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Management of non-vital anterior teeth with open apices: A study detailing two cases

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ABSTRACT

Treatment of teeth with open apex requires careful handling and diligence in clinical practice. Prognosisof endodontic treatment in such cases is directly related to the quality of apical obturation. Previously,a calcified barrier using calcium hydroxide treatment was recommended as an approach for these caseshowever due to various drawback of this method, current management approach suggests apexificationthrough an apical plug at the apical segment. This report describes two cases of apexification of upperleft incisor using mineral trioxide aggregate plug. After two year follow up, both teeth are clinicallyand radio graphically asymptomatic and the healing of the apical area is visible.

INTRODUCTION

The endodontic treatment of teeth with open apex canbe a challenge in daily practice. The apical anatomy ofthese teeth is characterized by greater width at the apicalportion, absence of apical constriction and thin dentinalwalls. Endodontic treatment of these teeth requires completeelimination of bacteria from the root canal and preventionof re-infection canal space. However, difficultiesin establishing the working length (WL)[1] and extrusion of irrigation or obturation materials[2] is possible duringtreatment. In order to allow the condensation of the rootfilling material and to promote an adequate apical seal, it is necessary to create an apical barrier.[3]Apexification is a treatment option that is done withthe aim of apical repair by formation of hard tissue barrierthrough apex. Conventionally, a calcified barrier is inductedusing a calcium hydroxide (CaOH2) mixture.[4]Completeformation of the calcified apical barrier is usually lastslong, requiring 6 to 24 months of treatment time[5]Althoughopposite has been reported by Chala et al.[6] durationof this method has several drawbacks such as the riskof tooth fracture due to prolonged use of CaOH2[7]withre-infection of the root canal[8] or difficulties in patientrecall. Considering all these negative factors, single-visitapexification is suggested for the management of teethwith open apex[9]Mineral trioxide aggregate (MTA) was described as analternative to traditional apexification treatment[10] whichincorporates the application of the material in the apicalthird of the canal to create an apical barrier. MTA is a biomaterialwith excellent biocompability and superior sealingabilities even in the presence of moisture.This report describes two cases of apexification in teethwith open apex managed with apical barrier technique.

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CASE REPORT

Case 1– An 17 year old female patient ongoing orthodontictreatment was referred to Rama Dental College, Hospital and Research Centre Departmentof Endodontics. Clinical investigation revealed aslight discoloration on maxillary left incisor. Palpation andpercussion was negative at the related area. Mobility andperiodontal probing was within physiological limits. Radiographicexamination showed an incomplete root formationalong with a periapical lesion located lateral to theapex for tooth #21 and (Fig. 1a). Pulp vitality with coldtest (Endo-Frost, Roeko, Langenau, Germany) and electricpulp testing (Digitest II, Parkell Inc), gave a negativeresponse which was suggestive of pulp necrosis. Consideringthe width of the apex, an apical plug was decided asthe treatment plan. Patient was informed with the treatment plan and a consent form was obtained.In the first session, coronal access was prepared with a round burr followed by rubber-dam placement for isolation.The WL was estimated by periapical radiographyusing a #90 K-file. Cleaning and shaping was done withcrown-down instrumentation together with 2.5% NaOClirrigation (PPH Cerkamed, Poland) and continuous aspirationto avoid any accidental extrusion of the solution.
Then, the canal was dried with sterile paper points andfilled with a mixture of CaOH2 powder (Sultan, USA)and saline and the tooth was temporarily restored. One week later, the intracanal medicament was removed andcanal was irrigated with 2.5% NaOCl solution. The canalwas dried with sterile paper points. MTA (Angelus, Londrina, Brazil) was mixed according to manufacturer'sinstructions. The mixture was applied inside the canal usingMTA gun and positioning of the material was checked with radiography. Using hand pluggers (Queen, Hungary),4-mm thick MTA plug was applied gently and packedinto the apical segment followed by a confirmation radiography (Fig. 1b). A moistened cotton pellet was appliedover the canal orifice and the tooth was temporarily restored.Next day, the setting of the plug was checked withan MTA plugger #4 through a gentle pecking motionand the rest of the canal was obturated with gutta percha (MetaBiomed, Korea) and a resinbased sealer (Adseal,MetaBiomed, Korea) using lateral condensation (Fig. 1c).Tooth was restored with composite (3M Filtek, 3M, USA) following root canal obturation. Orthodontic treatmentwas reassigned the following week.
Two year radiographic control showed that the periapicallesion at the apex was no longer present (Fig. 1d).Tooth was clinically and radiographically asymptomatic.

