Biological Restoration in a Young Patient with a Complicated Crown Root Fracture with an Autogenous Tooth Fragment

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Crown-root fractures are one of the most challenging trauma cases to treat. Reattachment of tooth fragment to a fractured tooth being a simple procedure conserves the tooth structure, maintains the natural esthetics value and is thus considered as a favorable treatment option. The reattachment procedure using composite resin should be considered if the subgingival fracture can be exposed to provide isolation after a careful evaluation of the biologic width involvement. This case report presents a complicated crown-root fracture of permanent maxillay left central incisor, involving the biologic width in an 11-year-old boy. The traumatized tooth was treated endodontically and reinforced by using glass fiber-post. Access to the subgingival margins was gained by electro surgery. The fractured fragment was reattached using bonding system and composite resin.

Keywords*: biologic width, central incisor, composite resin, crown-root fracture, electro surgery, glass fiber-post, tooth fragment reattachment, traumatic injury.*

INTRODUCTION

Traumatic injuries to the anterior teeth and their supporting tissues are relatively common among children and adolescents. 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, and occur 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 breaches the biologic width which is the sum of the lengths of epithelial and connective tissue attachment to the tooth.[3]

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The primary goal for treatment of fractured teeth is aesthetics and functional rehabilitation. Relief of psychological stress due to missing tooth structure is another important factor to be considered by the clinician in children and adolescents. Though several therapeutic procedures are available for restoring fractured anterior teeth, reattachment of the fractured fragment would be an excellent biological approach for restoration, when the fragment is available.[4]

A biologic restoration using autogenous tooth fragment offers the advantage of being simple, less time consuming and conservative procedure. The rate of incisal edge wear is similar to that of adjacent teeth. It provides natural aesthetics in the form of colour, morphology and translucency match and acceptable by the patients with psychological benefits.[4,5] 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

An 11-year-old boy reported to the department of Pedodontics, seeking treatment for his traumatized upper front tooth which occurred due to an accidental fall one week earlier. Following trauma immediate medical assistance was given by the general medical practitioner wherein medications to relieve pain was provided including tetanus-toxoid coverage. His medical and family histories were non-contributory. On examination, no extraoral injuries were detected. Intraoral examination revealed the patient was in mixed dentition stage. Maxillary left central incisor was fractured horizontally in mesio-distal direction in the cervical third. The fracture line extended in an oblique direction bucco-lingually and the margin was subgingival on the palatal aspect involving the biologic width. The fractured fragment was mobile and attached by the gingival tissue (Figure 1). It was a crown-root fracture involving enamel, dentin, pulp and a small portion of cementum. There was no associated mobility of the remaining portion of the affected tooth. Intra oral

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

Figure 2. Pre-operative intraoral periapical radiograph showing the extent of fracture line.

periapical (IOPA) radiograph exhibited the extent of the fracture subgingivally (Figure 2). The fracture line was coronal to the level of crest of the interdental alveolar bone. Apex of the involved tooth was completely formed. Patient was unable to maintain the oral hygiene due to pain associated with the fractured tooth.

Figure 3. Fractured fragment separated from the gingival tissue.

Endodontic Procedure

The fractured fragment was separated from the gingival tissue after administration of local anesthesia (Figure 3). The tooth fragment was preserved in distilled water until reattachment. As the patient reported one week after the trauma and there was a need for intra radicular retention, 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. Shaping and cleaning of the canal was performed using endodontic K-files and H-files [*MANI,* INC. Utsunomiya, Tochigi, Japan] after the determination of working length. 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 [Deepashree products, Ratnagiri, India] mixed with saline. After one week when the tooth seemed to be asymptomatic, final obturation was performed using endodontic sealer [Endoflux, Ammdent, Mohali, India] with gutta-percha [Dentsply, France, SAS] by lateral condensation technique (Figure 4). To gain intra radicular retention and reinforce the tooth, a glass fiber post [Fibra Post Plus, Produits Dentaires SA, Vevey, Switzerland] was cemented with dual cure composite resin according to the manufacturer's instructions [Sealacore DC, Produits Dentaires SA, Vevey, Switzerland] (Figure 5).

Figure 4. Intraoral periapical radiograph after endodontic treatment.

Figure 5. Intraoral view showing cemented glass fiber post

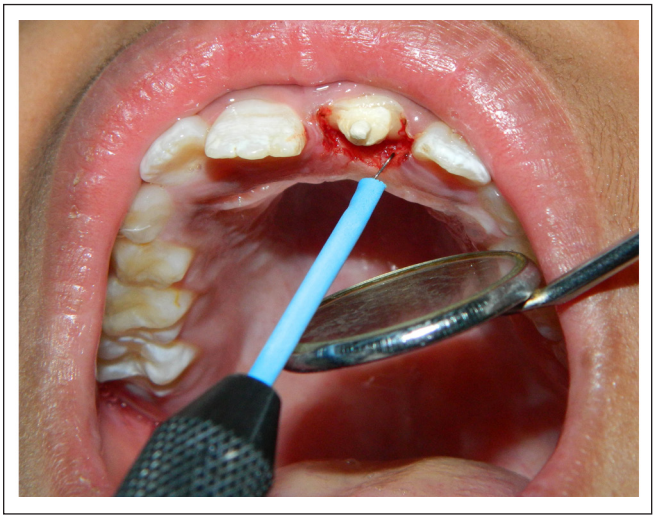

Figure 6. Intraoral view during electro surgery procedure.

