Avicenna J Dent Res. 2017 December; 9(4):e30189. doi: 10.5812/ajdr.30189.

Published online 2016 February 27. **Case Report**

The Treatment of Immature Teeth With Periapical Lesions Using $Ca(OH)_2$ and MTA: A Case Report

Zakieh Donyavi,[1] Elham Khoshbin,[1] and Zeinab Kavandi[2,*]

[1]Department of Endodontics, Faculty of Dentistry, Hamadan University of Medical Sciences, Hamadan, IR Iran
[2]Dental Faculty, Hamadan University of Medical Sciences, Hamadan, IR Iran

[*]*Corresponding author*: Zeinab Kavandi, Faculty of Dentistry, Hamadan University of Medical Sciences, Hamadan, IR Iran. Tel: +98-9163476531, E-mail: zeinabkavandi@gmail.com

Received 2015 May 25; **Revised** 2015 November 12; **Accepted** 2015 November 15.

Abstract

Introduction: One-step apexification using mineral trioxide aggregate (MTA) has been reported as an alternative treatment modality with more benefits than the use of long-term calcium hydroxide (CaOH) for teeth with an open apex. However, the orthograde placement of MTA is a challenging procedure in terms of length control, especially in teeth with a wide-open apex. Therefore, we took advantage of the desirable properties of Ca(OH)2 in the formation of apical barriers in order to control the length of MTA during placement.
Case Presentation: We would like to report the successful treatment of tooth 8 (in a 10-year-old girl) with an open apex and periapical lesions. In this case, we first used calcium hydroxide to form the primary apical barrier for six months and then we placed an MTA plug.
Conclusions: Based on evidence, both MTA and Ca(OH)2 can be used for the endodontic treatment of non-vital immature teeth. In this case, we took advantage of special properties of MTA and Ca(OH)2 in apexification.

Keywords: Apexification, Mineral Trioxide Aggregate, Open Apices, Calcium Hydroxide

1. Introduction

In teeth with incomplete root development due to pulp necrosis through trauma or decay, the lack of apical constriction at the end of the root canal makes controlling filling materials difficult and reduces the chances of success in a root canal treatment. One option for treating immature teeth with pulp necrosis involves regenerative techniques, including revascularization. Advantages include continued increasing the thickness of the canal walls, apical root development, and apical closure. The technique involves copious irrigation, minimal canal preparation, and the use of antibiotic paste as an interim medication. During a subsequent visit, bleeding is induced in the canal to induce a clot that is covered with MTA. In this case, revascularization was our first choice, but due to the lack of clot formation, we chose an alternative treatment. An alternative for standard root canal treatment, apexification or root-end closure, has been advocated (1). Teeth with an open apex need to be sealed with a hard tissue barrier to prevent bacterial infections and to provide favorable conditions for the formation of calcified tissue in the apical area. Apexification is a method of inducing a calcific barrier in a root with an open apex, or continued apical development of an incompletely formed root in teeth with necrotic pulp (2). According to the existing literature, both MTA and calcium hydroxide can be used efficiently for apexification procedures. Mineral trioxide aggregate (MTA) has been proposed as a material suitable for one-visit apexification (3-5), as it combines biocompatibility (6, 7) and a bacteriostatic action (8) with favorable sealing ability when used to repair root/pulp chamber perforations (9) or a root end filling material (10). For this reason, it is considered an appropriate apexification material (11). When MTA is mixed with sterile water, it forms a colloidal gel, and its setting time is 3 - 4 hours in the presence of moisture (12). MTA had less leakage, better antimicrobial properties, high marginal adaptation, and a short setting time (4 hours) (12, 13). Despite this, difficulties in delivering and filling the canal with MTA material from an orthograde direction have been reported (14, 15).

Calcium hydroxide is one of the most important medicaments used in the treatment of pulp conditions and apical periodontitis (16). The use of $Ca(OH)_2$ in apical barrier formation has shown promising results. Because of its enhanced success rate, easy availability for the clinician, and affordability for patients, it has gained the widest acceptance in the literature (17). Sheehy and Roberts reported that the use of calcium hydroxide for apical barrier formation was successful in 74 - 100% of cases, and the average time for apical barrier formation ranged from 5 to 20 months (18). However, calcium hydroxide as a treatment of choice has several disadvantages, such as multiple patient visits and reduced fracture resistance of the tooth due to the prolonged use of calcium hydroxide (19). In addition, the nature of the barrier formed with calcium hydroxide is incompletely calcified and porous (20), thus each of the methods mentioned above has limitations. In this case, we took advantage of the desirable properties of MTA and $Ca(OH)_2$. One way to prevent the apical extrusion of MTA and, consequently, to obtain a good apical seal is the creation of a primary apical barrier with calcium hydroxide in a long-term period.

