Clinical management of a complicated crown-root fracture using autogenous tooth fragment: A biological restorative approach

Vinaya Kumar Kulkarni, Divya S. Sharma, Naveen Reddy Banda, Mishthu Solanki, Vishal Khandelwal, Priyanka Airen

Abstract

Trauma resulting in crown-root fracture is one of the most challenging fracture types. However, biologic width involvement should be carefully evaluated. Reattachment of tooth fragment to a fractured tooth remains as the treatment of choice because of its simplicity, natural esthetics, and conservation of tooth structure. The reattachment procedure using composite resin should be considered if the subgingival fracture can be exposed to provide isolation. This report presents a case of complicated crown-root fracture of permanent maxillay left central incisor, involving the biologic width in a 10-year-old girl. The traumatized tooth was treated endodontically. Access to the subgingival margins was gained by orthodontic extrusion followed by gingivectomy. The fractured fragment was reattached using bonding system and composite resin.

Keywords: Biologic width, central incisor, composite resin, crown-root fracture, gingivectomy, orthodontic extrusion, tooth fragment reattachment, traumatic injury

Introduction

Trauma to the anterior teeth and their supporting tissues is relatively common among children and adolescents. Accidental fall or trauma during contact sports is the main reasons for injury. The maxillary central incisors are most often injured in the accidents and boys are affected more than the girls.[1] Every dental professional must be prepared to evaluate and treat them when necessary.

Factors influencing the management of traumatized tooth include extent and pattern of fracture, pulpal involvement, stage of root development, alveolar bone fracture, involvement of biologic width, soft-tissue injuries, presence/absence of fractured tooth fragment, secondary traumatic injuries, occlusion, and esthetics.[2-4]

Department of Pedodontics and Preventive Dentistry, Modern Dental College and Research Centre, Indore, Madhya Pradesh, India

Correspondence: Dr. Vinaya Kumar Kulkarni, Department of Pedodontics and Preventive Dentistry, Modern Dental College and Research Centre, Gandhi Nagar, Airport Road, Indore - 453 112, Madhya Pradesh, India. E-mail: vinayakumar53@gmail.com

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A crown-root fracture is a type of dental trauma, usually resulting from horizontal impact and represents 5% of all dental injuries. These fractures involve enamel, dentin and cementum, occurring below the gingival margin. Depending on the presence or absence of pulpal involvement, they are classified as complicated or uncomplicated fractures.[1,2] A crown-root fracture often involves the biologic width. Biologic width is the sum of the lengths of epithelial and connective tissue attachment to the tooth.[5]

Tooth fracture, besides the pain from the injury, causes psychological stress in children due to missing tooth structure. Primary goal of the treatment remains esthetic and functional rehabilitation. Several therapeutic procedures are available for fractured anterior teeth. However, reattachment of the fractured fragment is an excellent biological approach for restoration, when the fragment is available.[4] Tooth fragment reattachment (biological restoration) offers the advantage of being simple, less time consuming, and conservative technique. The rate of incisal edge wear is similar to that of adjacent teeth. They provide natural esthetics in the form of color, morphology, and translucency match and acceptable by the patients with psychological benefits.[4,6] The purpose of this case report is to describe biological restorative treatment in a maxillary central incisor with complicated crown-root fracture and involving the biologic width.

Case Report

A 10-year-old girl reported seeking treatment for her traumatized upper front tooth. Patient had trauma due to accidental fall in the school 1 week ago. They immediately reported for medical assistance, received immediate treatment for lip lacerations, medications to relive pain and tetanus-toxide coverage. Her medical and family histories were non-contributory. On examination, lip lacerations were

healing, no other extraoral injuries were detected. Intraoral examination revealed the patient was in mixed dentition stage. Maxillary left central incisor was fractured bucco-lingually and a small portion of the tooth was missing. The second fracture fragment was mobile and attached to the gingival tissue [Figure 1]. It was a crown-root fracture involving enamel, dentin, pulp and a small portion of cementum. The fracture line was subgingival and involving the biologic width. There was no associated mobility of the affected tooth. Intra oral periapical (IOPA) radiograph exhibited the extent of the fracture subgingivally [Figure 2]. The fracture line was extending slightly apical to the level of crest of the interdental alveolar bone, on the mesial half of the tooth. Apex of the involved tooth was nearer to its completion. Patient was unable to maintain the oral hygiene due to pain associated with the fractured tooth.

