

Microsurgical Repair of root defect and follow-up for 2 years and 3 month: case report

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ABSTRACT

Apical periodontitis is the disease of microbial origin. Most of the cases of apical periodontitis responds positively towards the root canal treatment and lesion heal. But, some cases with extracellular microbial biofilm do not respond toward treatment. These cases are known as persistent apical periodontitis. The line of management for cases with persistent apical periodontitis is root canal treatment followed by surgical management. This report presented to inform the management of surgical repair of tooth with persistent apical periodontitis due to large apex and crack on the root surface. The lesion has satisfactory healing and a tooth is function after 2 year and 3 month follow-up.

INTRODUCTION

Apical periodontitis is an inflammatory disease causing bone destruction around the apical foramen of tooth due to leaking inflammatory product by bacteria present in pulp space.¹ Endodontic treatment is performed to control the intra-canal infection and create the suitable environment for body to take over the healing process. But, some cases do not respond towards treatment after meticulous procedure, these are known as persistent infection. Persistent inflammation is caused by bacteria that have survived from lethal effect of chemo-mechanical preparation.^{2,3} The various reasons for persistent lesion are discussed by authors.⁴⁻⁶

Bacteria responsible for persistent infection are found located in lateral canals, apical ramifications and isthmus. These areas are left untouched and unaffected by instruments and chemical substances during endodontic treatment.⁷⁻¹¹ Sometimes the bacteria biofilms are found attached to the main root canal wall even after through instrumentation.¹²⁻¹⁵

Dentinal tubules infection is also considered as one of the potential cause for persistent apical periodontitis.¹⁶⁻²¹

This case report describes the treatment performed on the tooth with persistent apical periodontitis with sinus on labial attached gingiva. The vertical crack on the disto-labial surface of root was judged to be most reasonable explanation for cause for persistent lesion of root and lesion healed after repair of defect. The case was followed for 2 years and 3 months.

CASE REPORT

A 20-year-old female was visited the endodontic department with chief complain of sinus and drainage on left maxillary anterior teeth since three years. Patient had previous history of trauma to maxillary central incisor at the age of eight years. The tooth went under root canal treatment at the age of twelve. The maxillary central incisor was discolored, had grade one mobility and 4mm periodontal

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pocket on distal aspect. The sinus is present at apical region between maxillary right central and lateral incisor. The maxillary right lateral incisor and left central incisor were responsive to electric pulp test.

The cone-beam computed tomography (CBCT) image (fig. 1) shows the presence of single radio-opaque material present in root canal and also extruding out in periapical area. The tooth had approximately 4mm of apical opening on labio-distal segment. The tooth has denuded labial cortical plate at apical region. The size of lesion was approximately 10 by 7. Re-root canal treatment with periapical surgery was planned and performed. On first day of treatment, access opening was made and previous gutta-percha was removed, canal was prepared till full radiographic length and 1% sodium hypochlorite solution was used as irrigate. Calcium Hydroxide was placed in canal and patient was re-called after three months. On 19th of March 2013, canal was obturated by modified Schilder method. The radiograph shows overextended gutta-percha (fig. 2.B).

During the day of obturation as well as on the day of surgery sinus was still present. The arrow shows the location of sinus on attached gingiva (fig. 2.A). Exploratory periapical surgery was discussed with patient. A full thickness flap was raised. The periapical lesion involves labial and distal area of root (fig 3.A), gutta-percha was seen extruding out of root from apical foramen (fig 3.A). After periradicular curettage, bleeding was controlled by application of

epinephrine cotton pellet, periapical segment of root was stained with methylene blue and excess stain was flushed out with normal saline. Under micro-mirror reflection, the crack line extending vertically and distally from apical foramen was observed (fig 3.B). The apical foramen and crack line were prepared with ultrasonic tip (fig 3.C) and prepared cavity was filled with resin (BEAUTIFIL[®] Flow Plus, Shofu Dental) (fig 3.D). The surgery was concluded by filling the bony defect with allograft (Geistlich Bio-Oss[®], Geistlich Pharma AG) (fig 3.E) and collagen matrix (Geistlich Bio-Oss[®], Geistlich Pharma AG) (fig 3.F). Suture was removed on fifth day after. The clinical examination shows satisfactory tissue healing and sinus opening was still visible (fig 4.a). Radiograph shows adequate restoration. The 4th month clinical and radiographic examination shows the satisfactory tissue healing, healed sinus tract and normal bone healing on progress. (fig 4.b). Follow-up examination 1.5 years showed complete osseous healing with normal periodontal ligament space developed around previous treated defect area and tooth was functional (fig 4.c). In the follow-up appointment 2 years and 3 months the teeth is still asymptomatic and functional. But clinical and radiograph examination revealed developing periodontal pocket on distal aspect of treated. The patient is referred to department of periodontics for needful treatment.