2. Case Presentation

An 11-year-old female patient with a history of trauma two years ago and severe pain in tooth 8 was referred to the department of endodontics at Hamadan Dental University. She was not under any treatment. The right maxillary central incisor was non-vital and tender on percussion. Radiographic examination revealed a wide-open apex and an associated periapical lesion was noticed in relation to the right incisor (Figure 1). In this case, revascularization was our first choice. During the first appointment, after the administration of local anesthesia using 2% lidocaine with 1:80000 epinephrine and rubber dam isolation, tooth 8 was accessed (Figure 2). The canal length was confirmed radiographically with the first endodontic instrument. Preparation of the canal was performed very lightly and irrigated using 5/25% sodium hypochlorite (NaOCl). Then, the canal was dried with paper points and an antibiotic paste as an interim medication was spun into the canal. Access to the cavity was sealed with glass inomer (GI). The patient was recalled after three weeks. At a subsequent visit, we tried to induce bleeding in the canal, but we did not reach the result. Hence, we have started apexification. In this case, the apex of the tooth had a divergent form and placing the MTA was very difficult. Therefore, we decided to start apexification with $Ca(OH)_2$. Pure $Ca(OH)_2$ powder was mixed with sterile saline to a thick consistency and packed in the canal (Figure 3), and access was sealed with GI. At 3-month intervals, a radiograph was taken to evaluate whether a hard tissue barrier had formed. After six months, the size of the periapical lesion was reduced (Figure 4), the $Ca(OH)_2$ washed out of the canal with NaOCl, and a radiograph was taken to evaluate the radiodensity of the apical stop. In this case, a hard tissue barrier was partially formed and placing the MTA was easier than before (Figure 5). So, in order to prevent further weakening of the canal walls, we preferred to continue treatment by MTA. $Ca(OH)_2$ was washed from the canal and MTA was mixed and placed into the apical 3 to 4 mm of the canal (Figure 6). A wet cotton pellet was placed against the MTA and left for one day, and then the entire canal was filled with warmed gutta-percha (Figure 7). After filling the root, the material was removed to below the marginal bone level and a bonded resin filling was placed (Figure 8). In this case, after 1.5 year, the periapical lesion healed (Figure 9).

Figure 1. Preoperative Radiograph

3. Discussion

The goal of apexification is to obtain an apical barrier to prevent the passage of toxins and bacteria into the periapical tissues from a root canal (21). Based on the existing literature, both MTA and calcium hydroxide can be used efficiently for apexification procedures. MTA has good sealing ability, good marginal adaptation, a high degree of biocompatibility, and a reasonable setting time, and it can be used in the presence of moisture in the root canal (22). Witherspoon and Ham asserted that MTA provides scaffolding for the formation of hard tissue and the potential

Figure 2. Tooth 8 Was Accessed

Figure 3. Radiographic View After Dressing the Canal With $Ca(OH)_2$

for a better biological seal (23). Despite this, difficulties in

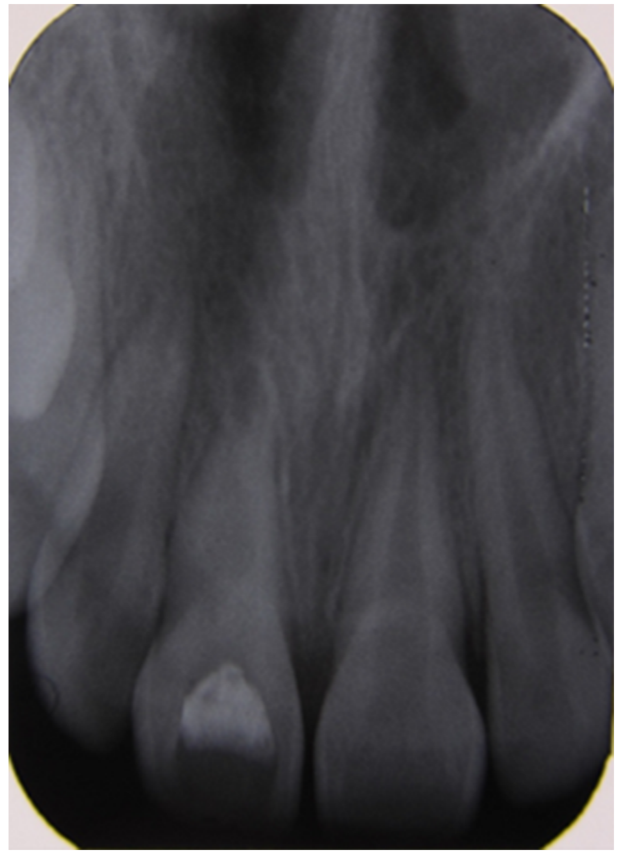

Figure 4. Six Months After Placing $Ca(OH)_2$

delivering and filling the canal with MTA material from an orthograde direction have been reported (14, 15). The use of $Ca(OH)_2$ in apical barrier formation has shown promising results. Because of its enhanced success rate, easy availability for the clinician, and affordability for patients, it has gained the widest acceptance in the literature (17).