The fractured fragment was separated from the gingival tissue after administration of local anesthesia. The tooth fragment was preserved in distilled water until reattachment. As patient reported 1 week after the trauma, preservation of the tooth vitality was difficult. Hence, root canal treatment for the involved tooth was planned. Access was gained to the root apex after isolation. The working length of the root canal was determined using IOPA radiographs, after eliminating the magnification factor. Shaping and cleaning of the canal was performed using endodontic K-files and H-files (MANI, INC. Utsunomiya, Tochigi, Japan). Irrigation of the root canal at every step was done with 5.2% sodium hypochlorite and normal saline. The canal was finally flushed with normal saline and dried with absorbent paper points. The root canal was filled with a paste of calcium hydroxide powder mixed with saline (Deepashree products, Ratnagiri, India) for 1 week. After 1 week as the tooth was asymptomatic, final obturation was done using endodontic sealer (Endoflux, Ammdent, Mohali, India) with gutta-percha (Dentsply, France, SAS) by rolled cone technique. After root canal filling the access cavity was sealed by glass ionomer cement (Ketac™ Molar Easymix, 3M ESPE AG, Seefeld, Germany).

After completing the endodontic procedure, it was planned for orthodontic extrusion of the tooth, to facilitate access to the fracture line. Orthodontic traction was applied by a bracket fastened to the labial surface of the fractured tooth and elastics anchored to the orthodontic appliance [Figure 3]. As gingiva followed the path of extruding tooth, crown lengthening by gingival re-contouring (gingivectomy) was performed, for better esthetics and to gain access to the fracture line.

Biological restoration was carried out under rubber dam isolation. The proper position and the fit of the fragment were checked on the fractured tooth. Internal grooves were prepared on the coronal aspect of both fragment and the fractured tooth to enhance the bond strength. The tooth fragment and the remaining tooth structures were etched with 37% phosphoric acid gel, followed by rinsing. After removal of the excess water, dentin bonding agent (Adper™ Single bond 2, adhesive; 3M ESPE AG, Seefeld, Germany) was applied to both bonding surfaces, in accordance with the manufacturer's instructions. A small layer of A2 shade composite resin material (Filtek Z250; 3M ESPE AG, Seefeld, Germany) was then applied to the fractured area of the tooth to which the fragment was reattached. The fragment was properly positioned on the fractured tooth surface, excess resin was removed and the area was light cured for 40 s, while the fragment was held in place under pressure. On the coronal aspect of the fractured tooth, a double chamfer margin was created 1 mm coronally and apically to the fracture line using a round diamond bur. After acid etching, single bond adhesive was applied to the chamfer area, followed by composite resin (Filtek Z250, shade A2) application and light curing was done, according to the manufacturer's instructions. The reconstruction of lost tooth structure was also carried out using the same composite resin in an incremental manner. Final finishing and polishing of the margins and composite resin restoration was done using finishing burs and composite finishing kit (SHOFU, SHANK CA, PN 0306, Shofu Dental Corporation, USA) [Figures 4 and 5].

Patient was followed-up for 1 year at bimonthly intervals; the patient was asymptomatic throughout the period and the tooth was serving both esthetics and function.

Discussion

Management of complicated crown-root fractures remains a challenge. This is due to difficulty in achieving isolation with a rubber dam for a dry operating field, which might compromise the hermetic seal of restoration. Various treatment modalities have been proposed for crown-root fractures; like removal of coronal fragment with subsequent restoration above gingival level. This allows the subgingival portion of the fracture to heal with formation of a long junctional epithelium. The second option is to convert the subgingival fracture to a supragingival fracture with the help of gingivectomy and osteotomy procedures. However, it is not indicated in the areas where esthetics is required. The third option is removal of the coronal fragment and surgical extrusion of the tooth, to surgically move the fracture to a supragingival position. In this procedure, the periodontal ligament may fail to reattach to the root surface and remarkably increases the risk of root resorption. The fourth modality of the treatment is removal of the coronal fragment and subsequent orthodontic extrusion of the tooth.[1] Orthodontic extrusion, expose the fracture line by the tooth movements, very similar to the physiological tooth eruption. In spite of prolonged treatment procedure, it is favorable for the gingival and periodontal health. In addition, it does not cause loss of alveolar bone or periodontal support and provides good esthetic results.[7] In the present case, after taking the parental consent, orthodontic extrusion was carried out followed by gingivectomy.