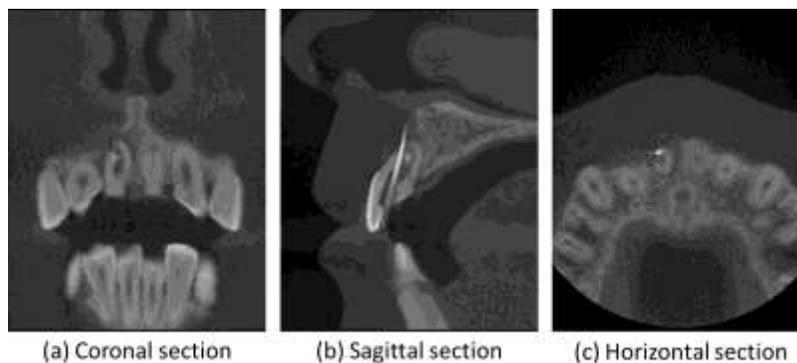


Figure 1. The pre-operative CBCT image shows apical foramen location, shape and size of lesion. The lesion is located more labial and distal aspect of root.

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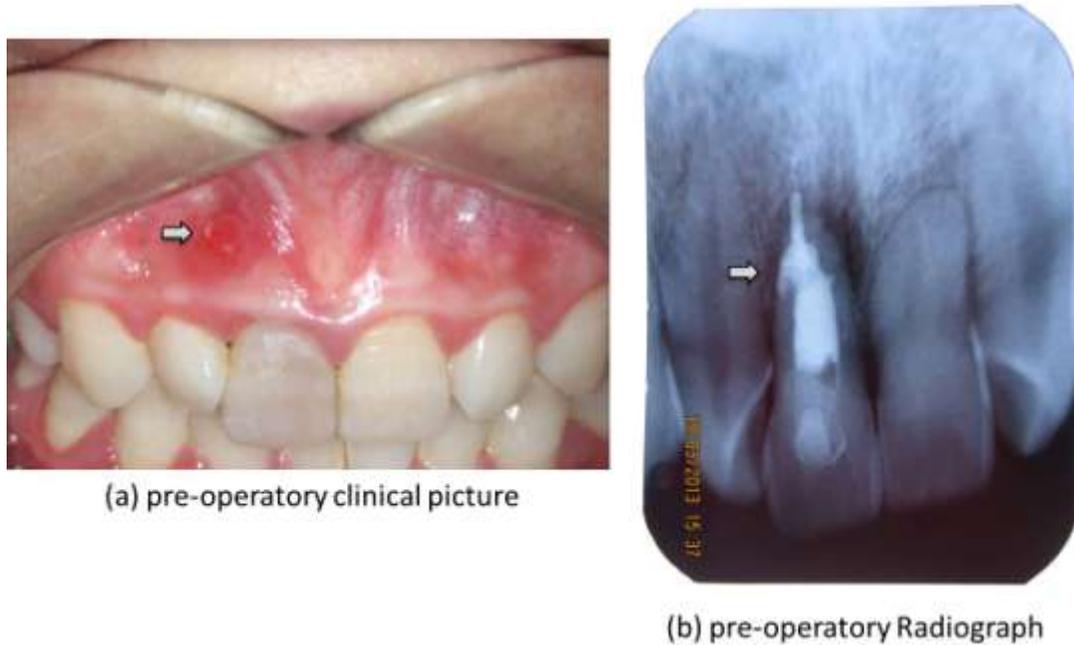


Figure 2. A: Clinical picture of teeth with adjacent gingiva on the day of surgery. The gingiva around the sinus opening is indurated. B: Post-obturation radiograph showing the lateral extension of sealer on distal side indicating the port of extension of inflammatory irritant to periodontal tissue and over-extension of gutta-percha from apical foramen.



