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Non Surgical Management and Modified Apexification Procedure for Immature Permanent Teeth with Necrotic Pulp, Root Resorption and Large Periapical Lesion: A Case Report

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Abstract

This case report aims to avoid tooth extraction by nonsurgical treatment of periapical lesion and to ensure continuous root development while maintaining the possibility of restoring with a post and core if needed later. This case report shows healing progress in response to metapex containing calcium hydroxide,iodoform,silicon oil followed by modified apexification procedure in an immature permanent teeth with apical periodontitis,root resorption and large periapical lesion.Radiographs were used to verify lesion size , ensure correct delivery to the site, and monitor the progress of bone healing in the lesion area.

Regenerative procedures are done in immature permanent teeth with necrotic pulp and open apex. Regenerative procedures can only be done when the pulp space is not needed for a post/core in the final restoration. So in such a situation immature permanent teeth is treated by apexification or mineral trioxide aggregate/Biodentine (Septodent, Lancaster, PA) apical barrier techniques.No further root maturation would occur in apexification.. This case report presents presents mandibular second premolar which was an immature permanent teeth with necrotic pulp with root resorption , large periapical radiolucency treated with metapex as intracanal medicament and intentionally extruded beyond periapex followed by modified apexification procedure.Metapex indicated an

antiseptic effect, which enhanced and shortened healing time of periapical lesions. The less invasive procedure avoids tooth extraction and reduces bone resorption.. The outcome shows a bone regenerative capacity of metapex . After the procedure tooth showed no clinical symptoms/signs and showed radiographic evidence of healed periapical lesion after a 6 month review. Also showed increased thickness of the apical root canal walls, increased apical root length, and apical closure.The modified apexification procedure presented here allows for the tooth to be restored with a post/core if required for the final restoration along with the benefit of continued root development.

Keywords :periapical lesion ,root resorption, apical periodontitis,metapex,regenerative procedures, modified apexification procedure, MTA, biodentin,non-surgical management.

Introduction

Periapical lesions usually develop in non vital teeth as a result of a chronic aggression by the presence of pathogenic microorganisms into the root canal which may appear as radiolucent lesions in radiographs[1]. Such periapical lesions are generally diagnosed either during routine dental radiographic examination or during an episode of acute pain elicited by the patient[2,3]. Most periapical lesions can be classified as periapical granuloma, abscess or cyst. Incidence of periapical granuloma ranges between 9.3 and 87.1%, abscess between 28.7 to 70.7% and periapical cyst varies between 6 to 55%[4]. Treatment of such lesions varies from non surgical to surgical means depending upon individual case. In the era of minimally invasive dentistry, non surgical endodontic approach has been highly recommended to promote periapical healing. Calcium hydroxide plays a pivotal role in such procedures since it has very effective anti-bacterial properties and special ability of tissue repair by hard tissue formation[1].All inflammatory periapical lesions should always be initially treated by conservative non-surgical technique. Surgical intervention is recommended only when nonsurgical techniques have failed. Moreover, surgical techniques have major drawbacks which limit its use in the routine management of periapical lesions. Various studies have reconfirmed that non-surgical treatment with adequate infection control can help to create favourable environment in the healing of large periapical lesions upto 85%[5,6].

Chemo-mechanical preparation techniques alone can't adequately clean the root canal system of microorganisms. Microorganisms tend to proliferate at the intra-appointment time. Hence, a suitable intracanal medicament like calcium hydroxide has to be delivered in the intra-canal space to prevent inter-appointment flare ups. Calcium hydroxide has been extensively used as an intra-canal medicament in the field of endodontics for many years because of its good antibacterial properties and its ability to encourage osseous repair and promote healing[7,8].Metapex contains Calcium Hydroxide with Iodoform.Advantages include Excellent antibacterial effect and radiopacity.Available as Pre-mixed paste Syringe-type for easy delivery of the paste into the canal. Disposable tip prevents cross-contamination. Componenets include 2.2g paste in a syringe, Disposable tips and One ring rotator for direction control of the tip.Metapex is composed of Calcium Hydroxide, Iodoform, Silicon oil.

