Revitalization of a necrotic immature permanent anterior tooth (Case Report)

Rabab Kubba, B.D.S. (1)
Zainab Al-Dahan, B.D.S., M.Sc. (2)

ABSTRACT

Background: Management of immature permanent teeth with necrotic pulp is considered challenging to the clinician. Regeneration of pulp tissue is a relatively new approach for management of these teeth that allow continuation of root maturation rather than formation of just a calcific barrier as in apexification.

Method: 9 years-old girl with traumatized upper left central incisor. The clinical and radiographical examinations revealed uncomplicated crown fracture, tenderness to percussion, absence of response to cold vitality test. Diagnostic X-ray revealed open apex with periapical radiolucency. Revascularization was suggested to treat the tooth, starting with irrigation of canal with 5% NaOCl + 3% H_2O_2, followed by 2 weeks of triple antibiotic (metronidazole, ciprofloxacin and minocycline) paste application. Then antibiotic paste was removed, bleeding was induced and calcium enriched mixture (CEM) cement was applied over the blood clot and the access cavity was filled with Glass Ionomer filling material. The patient was evaluated clinically and radiographically after 1 and 7 months.

Results: In clinical and radiographical examinations in follow-up visits, the tooth was asymptomatic and functional and periapical radiolucency was healed. Apical closure and positive response to cold test were noticed in the 7th month follow-up visit.

Conclusion: Revascularization is an effective treatment for immature necrotic teeth. In addition, CEM cement provides favorable outcomes in revascularization treatment. **(J Bagh Coll Dentistry 2018; 30(2): 82-85)**

INTRODUCTION:

Management of immature permanent teeth with necrotic pulp is considered challenging to the clinician [1]. These teeth have thin root walls and open apices making their endodontic treatment very difficult [2, 3].These cases are common among children with dental traumatic injuries, dental anatomical anomalies (eg, dens evaginatus), and untreated carious lesions [1].

Historically, apexification without paste was used successfully for immature necrotic teeth [4, 5]. Apexification with calcium hydroxide was considered the treatment of choice for immature necrotic teeth [6], which stimulates hard tissue barrier formation [7, 8]. Later on, single visit apexification by apical plug using materials like mineral trioxide aggregate (MTA) was suggested which reduced time of treatment and number of visits [9, 10]. Apexification with biodentin also found to be effective [11]. The main disadvantage of apexification techniques is not permitting continuation of root maturation ending with fragile root structure [12].

An alternative approach for management of immature necrotic permanent teeth is the regeneration of pulp tissue to allow continuation of root maturation rather than formation of just a calcific barrier as in apexification [13-15].

(1) Master Student, Department of Pedodontics and Preventive Dentistry, College of Dentistry, University of Baghdad.
(2) Professor, Department of Pedodontics and Preventive Dentistry, College of Dentistry, University of Baghdad.

The advantages of endodontic regeneration are the continuation of root lengthening and reinforcement of root walls through the deposition of new hard tissue [16].

Several protocols were suggested for regenerative endodontics, most of them are based on the same principles: chemical disinfection of the root canal, providing a suitable environment for a scaffold to encourage tissue ingrowth, and sealing the access cavity tightly to avoid the entry of bacteria [17].

CEM Cement is a novel bioceramic material with a sealing property similar to MTA [18]. The three properties: slight expansion, thin film thickness and reasonable flow of CEM give the material effective sealing and lower the subsequent leakage [19].

CASE REPORT:

9 years old girl was referred to the department of pediatric and preventive dentistry in the specialized dental health center at Al-Sader City. The patient has an uncomplicated crown fracture that occurred due to traumatic injury several months ago. On examination, the tooth tender to percussion associated with mobility within normal limits, absence of sinus tract, and absence of response to cold vitality test were found.

Diagnostic periapical radiograph (Figure 1) revealed that upper left central incisor has open apex with a radiolucent periapical lesion. The diagnosis of necrotic pulp with symptomatic

apical periodontitis was made. Treatment options were discussed with parents and informed consent was obtained. Local anesthesia 2% Lidocaine with 1:80,000 epinephrine was given, rubber dam was applied, then access opening was done and working length was determined by inserting a large K-file 2mm shorter than the apex confirmed by periapical radiograph (Figure 2). Then minimal instrumentation was done and the canal was irrigated with 5% NaOCl + 3% H_2O_2 using closed end endodontic needle [20], keeping its tip 2mm shorter than the apex [20-23]. The canal was dried with large sterile paper point. Then the pulp chamber walls were sealed with a dentine bonding agent to minimize discoloration caused by minocycline [24]. A freshly prepared triple antibiotic paste (400 mg metronidazole (Julphar - U.A.E.), 250 mg ciprofloxacin (Acino-Switzerland) and 50 mg Minocyclin (Alfares pharmaceuticals-Syria) mixed with distilled water was applied into the canal with lentulo spiral, keeping the paste 1 mm shorter than apex [17]. Cavity was sealed with glass ionomer filling material and the patient was given an appointment 2 weeks later.