Figure 3. Steps of surgical procedure. A: after curettage and hemostasis, B: After staining with methylene blue, sealer material is found extruded from defect on distal wall, C: after preparation of defect with ultrasonic tip, D: after restoration of defect with resin, E: Filling the bone defect with allograft, and F: placing graft membrane over bone graft.



Figure 4. Follow-up radiograph and clinical photograph shows the progress of treatment.

DISCUSSION

The objective of this paper is to discuss the treatment options available for necrosed tooth with open apex, reasons for persistent apical periodontitis and management for crack on the root surface.

Persistent apical periodontitis is an infectious disease caused by microbes present in the root canal or on the external root surface.^{9, 10, 22-28}

Among the various reasons for the persistent apical periodontitis⁴⁻⁷, crack root on the root surface can also be one of the reasons for persistent apical periodontitis. Probably this is the first clinical case to report crack root with the persistent apical periodontitis, its management and follow-up for 2 years.

The patient had history of trauma at age of eight; during this time the apical constriction is not yet formed at the root end. The apex of root is thin and is vulnerable to vertical split if excess force is used. The history was not suggestive to rule out the cause of crack on root, but the presence of large apical opening

was suggestive that tooth had trauma before formation of apical constriction and tooth became non-vital immediately after trauma. The cases of large apical opening could have been treated at early age by apexification induction with calcium hydroxide or MTA³⁷, or apexogenesis.^{38, 39} Apexification creates the calcific barrier at root end but the possibility of cervical root fracture possibility is always present, therefore the process to restore the vitality of tooth and initiation of apexification would be the better treatment option for necrosed tooth with open apex.⁴⁰

The presence of bacteria at the site is major reason for persistent apical periodontitis. In this case it is not difficult to understand that the presence of abnormally large apical foramen is reason for persistent disease because this foramen cannot be instrumented and the apex is left with microbes, their by-products and necrotic tissue. Therefore the microbes always persist in this area and so do lesion. This case needs to be managed by surgical approach. So,

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the surgical exploratory treatment was planned. The exploration of apical area revealed the large apical foramen with crack on root. Three factors were playing critical role in persistence of infection: large apical foramen, crack on the root and extruded filling material.

In the tooth with abnormally large apical foramen, microbes in these areas are untouched by effect of instrumentation, medication and microbes are in direct contact with the source of nutrition supply from periodontal area.^{9, 10, 16} These all factors contribute in persistence of infection and it gives reason to believe that persistence of bacteria is the major reason for persistence of infection. This fact is also supported by the belief that the result of tooth treated with positive bacteria culture has negative outcome.^{35, 36}

In this case report, the teeth has abnormally large apical foramen with persistent apical periodontitis and was treated with exploratory microsurgery. The crack on the root surface was prepared with ultrasonic tip. The prepared surface was treated with self-etch bonding agent and restored with resin. The 2 year and 3 months follow-up shows the promising result. No new lesion was seen forming around the restored surface of root, confirming that the body has accepted the materials and the material has maintained the marginal integrity with root surface.

The defect on the external surface of root can be managed by either incorporating it in resected root segment or the restoring the defect with sealing materials. The common sealing material is mineral trioxide aggregate (MTA). MTA is biocompatible material, seal the cavity well and induces cementum and bone formation above it²⁹⁻³¹ but it lacks the property to bond with dentin and cementum. Geristore[®] is tested to have excellent biocompatibility and is recommended as alternate choice for root repair³²⁻³⁴. During our procedure we used Beautiful[®] (Japan Shofu, Kyoto, Japan). The follow-up study shows that the result was

satisfactory and it can be used as alternate for repair.

CONCLUSION

The findings from this case suggest that small defect on the root surface not communicating with the crevicular gingiva can be repaired with resin cement and tooth can be saved. Despite the limitations on materials availability, proper selection of material for case can give satisfactory result.