A regenerative endodontic procedure has the potential to promote thickening of the canal walls and/or continued root development of immature permanent teeth with necrotic pulp/apical periodontitis[9].The current American Association of Endodontists clinical considerations for a regenerative endodontic procedure state that a

regenerative procedure is suitable for immature permanent teeth with necrotic pulp when the pulp space is not needed for a post/core in the final restoration.While a modified apexification procedure provides immature permanent teeth with necrotic pulp/apical periodontitis requiring a post/core for a final restoration the potential of continued apical root development, which is an advantage over current apical barrier techniques[1].

Calcium hydroxide apexification usually takes an extended period of time such as months for an apical calcified tissue barrier to form. Additionally,calcium hydroxide has a poor sealing ability and poor setting. Compared with calcium hydroxide, MTA and Biodentine have an excellent sealing ability and take a shorter time to set. Therefore, MTA and Biodentine can serve as an apical barrier, and clinicians do not have to wait for an apical hard tissue barrier to form. Consequently, MTA and Biodentine apical plugs have been used more often than calcium hydroxide apexification in recent years[10]

The suggested criteria of a modified apexification procedure are the following[10]:

1. Immature permanent teeth have lost substantial coronal tooth structure for final proper restoration. A post/core may reinforce the strength of these teeth against masticatory force to prevent cervical root fracture[11-13].

2. Immature permanent teeth at stage 3 and 4 root development16 because these immature permanent teeth have an adequate thickness of the root canal walls and root length for intraradicular post/core if required; immature permanent teeth at stage 1 and 2 root development[14] are excluded because they do not have enough thickness of the root canal walls and root length for an intraradicular post/core.

3. A modified apexification procedure can be an alternative treatment to traditional apexification to encourage continued root development.

In the modified apexification procedure, the involved tooth is isolated with a rubber dam under local anesthesia. The canal is chemomechanically debrided to ensure disruption and disinfection of bacterial biofilm on the canal walls. A 3-mm thick biocompatible resorbable collagen matrix is placed in the apical canal approximately 1–2 mm from the open apex to prevent MTA/ Biodentine from extruding into the periapical tissues. A 3-mm thick MTA/Biodentine plug is then placed over the collagen matrix. The rest of the coronal canal space is backfilled with warm gutta-percha using the vertical compaction technique (Fig. 1). The access cavity is restored with permanent restorative materials. The collagen matrix in the apical canal will eventually be resorbed, leaving 4–5 mm of apical canal space unfilled for continued apical root development. An EDTA canal rinse and induction of periapical bleeding into the apical canal were not used in our modified apexification procedure.

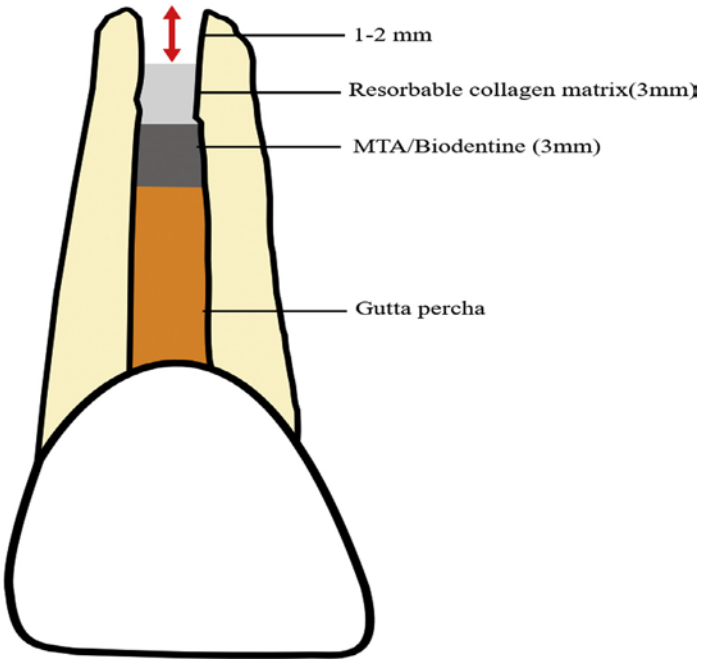

Figure 1: A drawing of an immature permanent tooth to show the modified apexification procedure.

