Journal of Applied Dental and Medical Sciences
NLM ID: 101671413 ISSN:2454-2288
Volume 6 Issue 1 Jan-March 2020

Case Report

Management of immature open apex using Mineral Trioxide Aggregate Plug Technique- Case Report

Vijay Ugale[1], Mohini Lokhande[2], Swapnil Kolhe[3], Meenal Gulve[4]

[1]Lecturer, Department of Conservative Dentistry and Endodontics, MGV's KBH Dental College and Hospital, Nashik
[2]Part III MDS, Department of Conservative Dentistry and Endodontics, MGV's KBH Dental College and Hospital, Nashik
[3]Professor, Department. of Conservative Dentistry and Endodontics, MGV's KBH Dental College and Hospital, Nashik
[4]Principal and Head of The Department, Department of Conservative Dentistry and Endodontics, MGV's KBH Dental College and Hospital, Nashik

ARTICLE INFO

ABSTRACT

Trauma or caries during root development causes pulp necrosis result in immature root formation. The absence of a natural constriction at the end of the root canal makes control of filling materials difficult. Apexification or induction of apical closure is choice for such condition. Most commonly used materials are calcium hydroxide or MTA. MTA has several advantages such as good sealing property, biocompatibility and periradicular tissue regeneration. This case report present management of maxillary anterior teeth with immature open apex using mineral trioxide aggregate apical plug.

Keywords:
Apexification, Calcium Hydroxide, immature open apex, mineral trioxide aggregate.

INTRODUCTION

Health The primary objective in endodontic therapy is complete obturation of root canal space to prevent reinfection.[1] Management of immature root with a necrotic pulp and apical periodontitis is a challenging task. Incomplete root development caused by trauma, caries and other pulpal pathosis, result in absence of natural constriction at the end of the root, causes difficulty in obturation of the root canal.[2] The aim is to seal a sizeable communication between the root canal system and the periradicular tissue and provide a barrier against which obturation material can be compacted.[2] 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 Endodontists 2003). Calcium hydroxide and MTA is most commonly used for this purpose. Calcium hydroxide is used for the induction of hard tissue barrier. But, this material requires 5–20 months to form the hard tissue barrier and also weakens the resistance of the dentin to fracture.[3] This unpredictable and often lengthy course of this treatment create the challenges, including the vulnerability of the temporary

* Corresponding author: Dr. Vijay B. Ugale,01, Atharv Heights,Karmayogi Nagar, Nashik.Mobile No. 7972280772Email Address-vijayugale81@gmail.com

coronal restoration to re-infection. Moreover, the treatment requires a high level of patient compliance.[4]

A one step apexification procedure eliminates these problems. It implies the non-surgical compaction of a biocompatible material into the apical end of the root canal, thus, creating an apical stop and enabling immediate filling of the root canal.[5] MTA has been described as a good material for this procedure owing to its good canal sealing property, biocompatibility and ability to promote dental pulp and periradicular tissue regeneration and produces apical hard tissue formation with significantly greater consistency than calcium hydroxide.[6] It has been reported that MTA root fillings placed at the cemental canal limit showed better results than overfillings and helps inthe formation of bone and periodontium around its interface.[7] It also offers a barrier at the end of the root canal (apical plug) in teeth with necrotic pulps and open apices that permits vertical condensation of warm gutta-percha in the remaining canal.[7]

This article presents a case treated with MTA apexification in immature open maxillary anterior teeth.

Case 1

A 21 year old female patient reported with a chief complaint of pain in maxillary right central and lateral incisor. History revealed that the patient had suffered trauma 10 years back and undergone treatment in a private clinic. The medical history was not significant. Clinical examination revealed slightly grayish discolored tooth 11 and 12 and previously attempted root canal treatment in the same tooth. The tooth was tender to percussion. Intraoral periapical radiograph showed well-defined periapical radiolucency and previous endodontic treatment with over extended gutta-percha in relation to 11 (Fig.1). After examination ReRCT of 11 and 12 was decided. After written consent, complete removal of GP radiograph showed wide open apex in relation to 11. After discussing different treatment options with the patient, we opted to go for MTA apexification. Working length was established by radiograph (Fig.2). Root canal was chemo-mechanically debrided with circumferential filing using the International Organization for Standardization (ISO) 80 K-file (DentsplyMaillefer, Switzerland) in conjunction with copious amount of 3% sodium hypochlorite (Shivam Industries, India) and 17% ethylenediaminetetraacetic acid (EDTA) solution. The canals were dried with sterile paper points and filled with calcium hydroxide (Metapex, Meta Biomed Co. Ltd., Korea) and the access cavity was sealed with Cavit (3M ESPE AG, Seefeld, Germany). One week later, tooth was again accessed under rubber dam isolation, and copious amount of normal saline was used to remove any remnants of the calcium hydroxide medicament. Canal was thoroughly dried with absorbent paper

points. White MTA Angelus (Angelus, Londrina, PR, Brazil) was mixed according to manufacturer's instructions and carried to the canal with an amalgam carrier. Apical plug of 5mm of thick paste of MTA was condensed using hand pluggers and confirmed radiographically (Fig.3). After placing a moist cotton pellet, the access cavity was restored with Cavit. After 72 hours, the hard set of MTA was confirmed and the remainder of the root canal was obturated with thermoplasticized gutta-percha (Obtura II, Obtura Spartan, and Fenton, Missouri, USA) and zinc oxide eugenol sealer followed with post endo restoration with composite (Fitek Z350 XT 3M ESPE) (Fig. 4).