Some of the postulated mechanisms of $Ca(OH)_2$ are as follows: (24)

1. The presence of a high calcium concentration increases the activity of calcium-dependent pyrophosphatase

2. Direct effect on the apical and periapical soft-tissue

3. High pH, which may activate alkaline phosphatase activity

4. Antibacterial activity

In the present case, we took advantage of the advantages of both methods. In this case, because of wide-open apex in tooth 8, and to prevent the extrusion of MTA into periapical tissue, we first used calcium hydroxide. The calcium hydroxide initiated hard tissue formation. Despite the incomplete barrier formed with calcium hydroxide

Figure 5. A Hard Tissue Barrier Was Partially Formed (After Six Months)

Figure 6. Apical Plug of MTA in the Canal

(20), it seems to be sufficient for creating a barrier against MTA extrusion. In the present case, a primary apical barrier was created in six months. Then, to prevent the disadvantages of long-term calcium hydroxide, we continued treatment with MTA. The successful treatment method in the current case is similar to many other published case reports, in which calcium hydroxide and MTA have been used to treat immature teeth with necrotic pulp (25-28).

Figure 7. The Canal Was Filled with Warmed Gutta-Percha

Figure 8. The Tooth Was Restored with a Composite Resin Bond

Based on evidence, both MTA and $Ca(OH)_2$ can be used

Figure 9. The Periapical Lesion Healed (After 1.5 Years)

for the endodontic treatment of non-vital immature teeth. In this case, we took advantage of the desirable properties of MTA and $Ca(OH)_2$ in apexification.

Footnotes

Authors' Contribution: Critical revision of the manuscript for important intellectual content: Zakieh Donyavi; study supervision: Elham Khoshbin; the study concept, design, acquisition of data, analysis, interpretation of data, drafting of manuscript: Zeinab Kavandi.

Funding/Support: Hamadan University of Medical Sciences provided administrative, technical and material support for this study.