Case Report

In the present case, a 25 year old man reported with a chief complaint of chronic an immature permanent

teeth,lower right second premolar with necrotic pulp/apical periodontitis,root resorption and large periapical lesion were referred from the undergraduate department and root canal treated with metapex as intra canal medication for 3 months followed by modified apexification procedure.Procedures were done in the postgraduate endodontic clinic. Composite was given as final restoration.

Procedure

Under local anesthesia with 2% lidocaine containing 1:100,000 epinephrine (Dentsply Sirona, York, PA), the involved tooth was isolated with a rubber dam. The access cavity was entered through the occlusal surface for 45. The pulp chamber was irrigated with 5.25 % sodium hypochlorite. The single large canal was identified. The working length of the canal was determined with a hand K-file, Root ZX II Apex locator (Morita, Irvine, CA), and a conventional periapical radiograph. The canal was chemomechanically debrided with hand K-files and ProTaper Universal Rotary Files (Dentsply Tulsa Dental Specialties, Johnson City, TN) to an appropriate size to disrupt bacterial biofilm on the canal walls and irrigated with copious amounts of 5.25% sodium hypochlorite. The canal was dried and dressed with metapex.Metapex was intentionally extruded into periapical area for better healing. The access cavity was closed with a cotton pellet and Intermediate Restorative Material (Dentsply Sirona, Charlotte, NC) for 1 month. At the second visit,review of periapical lesion was done and radiograph showed decrease in size of periapical radiolucency.The next visit was scheduled after 2 months.The 3 month review radiograph showed significant decrease in size of periapical radiolucency.The lesion almost disappeared.By the time the periapically extruded metapex was resorbed completely.So the access cavity was reopened,removal of metapex within the canal was done using H file and XP endofinisher. Copious amounts of sodium hypochlorite and saline irrigation was done using endovac. The canal was dried with paper points without EDTA irrigation.Induction of intracanal bleeding from the periapical tissues was done using 10 K file. A biocompatible resorbable collagen matrix (Collagen Matrix, Inc, Oakland, NJ) of 3-mm thickness was prepared and placed into the apical canal approximately 1–2 mm short of the apex using appropriate hand plungers (SybronEndo, Orange, CA) to prevent extrusion of MTA into the periapical tissues. A 3-mmn thickness of ProRoot MTA (Dentsply, Johnson City, TN) prepared according to the manufacturer's instructions, carried into the canal with the MAP system (Produitis Dentaies SA, Vevey, Switzerland), and carefully condensed into the canal coronal to the collagen matrix with measured hand pluggers. Radiography was performed to check the placement of the MTA plug. The rest of the coronal canal space was backfilled with warm gutta-percha using a vertical compaction technique.(FIG.2). The access cavity was restored with composite resin (Fig. 2). The treated teeth were reviewed at 3 and 6 months. The radiographic outcome was assessed.Review showed no clinical symptoms/signs and showed radiographic evidence of healed periapical pathology with increased thickness of the apical canal walls, increased apical root length, and apical closure.6 month radiograph revealed increase in thickness of root dentin.

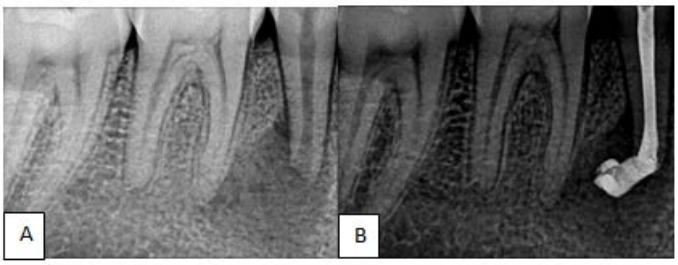

Fig 2 (A) A preoperative periapical radiograph of tooth 45. The tooth had an open apex,root resorption and a

periapical lesion. Clinically, the tooth was diagnosed with necrotic pulp and asymptomatic apical periodontitis. (B) 45 after chemomechanical debridement and filled with metapex.metapex was intentionally extruded beyond apex.

