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Case Report

Management of horizontal middle root fracture using calcium silicate based sealer and intraradicular fiber splint- Case report

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ABSTRACT

Traumatic injuries of teeth are among most serious dental accidents with anterior teeth mostly commonly affected. The knowledge of which can reduce the suffering, cost and time of patient. The prognosis is largely related to the patient's age, degree of displacement and the location and orientation of the fracture. The more apical the fracture is located, the better the prognosis. In the present case horizontal middle root fracture was managed with the bioceramic sealer and intraradicular stabilization was done via fiber splint. Monitoring of root-fractured teeth over time is essential to determine the healing response and other resorptive changes at fracture line

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1. Introduction

Traumatic injuries of teeth are among most serious dental accidents with anterior teeth mostly commonly affected. These injuries can range from simple enamel infarction to severe complicated crown - Root fractures and sometimes avulsion of the teeth.¹ Root fractures are rare and accounts 0.5–7% of all dental injuries. Maxillary centrals (68%) are most frequently affected followed by maxillary laterals (27%), mainly due to labial inclination and rarely mandibular incisors (5%) are involved.²

Depending on the direction of fracture line, root fractures are generally classified as horizontal, vertical, oblique or combination. Horizontal root fracture can occur at coronal, middle and apical region which determines the management and prognosis of the fractured root.^{1,3} The coronal portion being most unstable and mobile in which extraction is the only treatment. The middle and apical portion being stable with limited mobility and have good prognosis.⁴

The time of initiation of treatment is also important, the prognosis of freshly traumatic injuries is good because of early immobilization that maintains vitality of pulp. The pulp necrosis can complicate the treatment because of periradicular infection and also negotiation through fractured fragment gets complicated.¹

Root fractures are clinically challenging because of their complex management involving interdisciplinary /multidisciplinary treatment approach for the successful treatment outcome.⁵ However, initial treatment of the complicated coronal fragment should be repositioning of the fractured fragments, followed by immobilization with rigid or semirigid splinting to allow healing of the surrounding periodontal tissues and root.² The introduction of tooth colored and bondable fiber posts produce effective stabilization and can be used as a medium to retain the two fractured root fragments.^{6,7}

In this case report, the subgingival fracture line was exposed palatally by surgical crown lengthening and fractured fragments were stabilized with the help of glass fiber post.

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2. Case Report

A 22-year-old male patient reported to the department of conservative dentistry and endodontics with the chief complaint of pain in the broken upper front tooth and also desires to get it corrected in order to have a pleasing smile. Patient had a history of trauma due to Road traffic accident two months back. Clinical examination revealed a complicated crown fracture involving maxillary central incisor 11 and fracture line was deep palatally involving fracture of cingulum portion. The tooth was moderately tender on percussion and mobility was absent. The transgingival probing revealed subgingival fracture line on palatal side of 11. Radiographic examination showed the horizontal root fracture at the middle portion of root. The radiographs were repeated at different angulations to confirm the fracture line. On pulp sensibility testing, EPT and Endo Ice, there was no response. The treatment protocol and its prognosis were explained to the patient. The patient was willing to save his tooth and the written consent was taken.

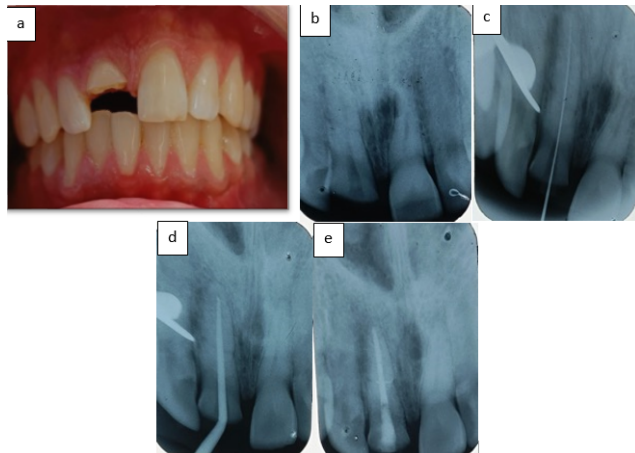


Fig. 1: **a:** preoperative photograph; **b:** Preoperative radiograph showing horizontal root fracture at the middle region 11; **c:** Canal negotiated through fracture fragment with 15k; **d:** Master cone 50 / .02; **e:** Obturation with bioceramic sealer.

The root canal of 11 was initiated under rubber dam isolation and fractured fragment were negotiated successfully up to working length by 15 k file. Cleaning and shaping done using hand K files in step back manner and size of master apical preparation was 50k file. Irrigation was done with 3% sodium hypochlorite followed by EDTA. The calcium hydroxide dressing was placed for 7 days. After the patient was asymptomatic, obturation was done with cold lateral condensation using bioceramic sealer CeraSeal (Meta BioMed). The sealer flows through the fractured fragment and good seal was achieved. On palatal side of 11, the fracture line was subgingival and ferrule was less than 1mm. Therefore, surgical crown lengthening was done to get supragingival margins and desirable ferrule.