On the second visit, if the tooth was found without signs and symptoms, 3% Mepivacaine anesthetic solution without vasoconstrictor was injected [25, 26], rubber dam was applied and temporary filling was removed. Antibiotic paste was washed by copious amount of 5% NaOCl + 3% H_2O_2 [20]. Then the canal was dried and intracanal bleeding was induced using a sterile #50 K-file which was inserted 2 mm beyond the apical end of the canal [16]. Bleeding was controlled with a cotton pellet 3 mm apical to the canal orifice. 15 minutes later, the clot was stable on gentle touch with a cotton pellet [25]. CEM cement was applied over the blood clot and the access cavity was filled with Glass Ionomer filling material to give double seal (Figure 3). The patient was recalled for clinical and radiographical evaluation after 1 and 7 months. No signs or symptoms in all follow-up visits were found, no discoloration was evident. Lesion healing was evident radiographically after 1 month (Figure 4). Apical closure and positive response to cold test were noticed in the 7 months follow-up visit (Figure 5).

Figure 1
Diagnostic X-ray

Figure 2
Estemation of working length

Figure 3
Second visit application of CEM

Figure 4
1 month follow up

Figure 5
7 months follow up

DISCUSSION:

Endodontic regeneration in immature roots is based on the fact that vital stem cells in the apical papilla can survive even in cases of pulpal necrosis with periapical infection [21]. These stem cells have high proliferative and odontogenic differentiation capacity [27, 28]. Also the close relation of apical papilla to the root apex renders this rich source feasible for endodontic regenerative therapies [29].

Other considerable sources for stem cells in regenerative procedures are stem cells of the periodontal ligament and bone marrow because of the mechanical effect on the apical tissue (induction of bleeding) which could cause the emission of these cells, even their relative proportion is thought to be significantly less than stem cells of the apical papilla [30].

Disinfection of the root canal system is the key factor in successful revascularization protocols

[23]. When compared with traditional endodontic treatment, higher levels of canal disinfection are needed in regenerative procedures [31]. Bacterial penetration into dentinal tubules has been documented [32]. Deeper bacterial penetration in younger patients also documented [33]. Therefore, canal disinfection in immature infected teeth is an actual challenge [34].

Several studies on vital pulp therapies found that CEM is a biocompatible material [35-37], and its biocompatibility, sealing ability and cementogenic properties are identical to those of MTA [18, 38-42]. CEM does not cause discoloration when used in orifice level. This is an advantage over MTA which causes crown discoloration as mentioned in some revascularization reports [24, 43]. CEM was used successfully in revascularization of permanent immature molars, and this study was done to evaluate its effectiveness in revascularization of necrotic immature permanent anterior teeth.

In spite of absence of histological evaluation of tissues formed inside the canal in this study, continued root maturation and positive response to cold vitality test are signs of an organized vital pulp tissue formation [44]. Root thickening observed may be attributed to deposition of cementum-like tissue along the walls [45].

CONCLUSION

Revascularization is an effective treatment for immature necrotic teeth. In addition, CEM provides favorable outcomes in revascularization treatment.

REFERENCES:

1. Camp J, F.A., Pediatric endodontics: endodontic treatment for the primary and young permanent dentition, in Pathways of the pulp, H.K. Cohen S, Keiser K, Editor. 2006, St Louis: MO: Mosby Elsevier. p. 822–82.
2. Hargreaves, K.M., et al., Regeneration potential of the young permanent tooth: what does the future hold? Journal of endodontics, 2008. **34**(7): p. S51-S56.
3. Trope, M., Regenerative potential of dental pulp. Journal of Endodontics, 2008. **34**(7): p. S13-S17.
4. Al-Dahan Z., Apexification of immature apices of pulpless permanent anterior teeth without catalyst paste. Journal Of The College Of Dentistry, 1998. **3**
5. . Whittle, M., Apexification of an infected untreated immature tooth. Journal of endodontics, 2000. **26**(4): p. 245-247.
6. Rafter, M., Apexification: a review. Dental Traumatology, 2005. **21**(1): p. 1-8.
7. Al-Dahan, Z.A., Apexification of immature apices with calcium hydroxide. J Bagh College Dentistry, 2002. **13**: p. 31-41.
8. Endodontists, A.A.o., Glossary of endodontic terms. 2003: American Association of Endodontists.
9. Torabinejad, M. and N. Chivian, Clinical applications of mineral trioxide aggregate. Journal of endodontics, 1999. **25**(3): p. 197-205.
10. Al-Dahan, Z.A., M.S. Khalaf, and A.H. Al-Assadi, Apexification and periapical healing of immature teeth using Mineral Trioxide Aggregate. Journal of Baghdad College of Dentistry, 2014. **26**(3): p. 108-112.
11. Nayak, G. and M.F. Hasan, Biodentine-a novel dentinal substitute for single visit apexification. Restorative dentistry & endodontics, 2014. **39**(2): p. 120-125.
12. Nosrat, A., N. Homayounfar, and K. Oloomi, Drawbacks and unfavorable outcomes of regenerative endodontic treatments of necrotic immature teeth: a literature review and report of a case. Journal of endodontics, 2012. **38**(10): p. 1428-1434.
13. Murray, P.E., F. Garcia-Godoy, and K.M. Hargreaves, Regenerative endodontics: a review of current status and a call for action. Journal of endodontics, 2007. **33**(4): p. 377-390.
14. Huang, G.J., Apexification: the beginning of its end. International endodontic journal, 2009. **42**(10): p. 855-866.
15. Hargreaves K, L.A., Regenerative endodontics, in Pathways of the Pulp, C.S. Hargreaves K, Editor. 2011, St Louis: MO: Mosby Elsevier. p. 602–19.
16. Estefan, B.S., et al., Influence of age and apical diameter on the success of endodontic regeneration procedures. Journal of endodontics, 2016. **42**(11): p. 1620-1625.
17. Wigler, R., et al., Revascularization: a treatment for permanent teeth with necrotic pulp and incomplete root development. Journal of endodontics, 2013. **39**(3): p. 319-326.
18. Asgary, S., M.J. Eghbal, and M. Parirokh, Sealing ability of a novel endodontic cement as a root-end filling material. Journal of Biomedical Materials Research Part A, 2008. **87**(3): p. 706-709.
19. Utneja, S., et al., Current perspectives of bio-ceramic technology in endodontics: calcium enriched mixture cement-review of its composition, properties and applications. Restorative dentistry & endodontics, 2015. **40**(1): p. 1-13.
20. Iwaya, S.i., M. Ikawa, and M. Kubota, Revascularization of an immature permanent tooth with periradicular abscess after luxation. Dental traumatology, 2011. **27**(1): p. 55-58.
21. Thibodeau, B. and M. Trope, Pulp revascularization of a necrotic infected immature permanent tooth: case report and review of the literature. Pediatric dentistry, 2007. **29**(1): p. 47-50.
22. Chen, M.H., et al., Responses of immature permanent teeth with infected necrotic pulp tissue and apical periodontitis/abscess to revascularization procedures. International endodontic journal, 2012. **45**(3): p. 294-305.
23. Neha, K., et al., Management of immature teeth by dentin-pulp regeneration: a recent approach. Med Oral Patol Oral Cir Bucal, 2011. **16**(7): p. e997-1004.
24. Reynolds, K., J. Johnson, and N. Cohenca, Pulp revascularization of necrotic bilateral bicuspids using a modified novel technique to eliminate potential coronal discolouration: a case report. International endodontic journal, 2009. **42**(1): p. 84-92.