Figure 3: (c) 3 month review shows significant decrease in size of periapical lesion,bone regeneration and complete resorption of apically extruded metapex. (D) Completed modified apexification procedure.

Figure 4: (E) 6 month review showed radiographic evidence of healed periapical pathology with increased thickness of the apical canal walls, increased apical root length, apical closure and increase in thickness of root dentin

Discussion

Periapical lesion is an infammatory process affecting soft and hard tissues surrounding the tooth. Infammation is associated with the loss of supporting bone, bleeding on probing and suppuration. Necrosis of the pulp found suitable environment for microorganisms to release toxins into periapical tissue. This secretion leads to infammatory reaction, which is associated with periapical lesion formation[15]. A systemic literature review by Froum 2011[16] showed that the ideal management of lesions should focus on infection control of the lesion and regeneration of lost support. Nonsurgical root canal treatment should always be the first choice in cases of nonvital teeth with infected root canals. Elimination of bacteria from the root canal is the key of periapical lesions treatment[17]. Vitapex, Metapex, and Tegapex are commercially available premixed calcium hydroxide-iodoform-silicon-oil paste. These products are used as a temporary or permanent root canal flling material afer pulpectomy. The paste has excellent antibacterial and bacteriostatic properties and promotes apexifcation and apexogenesis. Calcium hydroxide has ionic effect observed by chemical dissociation into calcium and hydroxyl ions. Calcium and hydroxyl ions have antimicrobial effects and induce mineralization. Calcium hydroxide stimulates “blast” cells aiding apexogenesis and its high pH neutralizes endotoxins produced by anaerobic bacteria. Hydroxyl ions act on the cytoplasmic membrane of bacteria and it enhances tissue enzymes activity such as alkaline phosphatase which plays a role of extending roots and apical closure[17,18,19]. Iodoform has bacteriostatic property by releasing free iodine. Thereby, iodine eliminates the infection of root canal and periapical tissue by precipitating protein and oxidizes essential enzymes[20]. Iodoform also enhances radiopacity for better visualization. Silicone oil is a lubricant, which ensures complete coating of canal walls and solubilizes calcium hydroxide to remain active in root canal. Recently, Calcium Hydroxide-Iodoform-Silicon-Oil Paste were reported to induce bone formation of apical periodontitis and periapical bone regeneration in vivo due to expression of BMP-2 in rats[21]. Furthermore, Singh et al. concluded

that extrusion of Metapex unintentionally into periapical lesion showed no negative effects or complications[17,19]. Both studies encouraged us to do the presented case using metapex.

The present case report provides a clear evidence of the enhanced healing of lesions using Metapex. The healing time in the studied cases was between 30 and 90 days. Also resorption of metapex occurred completely in the periapical area within 3 months. Furthermore, failure of conventional treatment requires the resort to more invasive treatment and can lead to tooth loss, bone grafts, and eventually dental implant. Higher resorption capability makes Metapex a suitable flling to treat failed cases of conventional method. Moreover, targeted delivery of metapex is benefcial when periapical lesions occur in close vicinity of vital cells. Three months posttreatment vast degradation of Metapex correlated to enhanced bone regeneration around the tooth apex was seen in this case. Therefore modified apexification of canals and permanent flling of the teeth were performed.