After 6 weeks, the healing was optimum and the post space was created by removing gutta percha passively using downpak device 2mm beyond the fracture line and appropriate glass fiber post was selected. The Paracore system (Coltene) was used for bonding and luting of fiber post. The core buildup was done with the same material. The Paracore kit was used according to manufactures instruction. The tooth was restored with PFM crown and patient was periodically recalled for follow up.

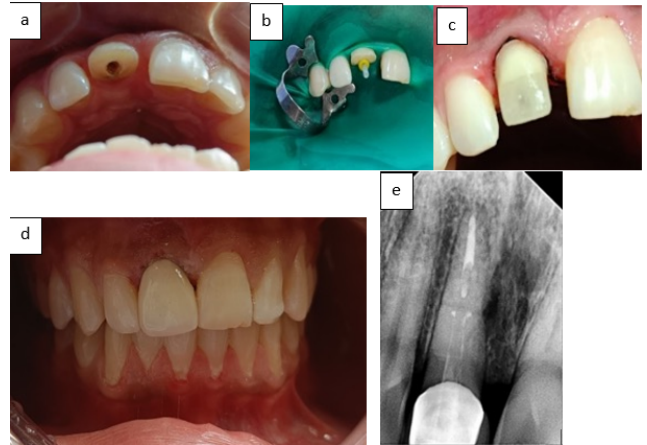


Fig. 2: **a:** Palatal ferrule after surgical crown lengthening; **b:** Fiber post was luted using paracore, under Rubber Dam isolation; **c:** Core buildup using paracore; **d:** Postoperative clinical photograph -PFM crown; **e:** 18 month follow up showing calcified tissue formation and indistinctly visible fracture

3. Discussion

The location and direction of fracture line is important because it dictates the emergency and subsequent treatment. Root fractures in the apical, middle and subcrestal in the coronal third of the root should be conservatively managed.¹ Heithersay in 1973 proposed that, fractures that are located supracrestally in the coronal third should be managed by removing the fractured fragment and Orthodontic extrusion of the remaining root.⁸ Surgical crown lengthening was done palatally to achieve palatal ferrule and fracture line was exposed supragingival. Although orthodontic extrusion gives optimum result it was time consuming and needed multiple visits.⁹ Also in this case we need only palatal ferrule, the labial tooth structure was adequate. The biologic width should not be encroached, and restorative margins should be 2mm away from the attachment apparatus, otherwise it might lead to plaque accumulation that ultimately give rise to gingival inflammation, resorption of the alveolar crest and recession.¹⁰

The healing of the fractured root depends on root maturation, nature of injury, diastasis between the fragments, and approximation of displaced fragments. In

this case, the fracture fragment were stable coronally and the separation between the fragments was very small. Traumatic injuries of teeth can result in necrosis of pulp and is difficult to diagnose early so periodic follow ups are necessary.¹¹ Bruno et al.2009, found that 85% teeth had become necrotic following traumatic injuries. The necrotic fractured teeth were cleaned and shaped involving both coronal and apical fragment to remove the inflammatory and infectious tissue. Therefore, the sterile and infection free environment is necessary for the healing of fractured fragments.¹²

In the present case report, the bioceramic sealer is used for obturation because of its biocompatibility and flow.¹³ Chang et al. 2014, found that bioceramic sealers are mediators for osteoblastic differentiation and did not induce any inflammatory response on contact to tissues.¹⁴ calcium silicate based sealer CeraSeal was used in the present case that flows between the fractured segments and optimum seal was obtained. The bioceramic sealer therefore promotes healing around the fractured fragment and also act as barrier for the seepage of resin cement while splinting of fractured fragments with glass fiber post. Ricucci et al. 2020, also reported that bioceramic sealers do not produce any inflammatory or foreign body reactions on contact with the host tissue.¹⁵ The fractured fragments were stabilized with a fiber reinforced post, luted with resin cement that act as an intraradicular splint. The glass fiber post has modulus of elasticity similar to dentin and luting with resin cement together results in Monoblock system of bonding thus provides excellent seal as well minimizes the risk of root fractures.^{7,16} Gurtu and Singhal. 2012, stated that the use of a fiber reinforced post imparts support and stability to the tooth. The radicular splinting strengthens the restoration complex that are subjected to oblique forces when teeth are in function.¹⁷

Andreasen and Hjørtting-Hansen described four types of healing sequelae: (1) healing with calcified tissue, (2) healing with interproximal connective tissue, (3) healing with interproximal bone and connective tissue, and (4) interproximal inflammatory tissue without healing.¹ After 18 months follow up the radiograph shows rounding of margins and calcified tissue formation around the fractured fragments.^{1,2} The fracture line looks indistinctly faint between the fractured fragments. Thus, the use of bioceramic sealers for endodontic treatment seems beneficial for the healing of root fracture. On the mesial side of fractured root, some changes are evident that can be associated with the repaired related resorption. Therefore, long-term follow-ups are necessary to check for any possible pathological alterations.