Case 2 – A 15 year old female patient was referred toRama Dental College, Hospital and Research CentreDepartment of Endodontics with thecomplaint of a crack on upper anterior region with thehistory of trauma 2 years prior to the time of reporting.Clinical examination showed a fracture on tooth #21. Thetooth was not tender to palpation or percussion testing.
Mobility and periodontal probing was within physiologicallimits. Radiographic examination revealed an immatureapex (Fig. 2a). Tooth was not responsive to cold and electrical pulp testing. The treatment plan included apexificationwith MTA apical plug. An informed consent wastaken from the patient and his parents.Coronal access was prepared with a round burr andcaries was removed. The canal was easily located and WLwas determined through radiography. Gentle circumferentialfiling used to remove necrosed pulp. Copious irrigation

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with 2.5%NaOCl was done along with continuousaspiration. The canal was dried with sterile paper pointsand a mixture of CaOH2 powder with saline was placedinside. The tooth was temporarily restored and patient reappointedto next week.Next visit, CaOH2 was removed. Shaping and irrigationprotocol was followed as described above. The canal

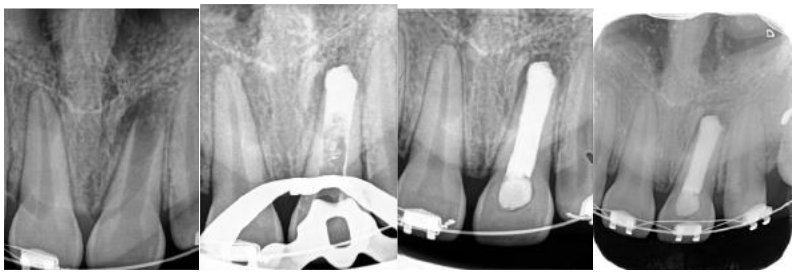

Fig. 1. (a) Preoperative radiography**(b)** Induction of apical plug**(c)** Canal obturation**(d)** 2 year follow up.

Fig. 2. (a) Preoperative radiography; **(b)** Apical plug with MTA; **(c)** Canal obturation; **(d)** 2 year follow up.

was dried and MTA (Angleus, Londrina, Brazil) mixed accordingto manufacturer's instructions was placed insideusing hand pluggers. A radiographic image was taken to correct the positioning of the material. 4-mm thick MTApacked into the apical segment and confirmation radiographywas taken (Fig. 2b). A moistened cotton pellet was placed at the orifice and patient was rescheduled. Nextday, the hardness of the plug was ensured and the rest ofthe canal was sealed with lateral condensation using GuttaFlow (Roeko, Langenau, Germany) as sealer (Fig. 2c).Patient was referred to the prosthetic department for acrown restoration.The tooth was clinically asymptomatic and functioning normally after two years. Follow-up radiography showedhealing of the apical area (Fig. 2d).

Discussion

Formerly, induction of a calcified barrier using long-termCaOH2 medication was the most common procedure toachieve a biological seal in teeth with incomplete apical formation.[11]Although, the technique showed clinicalsuccess, it had several disadvantages including; prolongedtime period[12] which requires patient's compliance, possibility of re-infection due to temporary sealing[13]or toothfracture during or after the treatment[14]To eliminatethese risks, several studies have proposed one-visit apexification[7,15] by placing MTA which has proven to be asuitable alternative due to its favourable

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physiochemicalproperties, biocompability[16] and high clinical success[3,17] Following the procedure, obturation of the canal andplacement of a coronal restoration is possible[18]Hence,for the cases described here, an apical plug obturation wasthe best approach since both needed an immediate restoration.In this report, the rationale of using an intracanal medicamentprior to final obturation was primarily to limitthe bacterial count since various combinations of bacteriaare found in root canal system of necrotic teeth.[19]

CaOH2 has the ability to provide an antibacterial environmentthus, facilitate the decontamination of the pulpcavity.[20] Additionally, with its high pH, the prior use of CaOH2 dressings becomes necessary to create favourableconditions for MTA setting and improve its properties.[21]Treatment outcome is an important part of evidence based practice.[22] Previously, case reports have been publishedabout the biological apical closure appearing afterthe filling of the root canal. An in-vivo study on dogs[3] reported formation of apical calcified barrier in all teethtreated with an MTA plug. Similarly, in a case-controlstudy of 50 patients,[17] apexification with MTA showed 83% success rate, emphasizing the predictability and prognosisof the treatment.

However, the success of the treatment is directly relatedto the diameter of the foramen or sealing ability andcorrect adaptation of used material. Adel et al.[23] pointedout that an increased diameter of apical foramen or reductionof apical plug thickness significantly increases theapical microleakage of barriers. In an dye leakage studycomparing different depths of MTA, 4-mm thick materialshowed signifcantly more effectiveness[24] which was appliedto the cases present in this report.

In present report, MTA was applied using hand pluggersfor a controlled adaptation of the material. To achievea good seal and retention during orthograd placement of MTA in teeth with open apices, delivery technique couldbe improved[25.]However, a leakage study comparing variousinsertion techniques showed similar sealing abilities when MTA was placed with pluggers, paper-points or ultrasonictips[26.]

As described in the reported cases, the use of MTAdemonstrated clinical and radiographic success at followupcontrols. An apical plug can be a treatment choice for management of teeth with incomplete root formation inneed of an immediate restoration.

Conflict of interest: None declared.

REFERENCES

1. de Jesus Soares A, Yuri Nagata J, Casarin RC, Flávio Affonsode Almeida J, Gomes BP, Augusto Zaia A, et al.Apexification with a new intra-canal medicament: a multidisciplinary case report. Iran Endod J 2012;7:165−70.