Figure 1: Intraoral view showing fractured maxillary left central incisor and the fragment attached by gingival tissue

Figure 3: Orthodontic appliance in place applying traction on the fractured tooth to facilitate extrusion

Figure 5: Post-operative intra oral periapical radiograph after root canal filling and fracture fragment reattachment along with restoration

The purpose of additional preparations on the fractured tooth and the fragment before and after bonding is to improve the bond strength and esthetics. Reis *et al*.[8] demonstrated that creation of an internal grooves on both fragment and on

Figure 2: Pre-operative intra oral periapical radiograph showing the extent of fracture line

Figure 4: Intraoral view after fracture fragment reattachment and polishing of composite resin restoration

the fractured tooth, as well as, composite over contouring to the fracture line by placement of a bevel provided high fracture strength. In the presented case, internal grooves were prepared before bonding to improve the strength. External double chamfer margin was created after the bonding procedure to mask the fracture line, along with the strength which improved the esthetics.

Maintenance of adequate hydration of the fracture fragment when it is outside the mouth is another important factor to ensure adequate bond strength. Hydration also maintains original esthetic appearance of the tooth.[9] In the present case, the fractured fragment was preserved in distilled water until reattachment, it improved the esthetics with proper color matching to the natural tooth structure.

Biological restoration is highly conservative technique that promotes preservation of tooth structure and allows restoration of tooth with minimal sacrifice of the remaining tooth structure.[4] Furthermore, with the advent of newer adhesive materials available today, in conjunction with

appropriate techniques, esthetic results can be achieved with predictable outcomes.

Conclusion

Successful management of complicated crown-root fracture, involving the biologic width in a permanent maxillary central incisor has been presented. The biological restoration using autogenous tooth fragment and composite resin was possible because, access to the fracture margins was gained by means of orthodontic extrusion followed by gingivectomy. This case also demonstrates that reattachment of tooth fragments can successfully benefit periodontal health, esthetic needs and normal functioning of the tooth. However, the prognosis is dependent on patient cooperation and maintenance of good oral hygiene. Long-term follow-up is required for such cases.

References

1. Andreasen JO, Andreasen FM, Andersson L. In: Textbook and Color Atlas of Traumatic Injuries to the Teeth. 4th ed. Copenhagen-Denmark: Blackwell-Munksgaard Publishers; 2007.
2. Olsburgh S, Jacoby T, Krejci I. Crown fractures in the permanent dentition: Pulpal and restorative considerations. Dent Traumatol 2002;18:103-15.
3. Andreasen FM, Norén JG, Andreasen JO, Engelhardtsen S, Lindh-Strömberg U. Long-term survival of fragment bonding in the treatment of fractured crowns: A multicenter clinical study. Quintessence Int 1995;26:669-81.
4. Sargod SS, Bhat SS. A 9 year follow-up of a fractured tooth fragment reattachment. Contemp Clin Dent 2010;1:243-5.
5. Nogueira Filho Gda R, Machion L, Teixeira FB, Pimenta LA, Sallum EA. Reattachment of an autogenous tooth fragment in a fracture with biologic width violation: A case report. Quintessence Int 2002;33:181-4.
6. Macedo GV, Diaz PI, De O Fernandes CA, Ritter AV. Reattachment of anterior teeth fragments: A conservative approach. J Esthet Restor Dent 2008;20:5-18.
7. Fidel SR, Fidel-Junior RA, Sassone LM, Murad CF, Fidel RA. Clinical management of a complicated crown-root fracture: A case report. Braz Dent J 2011;22:258-62.
8. Reis A, Francci C, Loguercio AD, Carrilho MR, Rodriques Filho LE. Re-attachment of anterior fractured teeth: Fracture strength using different techniques. Oper Dent 2001;26:287-94.
9. Capp CI, Roda MI, Tamaki R, Castanho GM, Camargo MA, de Cara AA. Reattachment of rehydrated dental fragment using two techniques. Dent Traumatol 2009;25:95-9.

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