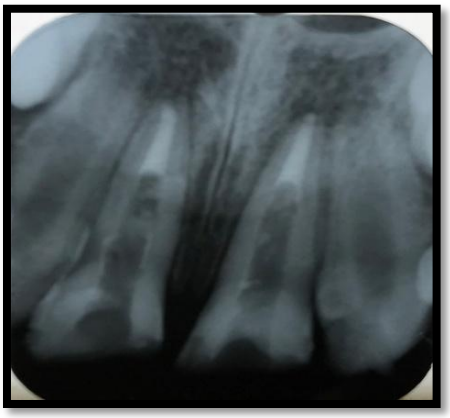
(Fig.1) Pre-operative



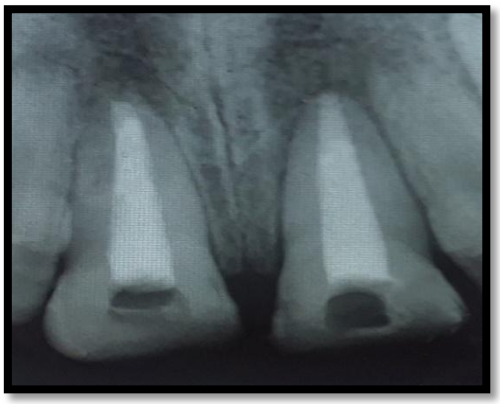
(Fig.2) Pre-operative IOPAR



(Fig.3) Working length



(Fig.4) MTA Plug



(Fig.5) Post Obturation

(Fig.6) Post- operative

III. Discussion

The success in endodontics is dependent on obtaining a perfect seal at the apical portion. The endodontic treatment of non vital immature anterior teeth after trauma remains complicated because of necrotic pulp tissue, large open apices, divergent root walls, thin dentinal walls, and frequent periapical lesion. The main aim of root end material is to seal the apical portion of the canal and to obtain hermetic seal between periodontium and the root canal system.[8] The apical closure helps to compact the obturating material into the canal promising for one visit apexification. Apexification is supposed to create an environment to permit deposition of periodontal tissues to continue root development. The most promising alternative to $Ca(OH)_2$ is MTA. The advantages of this material : reduction in treatment time, immediate restoration of tooth , no adverse effect on the mechanical properties of root dentin. However, the conventional apexification material $Ca(OH)_2$ has shown inherent disadvantages such as variability in treatment time, unpredictability of apical closure, difficulty in patient follow-up, failure in controlling infection, recurrence of infection, cervical fracture, and increased risk of root fracture.[5,6,9]

MTA has been developed by Torabinejad and coworkers in 1993 at Loma Linda University and is available as grey and white MTA. The material consists of tricalcium silicate, tricalcium aluminate, tetracalcium alumina ferrite, and calcium sulphate dihydrate and silicate oxide. Presence of bismuth oxide makes it radiopaque. The powder consists of fine hydrophilic particles that set in the presence of moisture. The hydration of the powder results in a colloidal gel with a pH of 12.5 that will set in approximately 3 hours.[10,11]

MTA provides a favorable environment for the cementum deposition because of the presence of calcium and phosphorus ion which induces osteoblastic or cementoblastic activity. The US Food and Drug Administration approved mineral trioxide aggregate (MTA) in 1998 as a therapeutic endodontic material for humans.[10,12] MTA has been shown to have superior sealing ability to amalgam, zinc oxide eugenol, intermediate restorative material (IRM) and super-ethoxybenzoic acid.[13-16]

The microhardness of 2mm and 5mm thicknesses of GMTA and WMTA was investigated when the materials were used as an apical barrier. Regardless of the formulation of MTA or placement technique used, a 5mm thickness was found to be significantly stronger with less leakage than a 2mm thickness.[17] A scientific article investigated displacement of MTA as an apical barrier material in teeth with open apices, showing that 4mm thickness of the apical barrier offers significantly more resistance to displacement than 1mm thickness.[18] This suggests that the thickness of MTA directly affects its hardness, sealing ability, and displacement when used as an apical barrier. Therefore, in accordance with the previous studies, in our case reports 4-5mm of MTA apical plug was placed.

Aminoshariae et al. (2003) evaluated placement of MTA using hand and ultrasonic condensation and suggested that hand condensation resulted in better adaptation and fewer voids than ultrasonic condensation. Accordingly, in these cases hand condensation was used to compact MTA at the apex.[19]

Maroto et al. have reported successful apexification with MTA in a tooth that did not respond favourably after 3 years of therapy with $Ca(OH)_2$.[9] **Kusgoz et al**. stated that necrotic pulp in teeth with open apices in which MTA as a filling material is effective with shorter treatment time and better sealing ability.[20]

In a comparative study on effectiveness of traumatized young permanent incisors, MTA demonstrated good success and an effective option for apexification with the advantage of reduced treatment time, good sealing ability and being biocompatible and provide barrier for immediate obturation.[21] However, MTA is much expensive and more difficult to work with during placement in a root canal due to its sandy consistency when hydrated.[22]

In the MTA plug technique, root canals must be disinfected with triple antibiotic paste before placing MTA for 2 weeks. This is because performing chemo-mechanical preparation alone is not effective for complete

elimination of microorganisms. Hence, we used triple antibiotic paste, in this case, in between the appointments in the root canal for disinfection.

