Case Report

Management of complicated crown root fracture using pizeo surgery, fiber post and fragment reattachment: A case report

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ABSTRACT

A common type of fracture involving tooth is complicated crown root fracture of anterior teeth. The reattachment of the coronal fragment to the remaining tooth will provide better and long-lasting aesthetics, improved function and a positive psychological reaction. It is a simple and less difficult procedure if the original tooth fragments are retained after fracture. This paper reports about a case of complicated crown root fracture that was treated successfully using broken fragment adhesive reattachment and post placement.

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1. Introduction

Anterior tooth fractures are very common in children and young adolescents. Falls and contact sports are the most common causes.^{1,2} The maxillary central incisors are the most often damaged because of their place in the arch. Endodontically treatment of complicated crowns or crown-root fractures pose a significant challenge for dentists because they necessitate a thorough and precise diagnosis and treatment plan.^{3–5} The use of a definitive crown after crown lengthening or orthodontic or surgical extrusion, extraction accompanied by implant or fixed partial denture, and post and core-supported restorations are all common procedures for complicated crown root fractures.⁶ If the crown fragment is retrieved at the time of injury, its reattachment provides several advantages like maintaining the natural shape, contour, surface texture, occlusal alignment and color of the fragment, which offers excellent esthetic and functional results and less chair time.⁷ Recent advances in restorative materials and procedures have made

it easier to restore fractured teeth. Resin-based restorative materials are commonly used in the repair of broken teeth. Because of the low mechanical resistance of these materials, various approaches to improving composite resin resistance, such as fibre posts, have been developed.⁸ Tooth-colored fibre posts were introduced in the 1990s and have a number of benefits, including aesthetics, bonding to tooth structure, and having a modulus of elasticity comparable to dentin, however dentin preparation is needed to fit into the canal.⁹ The purpose of this article is to report a case of successful crown reattachment of complicated crown root fracture with 1-year follow-up

2. Case Report

A 42-year old male patient presented to the Department of Conservative Dentistry and Endodontics after sustaining a complicated crown root fracture to his maxillary central incisors with history of trauma. The patient's medical history was non-contributory. No mobility of the injured tooth was recorded and there was no apparent trauma to the soft tissues extra orally and intraorally. On hard tissue

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examination, a complicated crown root fracture was seen wt 11, 12 with the fracture line extending from the cervical third of crown on labial aspect to 2 mm subgingivally on the palatal aspect (Figure 1). The fractured fragment was loosely attached to the tooth. A periapical radiograph showed that the root formation was complete, with no extrusion. The patient expressed the desire to maintain the tooth and restore it due to the lower cost compared to an indirect restoration. A detailed explanation about the treatment plan was given to the patient, which included root canal treatment and reattachment with fiber post. The treatment plan was accepted by the patient and written consent was obtained.

Fig. 1:

2.1. Phase 1: Surgical extraction of fragment (Figures 2 and 3)

Local anesthetic was administered and the segment was removed with minimal force, recovered and stored in normal saline to prevent discoloration and dehydration

2.2. Phase 2: Conventional nonsurgical endodontic treatment (Figure 4)

Access opening was done. Working length was determined with a radiograph and then confirmed with an electronic apex locator (Root ZX II, J. Morita Corp., Kyoto, Japan). Cleaning and shaping was done in a crown-down approach with ProTaper universal files (Dentsply Maillefer, Ballaigues, Switzerland) till F5 which has a diameter of 0.5 mm at D0 and 2% taper. Twenty milliliters of 3% NaOCl was used for irrigation. The tooth was then obturated with corresponding gutta-percha cones with AH plus sealer. A postoperative radiograph was obtained and was found to be satisfactory

Fig. 2:

Fig. 3:

2.3. Phase 3: Crown lengthening using Piezosurgery (Figures 5 and 6)

Table 1: A comprehensive periodontal examination was done.

11	MB	MIB	DB	MP	MIP	DP
CH	3	4	3	2	1	0
PD	1	1	1	1	1	1
12	MB	MIB	DB	MP	MIP	DP
CH	2	3	3	2	2	1
PD	1	1	1	1	1	1

CH: Crown height; PD: Probing depth; MB: Mesio Buccal; MIB: Mid Buccal; DB: Distobuccal; MP: Mesio Palatal; MIP: Mid Palatal; DP: Distopalatal.

Fig. 4:

Under local anesthesia (2% Lidocaine with adrenaline 1:200000 concentration), internal bevel incision of 2 mm buccal and 3 mm in the palatal aspect was given followed by crevicular incision and elevation of a full thickness periosteal flap. The marginal cuff of tissue was removed using an area specific Gracey curette (#1-2). Osseous reduction (2 mm) was carried out to increase the crown height and to establish adequate biological width. Piezosurgical tips CE1 (ball diameter — 1.75 mm) and CE2 (ball diameter — 1.20 mm) were used to recontour the bone around the tooth with light sweeping strokes. D2 setting was used for the procedure with a controlled flow of sterile saline (Flow rate - 80 ml/min) in the Piezotome (CUBE®) equipment.