REFERENCES

1. Nair PN et al. Pathogenesis of apical periodontitis and the causes of endodontic failures. *Crit Rev Oral Biol Med.* (2004)
2. Siqueira JF Jr. Endodontic infections: concepts, paradigms, and perspectives. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2002 Sep;94(3):281-93.
3. Ricucci D, Lin LM, Spångberg LS. Wound healing of apical tissues after root canal therapy: a long-term clinical, radiographic, and histopathologic observation study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2009 Oct;108(4):609-21.
4. Nair PN. On the causes of persistent apical periodontitis: a review. *Int Endod J.* 2006 Apr;39(4):249-81. Review.
5. Zakaria MN, Takeshita T, Shibata Y, Maeda H, Wada N, Akamine A, Yamashita Y. Microbial community in persistent apical periodontitis: a 16S rRNA gene clone library analysis. *Int Endod J.* 2015 Aug;48(8):717-28.
6. Arnold M, Ricucci D, Siqueira JF Jr. Infection in a complex network of apical ramifications as the cause of persistent apical periodontitis: a case report. *J Endod.* 2013 Sep;39(9):1179-84.
7. Nair PN, Henry S, Cano V, Vera J. Microbial status of apical root canal system of human mandibular first molars with primary apical periodontitis after "one-visit" endodontic treatment. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2005 Feb;99(2):231-52.
8. Vera J, Siqueira JF Jr, Ricucci D, Loghin S, Fernández N, Flores B, Cruz AG. One- versus two-visit endodontic treatment of teeth with apical periodontitis: a histobacteriologic study. *J*

Case Report

- Endod. 2012 Aug;38(8):1040-52.
9. Nair PN, Sjögren U, Krey G, Kahnberg KE, Sundqvist G. Intraradicular bacteria and fungi in root-filled, asymptomatic human teeth with therapy-resistant periapical lesions: a long-term light and electron microscopic follow-up study. *J Endod.* 1990 Dec;16(12):580-8.
 10. Ricucci D, Siqueira JF Jr, Bate AL, Pitt Ford TR. Histologic investigation of root canal-treated teeth with apical periodontitis: a retrospective study from twenty-four patients. *J Endod.* 2009 Apr;35(4):493-502.
 11. Ricucci D, Siqueira JF Jr. Biofilms and apical periodontitis: study of prevalence and association with clinical and histopathologic findings. *J Endod.* 2010 Aug;36(8):1277-88.
 12. Paqué F, Balmer M, Attin T, Peters OA. Preparation of oval-shaped root canals in mandibular molars using nickel-titanium rotary instruments: a micro-computed tomography study. *J Endod.* 2010 Apr;36(4):703-7.
 13. Peters OA, Schönenberger K, Laib A. Effects of four Ni-Ti preparation techniques on root canal geometry assessed by micro-computed tomography. *Int Endod J.* 2001 Apr;34(3):221-30.
 14. Versiani MA, Pécora JD, de Sousa-Neto MD. Flat-oval root canal preparation with self-adjusting file instrument: a micro-computed tomography study. *J Endod.* 2011 Jul;37(7):1002-7.
 15. Alves FR, Almeida BM, Neves MA, Moreno JO, Rôças IN, Siqueira JF Jr. Disinfecting oval-shaped root canals: effectiveness of different supplementary approaches. *J Endod.* 2011 Apr;37(4):496-501.
 16. Vieira AR, Siqueira JF Jr, Ricucci D, Lopes WS. Dentinal tubule infection as the cause of recurrent disease and late endodontic treatment failure: a case report. *J Endod.* 2012 Feb;38(2):250-4.
 17. Vera J, Siqueira JF Jr, Ricucci D, Loghin S, Fernández N, Flores B, Cruz AG. One- versus two-visit endodontic treatment of teeth with apical periodontitis: a histobacteriologic study. *J Endod.* 2012 Aug;38(8):1040-52.
 18. Haapasalo M, Orstavik D. In vitro infection and disinfection of dentinal tubules. *J Dent Res.* 1987 Aug;66(8):1375-9.
 19. Oguntebi BR. Dentine tubule infection and endodontic therapy implications. *Int Endod J.* 1994 Jul;27(4):218-22.
 20. Love RM, Jenkinson HF. Invasion of dentinal tubules by oral bacteria. *Crit Rev Oral Biol Med.* 2002;13(2):171-83.
 21. Peters LB, Wesselink PR, Buijs JF, van Winkelhoff AJ. Viable bacteria in root dentinal tubules of teeth with apical periodontitis. *J Endod.* 2001 Feb;27(2):76-81.
 22. Figdor D, Sundqvist G. A big role for the very small--understanding the endodontic microbial flora. *Aust Dent J.* 2007 Mar;52:S38-51.
 23. Signoretti FG, Endo MS, Gomes BP, Montagner F, Tosello FB, Jacinto RC. Persistent extraradicular infection in root-filled asymptomatic human tooth: scanning electron microscopic analysis and microbial investigation after apical microsurgery. *J Endod.* 2011 Dec;37(12):1696-700.
 24. Siqueira JF Jr. Aetiology of root canal treatment failure: why well-treated teeth can fail. *Int Endod J.* 2001 Jan;34(1):1-10.
 25. Tronstad L, Barnett F, Cervone F. Periapical bacterial plaque in teeth refractory to endodontic treatment. *Endod Dent Traumatol.* 1990 Apr;6(2):73-7.
 26. Ricucci D, Siqueira JF Jr. Apical actinomycosis as a continuum of intraradicular and extraradicular infection: case report and critical review on its involvement with treatment failure. *J Endod.* 2008 Sep;34(9):1124-9.
 27. Signoretti FG, Endo MS, Gomes BP, Montagner F, Tosello FB, Jacinto RC. Persistent extraradicular infection in root-filled asymptomatic human tooth: scanning electron microscopic analysis and microbial investigation after apical microsurgery. *J Endod.* 2011 Dec;37(12):1696-700.
 28. Wang J, Jiang Y, Chen W, Zhu C, Liang J. Bacterial flora and extraradicular biofilm associated with the apical segment of teeth with post-treatment apical periodontitis. *J Endod.* 2012 Jul;38(7):954-9.
 29. Torabinejad M, Parirokh M. Mineral trioxide aggregate: a comprehensive literature review--part II: leakage and biocompatibility investigations. *J Endod.* 2010 Feb;36(2):190-202.
 30. Nakata TT, Bae KS, Baumgartner JC. Perforation repair comparing mineral trioxide aggregate and amalgam using an anaerobic bacterial leakage model. *J Endod.* 1998 Mar;24(3):184-6.
 31. Ferris DM, Baumgartner JC. Perforation repair comparing two types of mineral trioxide aggregate. *J Endod.* 2004 Jun;30(6):422-4.
 32. Gupta SK, Saxena P, Pant VA, Pant AB. Adhesion and biologic behavior of human periodontal fibroblast cells to resin ionomer Geristore: a