Regenerative endodontic procedures of immature permanent teeth with necrotic pulp/apical periodontitis with arrested root will have the potential to continue to develop if infection/ inflammation of the pulpal-periapical tissue complex is controlled[10] . In such a case healing of the arrested root occur by repair and not by regeneration[22] . Same biological process should also occur to the arrested root in the modified apexification procedure of immature permanent teeth with pulp necrosis/apical periodontitis. In the present case , continued apical root development (thickening of the apical canal walls, increased root length, and apical closure) appeared to occur with the modified apexification procedure, because the potential of revascularization/revitalization is related to the length of the root and the size of the apical foramen preservation. In modified apexification procedure,progenitor cells from apical bone marrow, the periodontal ligament, and apical papilla can migrate and proliferate into the apical root canal space; differentiate into cementoblasts, osteoblasts, or odontoblasts; and produce cementumlike, bonelike, or dentinlike tissue, similar to the tissues formed in the canals after regenerative endodontic procedures of immature permanent teeth with necrotic pulp/apical periodontitis[23] . In the modified apexification procedure, only the apical 4–5 mm of the canal space is empty after chemomechanical debridement.

Chemomechanical debridement was used in the modified apexification procedure to help disrupt and disinfect intracanal bacterial biofilm. Because complete periapical healing was achieved, our infection control measurement of the infected root canals using chemomechanical debridement and metapex intracanal medication was effective.

In immature permanent teeth with loss of a substantial coronal tooth structure may require an intraradicular post/core for proper coronal restoration, the modified apexification procedure will be more suitable than regeneration endodontic procedures to retain the teeth because regenerative endodontic procedures do not allow for an intraradicular post or placing a core of composite resin into the cervical third of the root space. Apexification using MTA/ Biodentine as an apical barrier placed close to the open apex usually does not promote continued root development, probably because of the high pH (12.5) of MTA/ Biodentine, which might directly damage HERS and apical papilla cells.

In the case presented here 45 was treated with a modified apexification procedure, MTA was placed 4–5 mm coronal to the root apex and separated from periapical tissues by a resorbable collagen matrix In a clinical outcome study with a mean follow-up of 8.29 years, immature teeth treated with an MTA apical barrier and

restored with either composite resin or a post resulted in no teeth loss because of root fracture[23]. Strengthening the crown of the root in the cervical third of the root, which is the area at risk of fracture, is an advantage of modified apexification procedure. Similar to revascularization procedures, the modified apexification procedure also has the potential for further root maturation to occur, unlike traditional apexification procedures.

Conclusion

Use of Metapex as nonsurgical approach for treatment of periapical lesion showed success with bone regeneration. The bone regenerative efects are detrimental to the success of the treatment.. Healing of periapical lesion within 3 months with is crucial properties when comparing Metapex to conventional treatment. The regenerative effect of Metapex can be examined in orthopedic and trauma surgery feld.

The modified apexification procedure is easier than traditional apexification procedures to perform because an MTA/Biodentine apical plug does not have to be placed close to the open apex. In addition, the modified apexification procedure has the potential to promote continued apical root development, thus increasing the crown/root ratio. This is the advantage of the modified apexification procedure over calcium hydroxide apexification and an MTA/Biodentine apical plug of immature permanent teeth with necrotic pulp.. However, more prospective controlled clinical trials are needed to verify the use of the modified apexification procedure for immature permanent teeth with necrotic pulp/ apical periodontitis to promote apical root development.

Reference

1. Non Surgical Management of Periapical Lesion Using Calcium Hydroxide: A Two Year Follow Up Vinisha Pandey , Vipin Kumar , Reshu Singh , Subhra Dey , Harshit Singhania , Vriti Kohli Journal of Advanced Medical and Dental Sciences Research Vol. 6 Issue 8 August 2018
2. Barbakow FH,Cleaton-Jones PE,Friedman D.Endodontic treatment of teeth with periapical radiolucent areas in a general dental practice.Oral Surg 1981:51:552-59.
3. Wood NK.Periapical lesions.Dent Clin North Am 1984;28:725-66.
4. Lalonde ER,Leubke RG.The frequency and distribution of periapical cysts and granulomas.Oral Surg Oral Med Oral Pathol 1986;25:861-68.
5. Sjogren U,Hagglund B,Sundqvist G,wing K.Factors affecting the long-term results of endodontic treatment.J Endod 1990;16:31-37.
6. Shah N.Nonsurgical management of periapical lesions:A prospective study.Oral Surg Oral Med Oral Pathol 1988;66:365-71.
7. Caliskan MK,Sen BH.Endodontic treatment of teeth with apical periodontitis using calcium hydroxide:A long term study.Endod Dent Traumatol 1996;12:215-21.
8. Desai S and Chandler N.Calcium hydroxide based root canal sealers:a review.J Endod 2009;35(4):475-80.
9. Diogenes A, Henry MA, Teizeira FB, Hargreaves KM. An update on clinical regenerative endodontics. Endod Topics 2013;28:2–23.
10. Modified Apexification Procedure for Immature Permanent Teeth with a Necrotic Pulp/Apical Periodontitis: Kamolthip Songtrakul, DDS, MS, Talayeh Azarpajouh, DDS, Matthew Malek, DDS, Asgeir Sigurdsson, DDS, MS, Bill Kahler, DClinDent, PhD, and Louis M. Lin, BDS, PhD, DMDA Case Series JOE 2019