References

1. Floratos SG, Tsatsoulis IN, Kontakiotis EG. Apical barrier formation after incomplete orthograde MTA apical plug placement in teeth with open apex–report of two cases. *Braz Dent J*. 2013;**24**(2):163–6. doi: 10.1590/0103-6440201302163. [PubMed: 23780353].
2. Wen PH, Liou JU, Duh BR. Apexification of nonvital immature mandibular premolars using two different techniques. *J Dent Sci*. 2009;**4**(2):96–101. doi: 10.1016/S1991-7902(09)60014-3.
3. Torabinejad M, Chivian N. Clinical applications of mineral trioxide aggregate. *J Endod*. 1999;**25**(3):197–205. doi: 10.1016/S0099-2399(99)80142-3. [PubMed: 10321187].
4. Shabahang S, Torabinejad M. Treatment of teeth with open apices using mineral trioxide aggregate. *Pract Periodontics Aesthet Dent*. 2000;**12**(3):315–20. [PubMed: 11404920].
5. Maroto M, Barberia E, Planells P, Vera V. Treatment of a non-vital immature incisor with mineral trioxide aggregate (MTA). *Dent Traumatol*. 2003;**19**(3):165–9. [PubMed: 12752539].
6. Koh ET, McDonald F, Pitt Ford TR, Torabinejad M. Cellular response to mineral trioxide aggregate. *J Endod*. 1998;**24**(8):543–7. doi: 10.1016/S0099-2399(98)80074-5. [PubMed: 9759017].
7. Holland R, Filho JA, de Souza V, Nery MJ, Bernabe PF, Junior ED. Mineral trioxide aggregate repair of lateral root perforations. *J Endod*. 2001;**27**(4):281–4. [PubMed: 11485268].
8. Torabinejad M, Hong CU, Ford TRP, Kettering JD. Antibacterial effects of some root end filling materials. *JEndod*. 1995;**21**(8):403–6. doi: 10.1016/S0099-2399(06)80824-1. [PubMed: 7595152].
9. Arens DE, Torabinejad M. Repair of furcal perforations with mineral trioxide aggregate. *Oral Surg, Oral Medic, Oral Pathol , Oral Radiol Endod*. 1996;**82**(1):84–8. doi: 10.1016/S1079-2104(96)80382-9.
10. Torabinejad M, Smith PW, Kettering JD, Pitt Ford TR. Comparative investigation of marginal adaptation of mineral trioxide aggregate and other commonly used root-end filling materials. *J Endod*. 1995;**21**(6):295–9. doi: 10.1016/S0099-2399(06)81004-6. [PubMed: 7673836].
11. Shabahang S, Boyne PJ, Abcdi HR, McMillan P, Torabinejad M. OR 65 Apexification in immature dog teeth using osteogenic protein-1, mineral trioxide aggregate, and calcium hydroxide. *J Endod*. 1997;**23**(4):265. doi: 10.1016/S0099-2399(97)80122-7.
12. Gunes B, Aydinbelge HA. Mineral trioxide aggregate apical plug method for the treatment of nonvital immature permanent maxillary incisors: Three case reports. *J Conserv Dent*. 2012;**15**(1):73–6. doi: 10.4103/0972-0707.92611. [PubMed: 22368340].
13. Kubasad GC, Ghivari SB. Apexification with apical plug of MTA-report of cases. *Arch Oral Sci Res*. 2011;**1**(2):104–7.
14. Bogen G, Kuttler S. Mineral trioxide aggregate obturation: a review and case series. *J Endod*. 2009;**35**(6):777–90. doi: 10.1016/j.joen.2009.03.006. [PubMed: 19482173].
15. Hachmeister DR, Schindler WG, Walker WA, Thomas DD. The sealing ability and retention characteristics of mineral trioxide aggregate in a model of apexification. *J Endod*. 2002;**28**(5):386–90. [PubMed: 12033201].
16. Vojinovic J, Cupic S, Dolic O, Mirjanic D, Sukara S, Obradovic M. Success rate of the endodontic treatment of young permanent teeth with calcium hydroxide. *growth*. 2010;**4**:8.
17. Nagaveni NB, Umashankara KV, Radhika NB, Manjunath S. Successful closure of the root apex in non-vital permanent incisors with wide open apices using single calcium hydroxide (caoh) dressing–report of 2 cases. *J Clin Exp Dent*. 2010;**2**(1):e26–9.
18. 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**(7):241–6. [PubMed: 9364090].
19. Solomon RV, Soumya SS, Siddhartha P. Membrane-assisted mineral trioxide aggregate apical plug for management of traumatized immature anterior teeth: Clinical case reports. *J Oral Res Rev*. 2014;**6**(1):14.
20. Sharma A, Krishna A, Hans M, Shetty S, Dahiya S. Apical barrier technique using MTA: report of two cases. *Health Renaissance*. 2012;**10**(3):239–41.
21. Andreasen FM. Pulpal healing following acute dental trauma: clinical and radiographic review. *Pract Proced Aesthet Dent*. 2001;**13**(4):315–22. [PubMed: 11402773].
22. Giuliani V, Baccetti T, Pace R, Pagavino G. The use of MTA in teeth with necrotic pulps and open apices. *Dent Traumatol*. 2002;**18**(4):217–21. [PubMed: 12442832].
23. Witherspoon DE, Ham K. One-visit apexification: technique for inducing root-end barrier formation in apical closures. *Pract Proced Aesthet Dent*. 2001;**13**(6):455–60. [PubMed: 11544818].
24. Anantharaj A, Praveen P, Venkataraghavan K, Prathibha RS, Sudhir R, Murali Krishnan B. Challenges in pulpal treatment of young permanent teeth a review. *J Dental Sci Research*. 2011;**2**:142–55.

25. Erdem AP, Sepet E. Mineral trioxide aggregate for obturation of maxillary central incisors with necrotic pulp and open apices. *Dent Traumatol*. 2008;**24**(5):e38–41. doi: 10.1111/j.1600-9657.2008.00636.x. [PubMed: 18557748].
26. Raldi DP, Mello I, Habitante SM, Lage-Marques JL, Coil J. Treatment options for teeth with open apices and apical periodontitis. *J Can Dent Assoc*. 2009;**75**(8):591–6. [PubMed: 19840502].
27. Kristoffersen O, Nag OH, Fristad I. Dens invaginatus and treatment options based on a classification system: report of a type II invagination. *Int Endod J*. 2008;**41**(8):702–9. doi: 10.1111/j.1365-2591.2008.01399.x. [PubMed: 18479378].
28. Ghaziani P, Aghasizadeh N, Sheikh-Nezami M. Endodontic treatment with MTA apical plugs: a case report. *J Oral Sci*. 2007;**49**(4):325–9. [PubMed: 18195517].