

Holistic management of complicated crown fracture: A case series

Madhuri Patil, Vivek Hegde, Mehrosh Khan, Nain Kharbe, Dhananjay Ghunawat

Department of Conservative Dentistry and Endodontics, M. A. Rangoonwala College of Dental Sciences and Research Centre, Pune, Maharashtra, India

Abstract

Coronal fractures of the anterior teeth give an agonizing experience for a young individual due to the physical disfigurement, and the psychological impact that is imposed on them. One of the options for managing complicated/uncomplicated crown fractures when the tooth fragment is available, and there is no or minimal violation of the biological width is the rebonding of the fractured segment. This treatment approach is promising, providing good and long-lasting esthetics as it helps in maintaining the tooth's original anatomic form, hue, and surface texture. This article describes three case reports of successful reattachment of fractured tooth fragments. Following the root canal treatment procedures, prefabricated posts were cemented as intraradicular splint to reattach the fractured segments.

Keywords: Complicated crown fracture; fiber post; fiber-reinforced composite; fragment reattachment; trauma

INTRODUCTION

Coronal fractures of the anterior teeth are a common form of dental trauma that affects the primary and permanent teeth because of their frequency which has an impact on economic productivity and quality of life. It mainly affects schoolchildren and youngsters, and its prevalence ranges from 7.4% to 58%.^[1] Crown root fractures account for 5% of all the traumatic injuries in permanent teeth involving enamel, dentin, and cementum. Management of such types of injuries mainly depends on the age of the patient, the extent of the fracture, severity and location of the invasion of the biological width, presence or absence of pulpal involvement, maintaining occlusion, esthetics, and also fulfilling the patient's expectations.^[2] Different approaches for the treatment of complicated and uncomplicated crown root fracture ranges from restoring with direct composite resin, ceramic restorations (full crowns, laminate, and

veneers), and fragment reattachment. According to the current International Association of Dental Trauma, 2020 guidelines tooth fragment reattachment (TFR) is the treatment of choice when the fragment is available, especially when there is no invasion of the supracrestal attached tissues, i.e., the biological width.^[3]

The TFR technique recovers esthetics, preserves natural tooth tissue, and also promotes a positive emotional and physiological state. In 1964, Choask and Eidelman described a case involving the reattachment of a natural tooth fragment. Since then, different preparation techniques, i.e., bevel, circumferential chamfer, buccal chamfer, over contour, and internal dentinal grooves as well as the introduction of adhesive materials have increased the chemical and mechanical retention of the fragments. The present article describes the esthetic rehabilitation of complicated crown fractures through an interdisciplinary approach.

CASE SERIES

Case I

A 28-year-old male arrived at the Department of Conservative Dentistry and Endodontics with mobile and damaged teeth

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Patil M, Hegde V, Khan M, Kharbe N, Ghunawat D. Holistic management of complicated crown fracture: A case series. J Conserv Dent Endod 2023;26:719-23.

Address for correspondence:

Dr. Madhuri Patil,
Department of Conservative Dentistry and Endodontics, M. A. Rangoonwala College of Dental Sciences and Research Centre, Hidayatullah Azam Campus Camp, Pune, Maharashtra, India.
E-mail: madhuripatil89@gmail.com

Date of submission : 01.06.2023

Review completed : 24.06.2023

Date of acceptance : 23.09.2023

Published : 22.11.2023

Access this article online

Quick Response Code:



Website:
<https://journals.lww.com/jcde>

DOI:
10.4103/JCDE.JCDE_2_23

in his maxillary anterior region as his chief complaint. The patient history revealed that he had sustained injury 2 days back after a road traffic accident. His medical history was noncontributory. Extraoral examination revealed no evidence of soft tissue damage. On electric pulp testing, the tooth (11) was non-responsive. On clinical examination, fracture line was noticed running in labio palatal direction along with pulp exposure. A diagnosis of complicated crown fracture (Andreasen) (873.62) with 11 was made. The fractured tooth fragment was incompletely separated and attached by the palatal soft tissue [Figure 1a]. The intraoral periapical (IOPA) revealed no associated root fracture [Figure 1b]. The treatment options suggested to the patients were (1) removal of fractured fragment followed by root canal treatment with full coverage crown, (2) reattachment of tooth fragment, and (3) extraction of tooth followed by implant. After explaining the merits, demerits, prognosis, and cost of every treatment options, the patient opted for the reattachment procedure.