IV. Conclusion

MTA has numerous applications in endodontic therapy that range from apexification to pulpotomy. MTA provides with multiple advantages which include reduced number of appointments, development of proper apical seal and excellent biocompatibility. MTA sets in the presence of moisture and does not require a moisture free environment. Apexification with novel biocompatible material like MTA is a new boon in effective management of teeth with open apex. Therefore, MTA apexification can be feasible and effective treatment for open apices.

References

[1]. **Andreason JO, M Torabinejad, R D Finkelman.** Response of oral tissues to trauma in Anderason JO, Anderason FM Textbook and the color atlas of traumatic dental injuries to the teeth. Third edition, Munksgaard. Chapter 2, 77-133.
[2]. **P Gaitonde and K Bishop**. Eur. J. Prosthodont. Rest. Dent., Vol.15, No. 1, pp 41-45
[3]. **American Association of Endodontists (2003)** Glossary of Endodontic Terms, 7th edn. Chicago:American Association of Endodontists
[4]. **Sheehy EC, Roberts GJ.** Use of calcium hydroxide for apical barrier formation and healing in non‐ vital immature permanent teeth: A review.Br Dent J 1997;183:241‐ 6.
[5]. **Andreasen JO, Farik B, Munksgaard EC.** Long‐ term calcium hydroxide as a root canal dressing may increase risk of root fracture. Dent Traumatol 2002;18:134‐ 7.
[6]. **Shabahang S, Torabinejad M, Boyne PP, Abedi H, McMillan P.** A comparative study of root‐ end induction using osteogenic protein‐ 1, calcium hydroxide,and mineral trioxide aggregate in dogs. J Endod 1999;25:1‐ 5.
[7]. **Komabayashi T, Spångberg LS.** Comparative analysis of the particle size and shape of commercially available mineral trioxide aggregates and Portland cement: A study with a flow particle image analyzer. J Endod 2008;34:94-8.
[8]. **Bodrumlu E.** Biocompatibility of retrograde root filling materials: A review. Aust Endod J 2008;34:30-5.
[9]. **M. Maroto, E. Barberia, P. Planells, and V. Vera.** "Treatment of a non-vital immature incisor with mineral trioxide aggregate (MTA)," Dental Traumatology, vol. 19, no. 3, pp. 165–169, 2003.
[10]. **Torabinejad M, Hong CU, McDonald F, Pitt Ford TR**: Physical and chemical properties of a new root-end filling material. J Endod, 1995; 21(7): 349-353.
[11]. **Torabinejad M, Hong CU, Pitt Ford TR, Kettering JD**: Antibacterial effects of some root end filling materials. J Endod, 1995; 21(8): 403-406
[12]. **Schwartz RS, Mauger M, Clement DJ, et al.** Mineral trioxide aggregate: a new material for endodontics. J Am Dent Assoc 1999;130:967–75
[13]. **Torabinejad M, Hong C, Pitt FT, et al.** Cytotoxicity of four root-end filling materials. J Endod 1995;21:489–92
[14]. **Pitt FT, Torabinejad M, Abedi H, et al.** Using mineral trioxide aggregate as a pulp-capping material . J Am Dent Assoc 1996;127:1491–4
[15]. **Sluyk S, Moon P, Hartwell G.** Evaluation of setting properties and retention characteristics of MTA when used as a furcation perforation repair material. J Endod 1998;24:768–71
[16]. **Tang HM, Torabinejad M, Kettering J.** Leakage evaluation of root-end filling materials using endotoxin. J Endod 2002;28:5–7
[17]. **G. D. Matt, J. R. Thorpe, J. M. Strother, and S. B. McClanahan.** "Comparative study of white and gray Mineral Trioxide Aggregate (MTA) simulating a one- or two-step apical barrier technique," Journal of Endodontics, vol. 30, no. 12, pp. 876–879, 2004.
[18]. **D. R. Hachmeister, W. G. Schindler, W. A. Walker III, and D. D. Thomas.** "The sealing ability and retention characteristics of mineral trioxide aggregate in a model of apexification," Journal of Endodontics, vol. 28, no. 5, pp. 386–390, 2002.
[19]. **A. Aminoshariae, G. R. Hartwell, and P. C. Moon.** "Placement of mineral trioxide aggregate using two different techniques,"Journal of Endodontics, vol. 29, no. 10, pp. 679–682, 2003.
[20]. **Kusgoz A, Yildirim T, Tanriver M, Yesilyurt C.** Treatment of horizontal root fractures using MTA as apical plug: report of 3 cases. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2009 May 31; 107(5):e68-72.
[21]. **S. G. Damle, H. Bhattal, and A. Loomba.** "Apexification of anterior teeth," Journal of Clinical Pediatric Dentistry, vol. 36, no. 3, pp. 263–268, 2012.
[22]. **G. N. Glickman and K. A. Koch.** "21st-century endodontics," Journal of the American Dental Association, vol. 131, pp. 39S 46S, 2000.

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