Surgical Procedure

Following endodontic treatment, gingivectomy was planned using electro surgery to gain access to the fracture line on the palatal aspect of the tooth (Figure 6). After anesthetizing the area, bone sounding was performed with a Williams graduated periodontal probe. Electrosurgical tip was activated to remove the tissue ensuring adequate care to preserve the interdental papilla on either side of the tooth. Excision was performed to expose the sound tooth margin so as to facilitate seating of the fractured crown. The area was flushed with normal saline and tissue tags were excised with tissue nippers and Gracey curettes.

Tooth Fragment Reattachment Procedure

Dentine from the inner aspect of the tooth fragment was removed to provide space for the post. Proper position and the fit of the fragment was checked on the fractured tooth. 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 and the fiber-post, in accordance with the manufacturer's instructions. The space created for the post on the fragment was filled with A2 shade composite resin material [Filtek Z250; 3M ESPE AG, Seefeld, Germany] and a small layer of composite resin 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 photo polymerized for 40 seconds, while the fragment was held in place under pressure. On the coronal aspect of the fractured tooth, a double chamfer margin was created 1mm 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 photo polymerization was done according to the manufacturer's instructions. 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 7- 9).

Clinical and radiographic examinations after 3 months revealed a stable reattachment of tooth fragment, good aesthetics and periodontal health. The patient was asymptomatic throughout the period and the tooth was serving its function. Regular checkups at bimonthly intervals were advised.

Figure 7. Intraoral facial view after fragment reattachment.

Figure 8. Intraoral occlusal view after fragment reattachment.

Figure 9. Post-operative intraoral periapical radiograph after fragment reattachment.

DISCUSSION

Several factors need to be considered during the treatment of traumatized tooth such as the 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 aesthetics.[2,4,6] Management of complicated crown-root fractures is more challenging to the clinician due to difficulty in achieving isolation with a rubber dam. Failure to achieve dry operating field 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 zones of aesthetics. The third option is removal of the coronal fragment and surgical extrusion of the tooth in order to reposition the fractured margins 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] In the present case, the fracture line was above the crest of alveolar bone and extended subgingivally on the palatal aspect. Though the biologic width was invaded due to the fracture in the palatal aspect, in order to maintain the intact periodontal attachment on the labial and proximal areas, ostectomy after flap exposure was not considered. Hence, gingivectomy using electro surgery was carried out to expose the fracture line.

Nevins and Skurow[7] and Flores-de-Jacoby *et al* [8] reported that to maintain periodontal health, a space of 3 mm between the bone crest and the apical limit of the restoration would be necessary. Ramfjord[9] reported that it would be safer to place the restoration margin as far as possible from the bone. However, subsequently Ramfjord[10] affirmed that it is hard to justify the surgical removal of the bone at the alveolar crest just to create a 2 to 3-mm biologic width apical to the margin of the restoration. He stated that it appears to be more sensible to remove bone to the minimal extent needed to ensure access for placement and finishing of proper restorations in the areas of subgingival caries or fracture. In the presented case the fracture line on the palatal aspect of the tooth was exposed by electro surgery and no alveolar bone was removed, even though it did not reach the 3-mm distance between the margins and the crest of alveolar bone.

The periodontal healing was satisfactory and elicited no pocket formation after 3-months.

In fractures involving two thirds or more of the crown, post systems are usually used.[11] In the presented case the fracture was in the cervical third of the tooth. Hence, it was decided to gain intra-radicular retention for the fractured tooth fragment by using glass fiber post. The purpose of additional preparations on the fractured tooth and the fragment before and after bonding is to improve the bond strength and aesthetics. Reis *et al* [12] demonstrated that composite overcontouring to the fracture line by placement of a bevel provided high fracture strength. In the presented case dentine from the inner aspect of the tooth was removed before bonding to provide space for the post. External double chamfer margin was created after the bonding procedure to mask the fracture line which improved the aesthetics.

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 aesthetic appearance of the tooth.[13] In the present case, as the fractured fragment was preserved in distilled water until reattachment, it improved the aesthetics with proper colour matching to the natural tooth structure.

Advances in the field of biomaterials have opened-up new avenues in the treatment of fractured teeth. Van Dijken *et al* [14] reported that resin composite has a favorable subgingival reaction. Dragoo[15] showed the formation of junctional epithelium and connective tissue adjacent to subgingival restorative materials in humans. The important factor to consider is adequate fit and contour of the margin of subgingival restorations. In the presented case, the favorable clinical outcome may be attributed to good adaptation of the fragment, along with the sealing effect of the restorative materials used. A long junctional epithelium might have been established in the area.

CONCLUSION

A case of successful management of complicated crown-root fracture, violating the biologic width in a permanent maxillary central incisor has been presented. Access to the fracture margins was gained by means of gingivectomy facilitating a biologic restoration with autogenous tooth fragment and composite resin. This case also demonstrates the beneficial effects of tooth fragment reattachment on periodontal health, aesthetics 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.

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