On the same visit: after administration of local anesthesia, i.e., 2% lidocaine (Cadila), the teeth were isolated under a rubber dam. The mobile dental fragment was removed, and stored in normal saline to prevent dehydration and discoloration [Figure 1c]. The endodontic procedure was initiated soon after the detachment. Working length was determined with a #15 K file (Mani, Tochigi, Japan), using an electronic apex locator (Root ZX Mini) and a radiograph was taken for confirmation. E3 Azure rotary file system (ENDOSTAR) was used for biomechanical preparation up to apical file size 25.06. Sectional obturation was performed while maintaining a 5-mm apical seal using AH Plus resin-based sealer. Postspace was prepared using peeso reamers up to size two followed by fiber posttrial (Reforpost and Angelus), and the tooth was temporized with temporary restorative material (Cavit). Intrasulcular flap was reflected to expose the palatal fracture line palatally. Achieving complete isolation, the root canal and the tooth were etched with 37% phosphoric

acid for 15 s and then rinsed with water for 30 s. Two layers of adhesive (Tetric N-Bond Ivoclar) were applied and then light-cured for 20 s. In addition, the fiber post fit was evaluated, and the post-head was adjusted to ensure it perfectly accommodated the crown fragment and adapted precisely to the crown margins. The head of the post was fixed inside the pulp chamber with dual cure resin-based composite (Paracore, Coltene) without polymerization. The post along with the crown fragment *in situ* was then positioned, and an excess resin-based composite was removed and cured for 40 s each on the palatal and labial side. The flap was then repositioned and sutured followed by splinting with a fiber-reinforced composite (Ribbond, US) splint for 4 weeks [Figure 1d]. The patient reported to the department after 4 weeks, the splint was removed, and further finishing and polishing was performed using a composite polishing kit (Super snap, SHOFU) [Figure 1f]. In a follow-up clinical evaluation after 6 months, the fracture line was not visibly noticed, and periodontal conditions were observed satisfactory [Figure 1e].

Case 2

A 30-year-old female reported to the department of conservative dentistry and endodontics with a chief complaint of mobile and fractured teeth in the maxillary anterior region. She had a history of fall from a bike 2 days prior with the primary medical care done at a government dental hospital. On clinical examination, it was noticed that a small increment of composite resin was placed by the dentist in the emergency office to stabilize the fractured fragment. On extra oral examination, lacerations on the upper and lower lips were present with sutures on the lower lip. Intraoral examination including the electric pulp test was done which came out to be nonvital, and it also revealed a mobile fragment with maxillary right central incisor 11 and fracture line on the palatal surface extending subgingivally onto the labial side [Figure 2a]. Palatal gingiva and interdental papilla were neither inflamed nor edematous [Figure 2b]. IOPA revealed no associated root