11. Desai S, Chandler N. The restoration of permanent immature anterior teeth, root filled using MTA: a review. J Dent 2009;37:652–7.
12. Jose J, Shoba K, Aman S, Tomy N. An innovative technique to restore the non vital teeth with wide; open canals–a clinical study. J Dent Med Sci 2015;14:71–4.
13. Linsuwanont P, Kulvitit S, Grad H, Santiwong B. Reinforcement of simulated immature permanent teeth after minersl trioxide aggregste apexifiction. J Endod 2018;44:163–7.
14. Cvek M. Prognosis of luxated non-vital maxillary incisors treated with calcium hydroxide and filled with gutta-percha: a retrospective clinical study. Endod Traumatol 1992;8:45–55.
15. Nonsurgical Clinical Management of Periapical Lesions Using Calcium Hydroxide-Iodoform-Silicon-Oil Paste Qusai Al Khasawnah, Fathi Hassan, Deeksha Malhan, Markus Engelhardt, Diaa Eldin S. Daghma,Dima Obidat,Katrin S. Lips, Thaqif El Khassawna , and Christian Heiss]
16. S. Froum, “Review of the Treatment protocols for Periimplantitis,” Dentistry IQ, 2011, http://www.dentistryiq.com/ articles/2011/10/review-of-the-treatment-protocols-for-periimplantitis.html
17. U. Singh, R. Nagpal, D. Sinha, and N. Tyagi, “Iodoform based calcium hydroxide PASTE (Metapex): an aid for the healing of chronic Periapical lesion,” International Journal of Advanced Research in Biological Sciences, p. 63, 2014.
18. Z. Mohammadi and P. M. H. Dummer, “Properties and applications of calcium hydroxide in endodontics and dental traumatology,” International Endodontic Journal, vol. 44, no. 8, pp. 697–730, 2011
19. M. K. Caliskan, “Prognosis of large cyst-like periapical lesions following nonsurgical root canal treatment: a clinical review,” International Endodontic Journal, vol. 37, no. 6, pp. 408–416, 2004.
20. C. Estrela, C. R. D. A. Estrela, A. C. B. Hollanda, D. D. A. Decurcio, and J. D. Pecora, “Infuence of iodoform on antimicrobial ´ potential of calcium hydroxide,” Journal of Applied Oral Science, vol. 14, no. 1, pp. 33–37, 2006.
21. X. Xia, Z. Man, H. Jin, R. Du, W. Sun, and X. Wang, “Vitapex can promote the expression of BMP-2 during the bone regeneration of periapical lesions in rats,” Journal of Indian Society of Pedodontics and Preventive Dentistry, vol. 31, no. 4, pp. 249–253, 2013.
22. Kim SG, Malek M, Sigurdsson A, et al. Regenerative endodontics: a comprehensive review. Int Endod J 2018;51:1367–88.
23. Ree MH, Schwartz RS. Long-term success of nonvital, immature permanent incisors treated with a mineral trioxide aggregate plug and adhesive restorations: a case series from a private endodontic practice. J Endod 2017;43:1370–7.