Figure 1

Figure 2

Figure 3

Figure 4

Case 2

A 20 -year-old male patient presented with the chief complaint of discomfort while chewing in front region of upper jaw. Patient gave a history of traumatic incident 5 years back for which she had visited a private clinic. Medical history was insignificant. Clinical examination revealed slightly discolored tooth 12 and previously attempted treatment in the same tooth. The tooth was tender to percussion. Tooth also did not respond to cold and electric pulp vitality tests. Intraoral readiograph showed a well-defined periapical radiolucency surrounding the wide open apex of tooth 12 (Fig.5). Diagnosis was pulpal necrosis with chronic apical periodontitis. After detailed discussion with the patient, we decided to perform MTA apexification procedure. Written consent was obtained from the patient. After rubber dam isolation, access cavity was prepared and working length determined using the radiograph (Fig.6). Root canal was chemo-mechanically debrided with circumferential filing using the International Organization for Standardization (ISO) 80 K-file (DentsplyMaillefer, Switzerland) in conjunction with copious amount of 3% sodium hypochlorite (Shivam Industries, India) and 17% ethylenediaminetetraacetic acid (EDTA) solution. The canals were dried with sterile paper points and filled with calcium hydroxide (Metapex, Meta Biomed Co. Ltd., Korea) and the access cavity was sealed with Cavit (3M ESPE

AG, Seefeld, Germany). One week later, tooth was again accessed and copious amount of normal saline was used to remove any remnants of the calcium hydroxide medicament. Canal was thoroughly dried with absorbent paper points. White MTA Angelus (Angelus, Londrina, PR, Brazil) was mixed according to manufacturer's instructions and carried to the canal with an amalgam carrier. Apical plug of 5mm of thick pasteof MTA was condensed

using hand pluggers and confirmed radiographically (Fig.7). After placing a moist cotton pellet, the access cavity was restored with Cavit. After 72 hours, the hard set of MTA was confirmed and the remainder of the root canal was obturated with thermoplasticized gutta-percha (Obtura II, Obtura Spartan, and

Figure 6

Figure 7

Figure 8

Figure 9

Fenton, Missouri, USA) and zinc oxide eugenol sealer followed with post endodontic restoration with composite (Filtek Z350 XT 3M ESPE) (Fig. 8).

Discussion

Apexification is necessary to obtain an apical barrier which prevent the passage of toxins and bacteria into periapical tissues, also this barrier is mandatory to allow the compaction of the root filling material.[8] Apexification is supposed to create an environment to permit deposition of periodontal tissues to continue root development.[9] Calcium hydroxide has been considered as an efficient material for this purpose. This chemical has several disadvantages such as difficulty of the patient's recall management and delay in the treatment, unpredictability of apical closure, failure in controlling infection, recurrence of infection.[10,11] Furthermore, there is cervical fracture, and increased risk of root fractureafter dressing.[12] MTA has

been developed by Torabinejad and coworkers in 1990 at Loma Linda University. It is available as grey and white MTA. The material consists of tricalcium silicate, tricalcium aluminate, tetracalcium aluminoferrite, and calcium sulphate dihydrate and silicate oxide. Presence of bismuth oxide makes it radiopaque. pH of the material is 12.5 at three hours.[13] The US Food and Drug Administration approved mineral trioxide aggregate (MTA) in 1998 as a therapeutic endodontic material for humans.[14] The advantages of this material are (i) reduction in treatment time, (ii) immediate restoration of the tooth, (iii) no adverse effect on the mechanical properties of root dentin. In a prospective study, apexification treatment with MTA showed a high prevalence of healing and apical closure.[4] In MTA plug technique, root canals must be disinfected with calcium hydroxide because performing chemo-mechanical preparation alone is not effective for complete elimination of microorganisms and recent data suggest that the combination of MTA and calcium hydroxide in apexification procedures may favourably influence the regeneration of the periodontium.[15] Cwikla et al. in their in vitro study determined the antibacterial efficacy of three $Ca(OH)_2$ formulations and found $Ca(OH)_2$ mixed with iodoform and silicon oil (Metapex) was the most effective dentinal tubule disinfectant.[16] Therefore, in our case reports after minimal root canal preparation $Ca(OH)_2$ with iodoform and silicon oil (Metapex) short term dressing was given to disinfect the root canal followed by application of MTA.