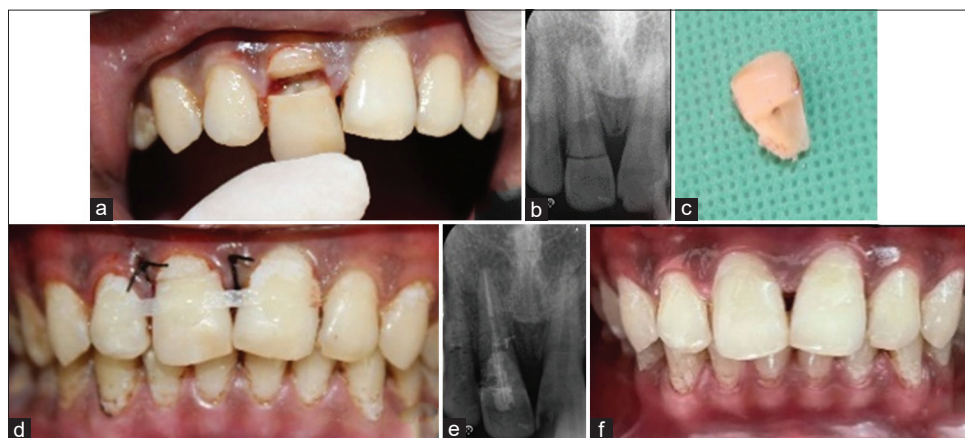


Figure 1: (a) Pre-operative clinical view, (b) pre-operative IOPA (11), (c) extracted fragment placed in saline, (d) suture placement and splinting, (e) 6 months follow-up IOPA (f) 6 months follow-up (clinical view)

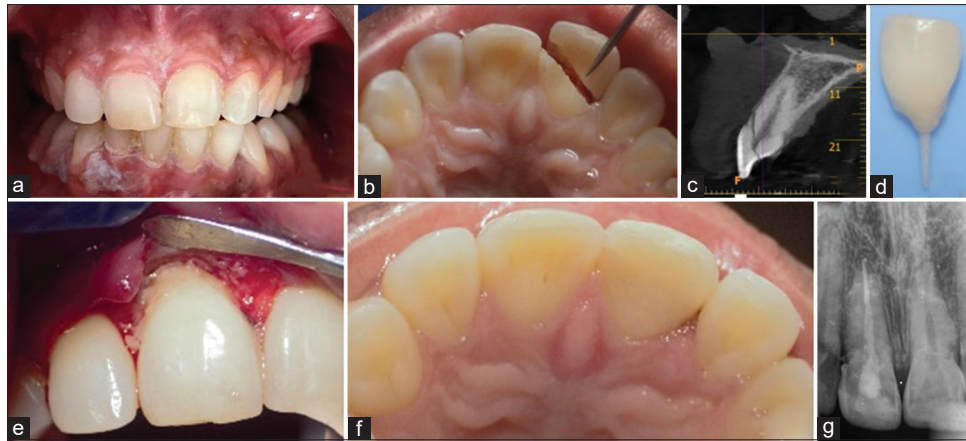


Figure 2: (a) pre-operative clinical view 11 (labial), (b) pre-operative clinical view (palatal), (c) pre-operative CBCT showing the extent of the fracture, (d) fiber post attached to the extracted fragment, (e) fragment reattached, (f) Postoperative palatal view showing complete healing, (g) 6 months follow-up (IOPA)