25. Nosrat, A., A. Seifi, and S. Asgary, Regenerative endodontic treatment (revascularization) for necrotic immature permanent molars: a review and report of two cases with a new biomaterial. Journal of endodontics, 2011. **37**(4): p. 562-567.
26. Khoshkhounejad, M., N. Shokouhinejad, and S. Pirmoazen, Regenerative endodontic treatment: report of two cases with different clinical management and outcomes. Journal of dentistry (Tehran, Iran), 2015. **12**(6): p. 460.
27. Huang, G.T.-J., et al., The hidden treasure in apical papilla: the potential role in pulp/dentin regeneration and bioroot engineering. Journal of endodontics, 2008. **34**(6): p. 645-651.
28. Ruparel, N.B., et al., Characterization of a stem cell of apical papilla cell line: effect of passage on cellular phenotype. Journal of endodontics, 2013. **39**(3): p. 357-363.
29. Hargreaves, K.M. and L.H. Berman, Cohen's pathways of the pulp. 2015: Elsevier Health Sciences.
30. Lovelace, T.W., et al., Evaluation of the delivery of mesenchymal stem cells into the root canal space of necrotic immature teeth after clinical regenerative endodontic procedure. Journal of endodontics, 2011. **37**(2): p. 133-138.
31. Fouad, A., The microbial challenge to pulp regeneration. Advances in dental research, 2011. **23**(3): p. 285-289.
32. Peters, L., et al., Viable bacteria in root dentinal tubules of teeth with apical periodontitis. Journal of Endodontics, 2001. **27**(2): p. 76-81.
33. Kakoli, P., et al., The effect of age on bacterial penetration of radicular dentin. Journal of endodontics, 2009. **35**(1): p. 78-81.
34. Nosrat, A., et al., Is pulp regeneration necessary for root maturation? Journal of endodontics, 2013. **39**(10): p. 1291-1295.
35. Asgary, S. and M. Eghbal, A clinical trial of pulpotomy vs. root canal therapy of mature molars. Journal of dental research, 2010. **89**(10): p. 1080-1085.
36. Nosrat, A. and S. Asgary, Apexogenesis treatment with a new endodontic cement: a case report. Journal of endodontics, 2010. **36**(5): p. 912-914.
37. Nosrat, A. and S. Asgary, Apexogenesis of a symptomatic molar with calcium enriched mixture. International endodontic journal, 2010. **43**(10): p. 940-944.
38. Asgary, S., et al., A comparative study of histologic response to different pulp capping materials and a novel endodontic cement. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 2008. **106**(4): p. 609-614.
39. Asgary, S. and S. Ehsani, Permanent molar pulpotomy with a new endodontic cement: A case series. Journal of conservative dentistry: JCD, 2009. **12**(1): p. 31.
40. Ghorbani, Z., et al., Microleakage of CEM cement in two different media. Iranian endodontic journal, 2009. **4**(3): p. 87.
41. Asgary, S., M.J. Eghbal, and S. Ehsani, Periradicular regeneration after endodontic surgery with calcium-enriched mixture cement in dogs. Journal of Endodontics, 2010. **36**(5): p. 837-841.
42. Samiee, M., et al., Repair of furcal perforation using a new endodontic cement. Clinical oral investigations, 2010. **14**(6): p. 653-658.
43. Petrino, J.A., et al., Challenges in regenerative endodontics: a case series. Journal of endodontics, 2010. **36**(3): p. 536-541.
44. BANCHS, F., TROPE, M. 2004. Revascularization of immature permanent teeth with apical periodontitis: new treatment protocol? J Endod, 30(4), 196-200.
45 Wang X, Thiboddeau B, Trope M, Lin L, Huang G. Histologic characterization of regenerated tissues in canal pace after the revitalization/ revascularization procedure in immature dog teeth with apical periodontitis. J Endod 2010; 36:56-63.

الخلاصة

الخلفية: تشخيص وعلاج الأسنان الدائمية غير مكتملة النمو وذات اللب الميت يعتبر تحدياً للطبيب. اعادة توليد نسيج اللب هي طريقة حديثة نسبياً لعلاج هذه الأسنان تسمح باستمرار نمو الجذور بدلاً من تكوين حاجز متكلس فقط كما في (apexification)

الطريقة: طفلة بعمر 9 سنوات أصيبت بشدة خارجية للقاطع العلوي المركزي الأيسر. الفحص السريري والشعاعي بيّن كسر غير معقد لتاج السن، تحسس للطرق، عدم الاحساس بفحص الحيوية بالبرودة، الأشعة التشخيصية بينت أن الذروة مفتوحة مع وجود شفافية شعاعية. العلاج المقترح للحالة كان اعادة توعية السن. بدأ العلاج بارواء القناة بواسطة 5% هايبوكلورايت الصوديوم + 3% بيروكسايد الهيدروجين تبع ذلك تطبيق معجون المضاد الحيوي الثلاثي (ميترونيدازول + سبروفلاكساسين+ مينوسايكلين) لمدة اسبوعين. بعد ذلك تم ازالة المعجون وتحفيز النزف ووضع خليط الاسمنت المدعوم بالكالسيوم فوق خثرة الدم وملئ تجويف مدخل اللب بحشوة glass ionomer وتم تقييم الحالة سريريا وشعاعيا بعد شهر واحد وبعد سبعة أشهر.

النتائج: ظهر بالفحص السريري والشعاعي في جلسات المتابعة أن السن كان بلا أعراض، وأن الشفافية الشعاعية قد زالت. انغلاق ذروة الجذر والاستجابة الايجابية لفحص الحيوية بالبرودة وجدت في جلسة متابعة الشهر السابع.

الاستنتاج: اعادة التوعية للاسنان هو علاج فعال للاسنان غير مكتملة النمو وذات اللب الميت، بالاضافة الى فعالية خليط الاسمنت المدعوم بالكالسيوم في علاج اعادة التوعية.