Matt GD et al[17] investigated the microhardness of 2mm and 5mm thicknesses of white MTA used as an apical barrier and 5mm thickness was found to be significantly stronger with less leakage than a 2mm thickness egardless the placement technique used. The previous study investigated displacement of MTA as an apical barrier material in teeth with open apices, showing that 5mm thickness of apical barrier offers significantly more resistance to displacement than 1mm thickness. This suggests that the thickness of MTA directly affects its hardness, sealing ability and displacement when used as an apical barrier.[18] Therefore, in accordance with the previous studies, in our case reports 5mmofMTAapicalplugwasplaced.Aminoshariae and coworkers with radiographic and microscopic evaluation showed that hand method of placement and condensation of MTA resulted in better adaptation with fewer voids than the ultrasonic method.[19] Accordingly in the present case reports MTA placement and condensation followed manually with pluggers. In a comparative study on effectiveness of MTA and $Ca(OH)_2$ in apexification, MTA demonstrated good success and an effective option for apexification. However, MTA is much expensive and more difficult to work with during placement in a root canal due to

its naturally sandy consistency when hydrate.[20]

Conclusion

Apexification in one visit by placing an apical plug of MTA is a predictable and reproducible clinical procedure. The primary advantages of this material as an apical barrier include development of proper apical seal and excellent biocompatibility. This innovative procedure is predictable and less time consuming one.

References

1. Kumar AG, Kavitha A. Single visit apexification with mineral trioxide aggregate. Indian J Dent Adv 2010;2:122–4.
2. 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.
3. 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.
4. Simon S, Rilliard F, Berdal A &MachtouP. The use of mineral trioxide aggregate in one-visit apexification treatment: a prospective study.Intendod J 2007;40;186-97.
5. Gangamwar N, Chandak M, NikhadeP, Ikhar A, Kela S, et al. Apexification with MTA placement – a case report . J Dent Med Sci2015;10:70-3.
6. Purra AR, Ahangar FA, Chadgal S, Farooq R. Mineral trioxide aggregate apexification: A novel approach. J Conserv Dent 2016;19:377-80.
7. Torabinejad M, Pitt Ford TR, McKendry DJ, Abedi HR, Miller DA, Kariyawasam SP. Histologic assessment of mineral trioxide aggregate as a root-end filling in monkeys. J Endod 1997;23:225-8.
8. Kubasad GC, Ghivari SB. Apexification with apical plug of MTA-report of cases. Arch Oral Sci Res 2011;1:104- 107.
9. Kumar V, Zameer M, Prasad V, Mahantesh T. Boon of MTA Apexification in Young Permanent Posterior Teeth. Hindwi pub 2014;
10. Dominguez Reyes A, Muñoz Muñoz L, Aznar Martín T. Study of calcium hydroxide apexification in 26 young permanent incisors. Dent Traumatol 2005;21:141-5.
11. Maroto M,Barbera E, PlanellsP,Vera V. Treatmentof a non-vital immature incisor with mineral trioxide aggregate (MTA). DentalTraumatol 2003;19:165–9.
12. Shabahang S, Torabinejad T, Boyne PP, Abedi H, McMillan P. A comparative study of root-end induction using osteogenic protein-1, calcium hydroxide, and mineral

trioxide aggregatein dogs. J Endod 1999;25:1–5.
13. Torabinejad M, Chiavian N. Clinical applications of mineral trioxide aggregate. J Endod 1993; 25:197-205.
14. Schwartz RS, Mauger M, Clement DJ, et al. Mineral trioxide aggregate: a new material for endodontics. J Am Dent Assoc 1999;130:967–75.
15. Ham KA, Witherspoon DE, Gutmann JL, Ravindranath S, Gait TC, Opperman LA. Preliminary evacuation of BMP-2 expression and histological characteristics during apexification with calcium hydroxide and mineral trioxide aggregate. J Endod 2005;31:275–9.
16. Cwikla SJ, Belanger M, Giguere S, Progulske-Fox A, Vertucci FJ. Dentinal tubule disinfection using three calcium hydroxide formulations. J Endod 2005; 31:50–2.
17. Matt GD, Thorpe JR, Strother JM, McClanahan SB. Comparative study of white and gray Mineral Trioxide Aggregate (MTA) simulating a one- or two-step apical barrier technique. J Endod 2004;30:876–9.
18. Hachmeister DR, Schindler WG, Walker WA, Thomas D. The sealing ability and retention characteristics of mineral trioxide aggregate in a model of apexification. J Endod 2002;28:386–90.
19. Aminoshariae A, Hartwell GR, Moon PC. Placement of mineral trioxide aggregate using two different techniques. J Endod 2003;29:679–82.
20. Damle SG, Bhattal H, Loomba A. Apexification of anterior teeth. J ClinPed Dent 2012;36:263–8.