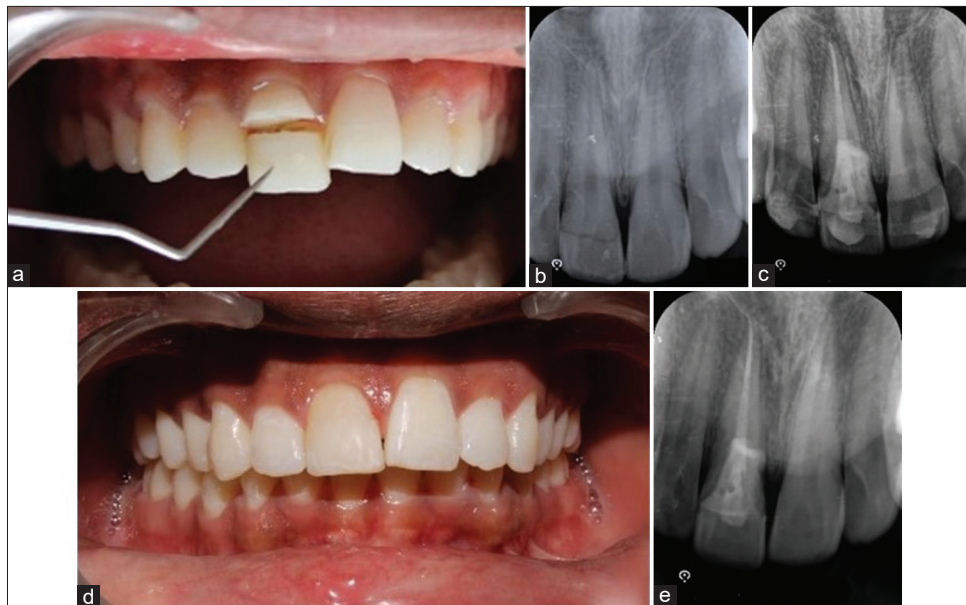


Figure 3: (a) pre-operative clinical view(labial), (b) pre-operative IOPA (11), (c) immediate post-operative IOPA after placement of splint, (d) postoperative clinical view, (e) 6 months follow-up IOPA

fractures or periapical radiolucency. Cone beam computed tomography (CBCT) scan revealed a fracture line running subgingivally below the level of cemento enamel junction (CEJ) on the labial side while supra-gingival on the palatal side suggestive of a complicated crown fracture (873.62) with 11 [Figure 2c]. The fracture was diagnosed as an Ellis class III fracture and according to Andreasen, it is a complicated crown fracture (873.62) with 11 [Figure 2c]. A single-visit root canal treatment was performed with 11. An access hole was prepared in the palatal surface of the fractured fragment, and a retention groove was made within the dentin to enhance the retention [Figure 2d]. Flap elevation was performed on the palatal side under local anesthesia. The remaining tooth structure, fiber-post, and the fractured segment were etched and two coats of dentin bonding agent (single bond 3M ESPE) were

applied. The segment was reattached with dual cure resin cement (Luxacore DMG) [Figure 2e]. All the margins were light cured for 40 s and were polished using a composite polishing kit (SHOFU) [Figure 2f]. At 6-month follow-up, esthetic results were satisfactory [Figure 2g].

Case 3

A 25-year-old male reported to the department of conservative dentistry and endodontics with a chief complaint of fractured teeth in the maxillary anterior region. He had suffered from trauma 4 days back after a fall from his motorcycle. On extraoral examination, there was no apparent trauma to the soft tissues. An intricate crown fracture of the maxillary right central incisor was discovered during an intraoral examination. The fracture line of 11 extended supragingival on the labial side and

subgingivally on the palatal side. The interdental papilla and palatal gingiva lacked edema or inflammation. IOPA revealed no associated root fractures and periapical radiolucency and a diagnosis of complicated crown fracture 873.62 (Andreasen classification), and Ellis class III fracture with 11 was made. As per the patients' esthetic demand, it was decided to reattach the fragment. The entire procedure was completed in a single visit. Sectional obturation was performed followed by reattachment of the fractured fragment with the fiber-reinforced post using dual cure resin cement (Luxacore). In the second visit, finishing and polishing were done using a composite polishing kit. Six-month follow-up visit confirmed the success of the treatment as the patient was asymptomatic based on clinical and radiographic evaluations [Figure 3].

DISCUSSION

The present article discussed a series of three cases of complicated crown fractures treated with TFR and the results of follow-up examinations at 6 months intervals. If the fracture exposes the dental pulp, the injury is defined as a "complicated crown fracture" or a Class 3 fracture (Ellis and Davey 1970, Andreasen and Andreasen 1993). The present case series observed complicated crown fractures, corroborating previous epidemiologic studies found that maxillary central incisors are the most commonly affected teeth. The treatment approach for a complicated crown fracture should consider the following points: (i) the period between the incidence of injury and initiation of treatment (ii) the level and position of the tooth fracture line (iii) the root development stage (iv) pulpal involvement (v) availability of displaced tooth fragments and (vi) presence of alveolar bone injury.^[4]