2.4. Phase 4: Post placement (Figure 7)

The root canal was prepared for the post placement by removing the gutta-percha from the coronal two third of the canal with peso reamers. The fiber post was tried in the canal and adjusted to the desired length. Space was also prepared in the pulp chamber of the fractured crown fragment for receiving the coronal portion of the post and also the core. The alignment of the coronal fragment was verified with the post in place. The root canal was then etched with 37% orthophosphoric acid, rinsed, blot dried with paper points, and bonding agent (PRIME and BOND NT, DENTSPLY) was applied. The post was then luted in the canal using dual-cured resin luting cement (RelyX, 3M, USA). The inner portion of the coronal fragment was similarly etched and bonded to the tooth using flowable composite resin

Fig. 5:

Fig. 6:

2.5. Phase 5: Post attachment bevel

Then, a 1 mm-deep circumferential chamfer was placed on the fracture line using a diamond bur with a depth marker. The chamfer was restored using the same composite

Flaps were then approximated with 3-0 BBS sutures (Figure 8). Post-operative medications prescribed comprised of Moxclav 625mg, twice daily use of Chlorhexidine oral rinse 0.2% was recommended for two weeks, along with other pertinent postoperative instructions. The postoperative healing was uneventful and the sutures were removed on the 10th postoperative day followed by a fibre splinting (Figures 9 and 10).

Fig. 7:

Fig. 9:

Fig. 8:

Fig. 10:

3. Discussion

Patients with fractured anterior teeth feel discomfort, anxiety, and emotional concern about their appearance.¹⁰ The best choice to give these patients is typically an immediate restoration of the aesthetic appearance while maintaining the natural tooth. Several case studies illustrate how uncomplicated tooth fractures can be successfully reattached.

Fragment reattachment, when the broken fragment is intact and accessible, can be the most functional and aesthetic treatment choice, even in complicated fracture cases, as illustrated in this article. The reattachment of a tooth fragment can have the following benefits.^{11,12} Shade matching and translucency would be fine, resulting in better aesthetics. Incisal edge can wear at a rate similar to that of adjacent teeth using a minimally invasive technique, particularly with current advances in dentinal adhesives, rehabilitation that is practical. It is possible that replacing the broken component would take less time than what is currently needed for completion of a provisional restoration, a positive emotional and social response from the patient for preservation of natural tooth structure, considered and used as a transitional restoration for a young patient. Over years particularly with teeth in the aesthetic zone, such as maxillary incisors, a clear transition from metal alloy posts to fiber-reinforced resin-based composite (FRC) posts has been observed. FRC posts have a dentin-like modulus, which allows for a more balanced distribution of occlusal stresses in the root dentin, resulting in fewer and milder in vitro root fracture failures.¹³ Furthermore, by combining a glass fibre post with a composite core and adhesive materials, a monoblock, a multilayered structure with no inherent weak interlayer interfaces, can be formed, which strengthens the tooth structure.¹⁴

In the case described, the fracture line was below the gingival stage, so the gingival flap was raised to gain access to the fractured site for bonding the fractured part. Since the biological width was invaded and the restorative margin could not be positioned at or above the cemento-enamel junction, bone recontouring by crown lengthening would be recommended in the pre-operative period. The literature suggested that whenever biologic width is invaded, surgery should be performed with minimum osteotomy and osteoplasty.¹⁵ In the present case the procedure of crown lengthening was done with Piezosurgery equipment. Compared with traditional rotary instrumentation, Piezosurgery requires less hand pressure allowing for enhanced operator sensitivity and control. Microvibrations produced by Piezosurgery are low frequency modulated vibrations at 25 to 30 kHz, which selectively cut the bone without damaging adjacent soft tissues.¹⁶ Piezosurgery not only selectively removes hard tissue, but also has a hemostatic effect on surrounding tissue. As a consequence, it can be used in cases where bone is

close to essential and fragile structures like nerves, blood vessels, or the sinus mucosa.¹⁷

For the reattachment of the fragments in the above cases, a dual cure resin cement RelyX 3M, which is a self-etching and self-adhesive device, was used. This dual cure resin cement has a solid bond, complete curing, and limited microleakage. The coronal fragment was bonded to the remaining tooth with a flowable composite resin with excellent colour stability, minimizes the presence of air voids and aids in the attainment of higher fracture segment bond strength. Cavaller et al., reported a better long-term prognosis for the reattachment of crown fracture comparing to composite resin restorations.¹⁷ In the present case a circumferential chamfer post reattachment bevel was given. According to Davis et al., the enamel margins of tooth and fragment were beveled circumferentially before reattaching the fragment to obtain a better retention and enhancement of the finishing line with resin composite. Its placement altered the enamel prism orientation, allowing more effective enamel acid etch.¹⁸

4. Conclusion

The choice of reattaching a fractured fragment offers immediate aesthetic, functional, and biologic restoration. It may be the first treatment option for anterior tooth crown fractures since it is the most conservative and time-saving option. The key requirements for suggesting and achieving success with this alternative therapy are intact broken fragment edges and clear access to the fracture.

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None.

6. Conflict of Interest

None.

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