Case Report

- comparative analysis. *Dent Traumatol.* 2013 Oct;29(5):389-93.
33. Greer BD, West LA, Liewehr FR, Pashley DH. Sealing ability of Dyract, Geristore, IRM, and super-EBA as root-end filling materials. *J Endod.* 2001 Jul;27(7):441-3.
 34. Al-Sabek F, Shostad S, Kirkwood KL. Preferential attachment of human gingival fibroblasts to the resin ionomer Geristore. *J Endod.* 2005 Mar;31(3):205-8.
 35. Peters LB, Wesselink PR. Periapical healing of endodontically treated teeth in one and two visits obturated in the presence or absence of detectable microorganisms. *Int Endod J.* 2002 Aug;35(8):660-7.
 36. Fabricius L, Dahlén G, Sundqvist G, Happonen RP, Möller AJ. Influence of residual bacteria on periapical tissue healing after chemomechanical treatment and root filling of experimentally infected monkey teeth. *Eur J Oral Sci.* 2006 Aug;114(4):278-85.
 37. Chala S, Abouqal R, Rida S. Apexification of immature teeth with calcium hydroxide or mineral trioxide aggregate: systematic review and meta-analysis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2011 Oct;112(4):e36-42.
 38. Shabahang S. Treatment options: apexogenesis and apexification. *J Endod.* 2013 Mar;39(3 Suppl):S26-9.
 39. Chen MY, Chen KL, Chen CA, Tayebaty F, Rosenberg PA, Lin LM. Responses of immature permanent teeth with infected necrotic pulp tissue and apical periodontitis/abscess to revascularization procedures. *Int Endod J.* 2012 Mar;45(3):294-305.
 40. Flanagan TA. What can cause the pulps of immature, permanent teeth with open apices to become necrotic and what treatment options are available for these teeth. *Aust Endod J.* 2014 Dec;40(3):95-100.