Injury to the front teeth is tragic and needs to be treated right away, because it might harm the patient's dentition and psychological well-being. Reattaching the broken tooth segment is an urgent restorative procedure for a fractured anterior tooth. The procedure restores the morphological, esthetics, and functional aspects of the dentition. Whenever the fragment is available TFR should be the option of choice. However, the fragment's ability to adapt well to the coronal remnant and its degree of hydration are key factors in successful reattachment. The tooth strength will be impaired as long as the tooth fragment remains dehydrated.^[5]

Although a recent guideline recommends rehydrating the fragment by soaking it in water or saline for 20 min before bonding, and a systematic review by de Sousa *et al.* in 2018 recommends a longer rehydration period, 24 h, for better adhesive results, especially if the fragment is severely dehydrated.^[6] Collagen fibers break as a result of dentin dehydration, which hinders the penetration of resin

monomers and results in poor adhesion between the dentin and composite. The patient presented to the department with a fractured segment posttrauma; thus, the fractured segment was much less likely to become dehydrated.^[7] The orientation of the fracture line is an important factor in restorability since it directly affects the prognosis of the teeth. Accordingly, in the above case series, the fractured fragment was in good condition and had a proper fit over the radicular portion. The reattachment method using fiber postreinforcement was therefore the most suitable. With a 12-month follow-up period, Sapna *et al.* reported three examples of successful reattachment of a fragmented piece of maxillary anterior teeth. They also concluded that tooth-colored fiber posts may be the best option with several advantages such as natural esthetics, better bonding between post and cement, similar modulus of elasticity as that of dentin, lower chair time, and minimal tissue removal.^[8] In addition, fiber posts allow stress to be distributed to the remaining radicular dentin. In addition to strengthening the tooth, luting the fiber posts with dual cure resin cement increases the bond strength of the fractured segment. Furthermore, it decreases the presence of air spaces, yields result in that are predictable, and is simple to use. Inadequate polymerization in apical regions is a risk with light-cured luting resin cement. Therefore, dual-curing systems are more suitable since they allow for the polymerization of even those areas that otherwise would have been left uncured because of insufficient light reaching deeper areas.^[9]

As per Shirani *et al.*, reattachment of the fragment with no preparation technique and adequate rehydration resulted in higher bond strength.^[9] One of the cases from the present case series involved reattaching the tooth with minimal internal groove preparation.^[7] Since eugenol based sealers may prevent resin cement from setting, a resin based sealer is often used to obturate the teeth that will be repaired by glass fiber posts. The intact tooth fragment must be accessible for this procedure to work, though.^[10]

The use of resin cement was opted over light cure composite resin, considering that the shade, viscosity, and dual-cure mechanism of these types of cement facilitate the insertion and polymerization while the innermost portions of the luting interface may not be light cured.^[11] Long-term follow-up is essential for a complete evaluation of the pulpal and periapical conditions of the traumatized tooth as well as the clinical follow-up of the restoration. Therefore, radiographic monitoring of dental trauma is essential for investigating small changes in supporting tissues that, when present, must be properly diagnosed and treated.^[12]

Reattaching teeth fragments has certain benefits over traditional composite and prosthetic restorations, especially in young patients. However, fractures that extend subgingivally are extremely challenging to repair and have

a low healing rate. The biological width is the sum of the epithelial and connective tissue attachment lengths. It has been suggested that flap surgery should be executed with minor osteotomy and osteoplasty when the fracture invades the biological width. However, Ramfjord reported that in situations with minimal biologic width invasion, the organism can restore biologic width by itself, and provided the dental plaque is properly controlled.^[13,14] Given that the biologic width invasion was relatively low and supraosseous in the aforementioned cases, and the fracture line was revealed through periodontal flap reflection. The fit, contour, and surface polish of the subgingival restoration also affect how successfully the teeth are reattached. After being followed up for 3–6 months, the patient's clinical and radiographic results were satisfactory, showing normal contour and look. Furthermore, efforts should be taken to increase the retention of the fractured segment by incorporating retentive factors such as using different techniques and materials including circumferential chamfer, vertical grooves with fiber-reinforced composite posts, and internal dentin groove technique.^[15] Contemporary management of biological restorations is always a reliable treatment option when the fractured fragment is in good condition and can be repositioned also, for biomimetic fracture lines, current restorative dentistry offers adhesive techniques and materials.^[16] Here, we demonstrated fragment reattachment in three cases of complicated crown fracture. The use of a fiber post along with adhesive technology may be a sound restorative alternative and less invasive procedure than full-coverage crowns.