4. Conclusion

The early diagnosis and prompt treatment in the management of the horizontal, oblique and transverse root fractures results in very good long-term prognosis. The

use of bioceramic sealer might have been responsible for excellent healing because of its osteoinductive property. The stabilization with glass fiber post of middle root fracture seems to be a good treatment option for managing the esthetics and functional needs of patient.

5. Conflict of Interest

None.

6. Source of Funding

None.

References

1. Paul V. Diagnosis and management of transverse root fractures. *Dent Traumatol.* 2019;35(6):333–47. doi:10.1111/edt.12482.
2. Andreasen FM, Andreasen JO. Crown fractures, in Textbook and Color Atlas of Traumatic Injuries to the Teeth. 3rd Edn. Munksgaard, Copenhagen, Denmark; 1994. p. 219–56.
3. Davidovich E, Heling I, Fuks AB. The fate of a mid-root fracture: A case report. *Dent Traumatol.* 2005;21(3):170–3. doi:10.1111/j.1600-9657.2005.00290.x.
4. Çalışkan MK, Pehlivan Y. Prognosis of root-fractured permanent incisors. *Endod Dent Traumatol.* 1996;12(3):129–36. doi:10.1111/j.1600-9657.1996.tb00111.x.
5. Aggarwal V, Logani A, Shah N. Complicated crown fractures-management and treatment options. *Int Endod J.* 2009;42(8):740–53.
6. Karhade I, Gulve MN. Management of Horizontal Root Fracture in the Middle Third via Intraradicular Splinting Using a Fiber Post. *Case Rep Dent.* 2016;p. 9684035. doi:10.1155/2016/9684035.
7. Bramante CM, Menezes R, Moraes IG, Bernardinelli N, Garcia RB, Letra A, et al. Use of MTA and intracanal post reinforcement in a horizontally fractured tooth: A case report. *Dent Traumatol.* 2006;22(5):275–8.
8. Heithersay GS. Combined endodontic-orthodontic treatment of transverse root fractures in the region of the alveolar crest. *Oral Surg Oral Med Oral Pathol.* 1973;36(3):404–15. doi:10.1016/0030-4220(73)90220-x.
9. Bach N, Baylard JF, Voyer R. Orthodontic extrusion: periodontal considerations and applications. *J Can Dent Assoc.* 2004;70(11):775–80.
10. Wang HL. Interactions between the gingiva and the margin of restorations. *J Clin Periodontol.* 2003;30(5):379–85.
11. Cvek M, Mejäre I, Andreasen JO. Healing and prognosis of teeth with intra-alveolar fractures involving the cervical part of the root. *Dent Traumatol.* 2002;18(2):57–65. doi:10.1034/j.1600-9657.2002.180202.x.
12. Bruno KF, De Alencar A, Estrela C, Batista AC, Pimenta FC, Carlos Estrela, a, Fabiana Cristina Pimenta. Microbiological and microscopic analysis of the pulp of non-vital traumatized teeth with intact crowns. *J Appl Oral Sci.* 2009;17(5):508–14. doi:10.1590/s1678-77572009000500028.
13. Zheng P, Shen ZY, Fu BP. Conservative endodontic management using a calcium silicate bioceramic sealer for delayed root fracture: A case report and review of the literature. *World J Clin Cases.* 2021;9(8):1835–43.
14. Chang SW, Lee SY, Kang SK, Kum KY, Kim EC. In vitro biocompatibility, inflammatory response, and osteogenic potential of 4 root canal sealers: Sealapex, Sankin apatite root sealer, MTA Fillapex, and iRootSProot canal sealer. *J Endod.* 2014;40(10):1642–8. doi:10.1016/j.joen.2014.04.006.
15. Ricucci D, Grande NM, Plotino G, Tay FR. Histologic Response of Human Pulp and Periapical Tissues to Tricalcium Silicate-based Materials: A Series of Successfully Treated Cases. *J Endod.* 2020;46(2):307–17. doi:10.1016/j.joen.2019.10.032.

16. Galhano GA, Valandro LF, Melo RM, Scotti R, Bottino MA. Evaluation of the flexural strength of carbon fiber-, quartz fiber-, and glass fiber-based posts. *J Endod.* 2005;31(3):209–11. doi:10.1097/01.don.0000137652.49748.0c.
17. Gurtu A, Singhal A. Management of horizontal fracture. *J Dent Sci Oral Rehabil.* 2012;p. 48–50.

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