2. Trope M, Chivian N, Sigurdsson A. The role of endodonticsafter dental traumatic injuries. In: Cohen SH, editor.Pathways of the pulp. 10 ed. St Louis: Mosby; 2006. p. 610−49.

3. Felippe WT, Felippe MC, Rocha MJ. The effect of mineraltrioxide aggregate on the apexification and periapical healingof teeth with incomplete root formation. Int Endod J 2006;39:2−9.

ISSN: 0975-3583, 0976-2833 VOL12, ISSUE 06, 2021

4. Nair PN. Pathogenesis of apical periodontitis and thecauses of endodontic failures. Crit Rev Oral Biol Med2004;15:348−81.
5. Al Ansary MA, Day PF, Duggal MS, Brunton PA. Interventionsfor treating traumatized necrotic immature permanentanterior teeth: inducing a calcific barrier & rootstrengthening. Dent Traumatol2009;25:367−79.
6. Chala S, Abouqal R, Rida S. Apexification of immatureteeth with calcium hydroxide or mineral trioxide aggregate:systematic review and meta-analysis. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2011;112:e36−42.
7. Andreasen JO, Farik B, Munksgaard EC. Long-term calciumhydroxide as a root canal dressing may increase riskof root fracture. Dent Traumatol2002;18:134−7.
8. Maroto M, Barbería E, Planells P, Vera V. Treatment of anon-vital immature incisor with mineral trioxide aggregate(MTA). Dent Traumatol2003;19:165−9.
9. Khalilak Z, Vali T, Danesh F, Vatanpour M. The Effectof One-Step or Two-Step MTA Plug and Tooth ApicalWidth on Coronal Leakage in Open Apex Teeth. Iran Endod J 2012;7:10−4.
10. Torabinejad M, Chivian N. Clinical applications of mineraltrioxide aggregate. J Endod1999;25:197−205.
11. Corbella S, Ferrara G, El Kabbaney A, Taschieri S.Apexification, apexogenesis and regenerative endodonticprocedures: a review of the literature. Minerva Stomatol 2014;63:375−89.
12. Rafter M. Apexification: a review. Dent Traumatol2005;21:1−8.
13. Torabinejad M, Rastegar AF, Kettering JD, Pitt Ford TR.Bacterial leakage of mineral trioxide aggregate as a rootendfilling material. J Endod1995;21:109−12.
14. Kahler SL, Shetty S, Andreasen FM, Kahler B. The Effectof Long-term Dressing with Calcium Hydroxide on theFracture Susceptibility of Teeth. J Endod2018;44:464−69.
15. Witherspoon DE, Ham K. One-visit apexification: techniquefor inducing root-end barrier formation in apicalclosures. PractProcedAesthet Dent 2001;13:455−60
16. Torabinejad M, Pitt Ford TR. Root end filling materials: areview. Endod Dent Traumatol1996;12:161−78.
17. Simon S, Rilliard F, Berdal A, Machtou P. The use of mineraltrioxide aggregate in one-visit apexification treatment:a prospective study. Int Endod J 2007;40:186−97.
18. Steinig TH, Regan JD, Gutmann JL. The use and predictableplacement of Mineral Trioxide Aggregate in one-visitapexification cases. AustEndod J 2003;29:34−42.
19. Sundqvist GK, Eckerbom MI, Larsson AP, SjögrenUT. Capacity of anaerobic bacteria from necrotic dentalpulps to induce purulent infections. Infect Immun1979;25:685−93.
20. Mohammadi Z, Dummer PM. Properties and applicationsof calcium hydroxide in endodontics and dental traumatology.Int Endod J 2011;44:697−730.
21. Saghiri MA, Lotfi M, Saghiri AM, Vosoughhosseini S,Aeinehchi M, Ranjkesh B. Scanning electron micrographand surface hardness of mineral trioxide aggregate in the presence of alkaline pH. J Endod2009;35:706−10.
22. Peak JD, Hayes SJ, Bryant ST, Dummer PM. The outcomeof root canal treatment. A retrospective study within thearmed forces (Royal Air Force). Br Dent J 2001;190:140−4.

ISSN: 0975-3583, 0976-2833 VOL12, ISSUE 06, 2021

23. Adel M, Nima MM, ShivaieKojoori S, NoroozOliaie H,Naghavi N, Asgary S. Comparison of endodontic biomaterialsas apical barriers in simulated open apices. ISRNDent 2012;2012:359873.
24. Valois CR, Costa ED Jr. Influence of the thickness of mineraltrioxide aggregate on sealing ability of root-end fillingsin vitro. Oral Surg Oral Med Oral Pathol Oral RadiolEndod2004;97:108−11.
25. Hachmeister DR, Schindler WG, Walker WA 3rd, ThomasDD. The sealing ability and retention characteristics ofmineral trioxide aggregate in a model of apexification. J Endod 2002;28:386−90.
26. Alhaddad Alhamoui F, Steffen H, Splieth CH. The sealingability of ProRoot MTA when placed as an apical barrierusing three different techniques: an in-vitro apexification model. Quintessence Int 2014;45:821−7