CONCLUSION

Restoration of the fractured fragment is considered a simple, economical, and effective alternative to restore esthetics and functions. However, long-term follow-up should be carried out to evaluate the prognosis of the fractured segment.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Diangelis AJ, Andreasen JO, Ebeleseder KA, Kenny DJ, Trope M, Sigurdsson A, *et al.* International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth. *Dent Traumatol* 2012;28:2-12.
2. Khandelwal P, Srinivasan S, Arul B, Natanasabapathy V. Fragment reattachment after complicated crown-root fractures of anterior teeth: A systematic review. *Dent Traumatol* 2021;37:37-52.
3. Bourguignon C, Cohenca N, Lauridsen E, Flores MT, O'Connell AC, Day PF, *et al.* International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations. *Dent Traumatol* 2020;36:314-30.
4. Aggarwal V, Logani A, Shah N. Complicated crown fractures—Management and treatment options. *Int Endod J* 2009;42:740-53.
5. Panchal D. A case report of uncomplicated crown fracture: Tooth fragment reattachment. *Br Dent J* 2019;227:259-63.
6. de Sousa AP, França K, de Lucas Rezende LV, do Nascimento Poubel DL, Almeida JC, de Toledo IP, *et al.* *In vitro* tooth reattachment techniques: A systematic review. *Dent Traumatol* 2018;34:297-310.
7. Rajnekar R, Mankar N, Nikhade P, Chandak M, Burde K. Conservative management of complicated crown-root fracture: An immediate esthetic rehabilitation. *Cureus* 2022;14:e25627.
8. Sapna CM, Priya R, Sreedevi NB, Rajan RR, Kumar R. Reattachment of fractured tooth fragment with fiber post: A case series with 1-year followup. *Case Rep Dent* 2014;2014:376267.
9. Shirani F, Malekipour MR, Sakhaei Manesh V, Aghaei F. Hydration and dehydration periods of crown fragments prior to reattachment. *Oper Dent* 2012;37:501-8.
10. Thapak G, Arya A, Arora A. Fractured tooth reattachment: A series of two case reports. *Endodontology* 2019;31:117-20.
11. Taguchi CM, Bernardon JK, Zimmermann G, Baratieri LN. Tooth fragment reattachment: A case report. *Oper Dent* 2015;40:227-34.
12. Andreasen JO, Andreasen FM, Andersson L, editors. *Textbook and Color Atlas of Traumatic Injuries to the Teeth*. John Wiley and Sons; Hoboken, NJ, 2019.
13. Ramfjord SP. Periodontal considerations of operative dentistry. *Oper Dent* 1988;13:144-59.
14. Mojirade AD, Funmilayo AS, Olaide GS. Reattachment of fractured anterior tooth: A 2-year review of a case. *Int J Prosthodont Restor Dent* 2011;1:123-7.
15. Karre D, Muppa R, Duddu MK, Nallachakrava S. Fracture resistance of reattached fragments using three different techniques with emphasis on vertical grooves and fiber-reinforced composite post: A novel technique. *J Conserv Dent* 2017;20:474-8.
16. Rodríguez-Astorga A, Romo-Ramírez G, Ortiz-Magdaleno M. Reinsertion of a fractured clinical crown as a biological restoration after dental trauma. *J Conserv Dent* 2020;23:538-42.