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Conservative Rehabilitation of Endodontically Treated Fractured Anterior Teeth Using Fragment Reattachment: A Case Series

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Abstract

Traumatic dental injuries involving the anterior teeth frequently present as complicated crown fractures, posing challenges in achieving functional and esthetic rehabilitation. Conservative fragment reattachment techniques, reinforced with fiber posts or polyethylene fibers, provide an ultraconservative approach while preserving tooth structure. In this report, two male patients (25 and 42 years old) presented with complicated crown fractures of the maxillary anterior teeth following trauma. Both cases were managed with nonsurgical root canal therapy followed by conservative fragment reattachment. Fiber reinforcement was employed using prefabricated fiber posts in one case and Ribbond polyethylene fiber in the other. Clinical and radiographic evaluation demonstrated stable fragment reattachment, satisfactory esthetic results, and restored occlusal function. Both patients remained asymptomatic on follow-up. These findings suggest that conservative reattachment of fractured tooth fragments using adhesive techniques, combined with fiber reinforcement, is a predictable and effective treatment for complicated crown fractures, ensuring functional stability and optimal esthetic outcomes while preserving natural tooth structure.

Keywords: Dental Injuries, Crown Fractures, Reattachment, Fiber Posts, Ribbond Polyethylene Fibers.

INTRODUCTION

Traumatic dental injuries affecting the anterior teeth are among the most common emergencies encountered in dental practice, particularly involving maxillary incisors due to their prominent position in the dental arch and exposure to direct impact during falls, interpersonal violence, and accidental trauma. These injuries can range from uncomplicated enamel fractures to more complex complicated crown and crown-root fractures involving the dental pulp and surrounding structures. Complicated fractures not only cause severe pain and functional impairment, but also present significant challenges in restoring esthetics and structural integrity of the tooth. [1]

The primary goals in managing complicated crown fractures are effective pain control, preservation of pulp vitality, when possible, restoration of functional occlusion, and achievement of esthetic outcomes. Traditional approaches have included conventional restorative techniques or full-coverage crowns following endodontic therapy; however, these may require extensive tooth reduction and may not always preserve the natural morphology of the tooth. [2,3]

Advancements in adhesive dentistry and fiber-reinforced materials have expanded conservative treatment options. Reattachment of the patient's own fractured tooth fragment using resin cement and fiber-reinforced techniques is increasingly recognized as a viable and ultraconservative option when the fragment is available and suitable for bonding. This approach preserves the original tooth color, texture, and morphology, resulting in superior esthetic integration and positive psychological benefits for the patient. [4]

Several clinical reports have shown that when combined with appropriate endodontic therapy and reinforcement strategies such as fiber posts or polyethylene fibers (e.g., Ribbond), fragment reattachment can lead to stable functional outcomes and satisfactory esthetics in the long term. [5]

In this case series, we describe two cases of complicated crown fractures in the maxillary anterior region that were managed using endodontic therapy followed by conservative fragment reattachment techniques, highlighting clinical decision-making and adhesive restorative protocols aimed at achieving optimal structural and esthetic rehabilitation.

CASE REPORT 1

A 25-year-old male patient presented to the Department of Conservative Dentistry and Endodontics, K.D. Dental College, Mathura, with the chief complaint of severe pain in the maxillary anterior region associated with fractured anterior teeth. The pain was aggravated even on slight touch. The patient reported to the clinic 8 days after sustaining trauma. History revealed a physical assault in which a direct blow was delivered to the maxillary anterior teeth. The patient's medical history was non-contributory, and he was not under any long-term medication.

Extraoral and intraoral soft-tissue examination revealed no swelling, laceration, or hematoma. Intraoral examination showed fractured tooth fragments attached but mobile in relation to teeth 21 and 22 (Figure 1A). These teeth were tender on palpation and percussion, while tooth 11 also exhibited tenderness on percussion. Pulp vitality testing using electric pulp testing and cold testing showed an early positive response in teeth 21 and 22, whereas tooth 11 did not respond to either test, indicating loss of vitality. Based on clinical findings, teeth 21 and 22 were diagnosed with Ellis Class III fractures, while tooth 11 presented with an Ellis Class IV fracture. The fracture line in tooth 22 extended subgingivally and was confirmed clinically.

Intraoral periapical radiographs revealed fracture lines involving enamel and dentin with pulpal exposure in teeth 21 and 22 (Figure 1B). The fracture line in tooth 22 extended below the gingival margin.

A B

Figure 1: Peroperative (A) Clinical and (B) Radiographic images of complicated crown fracture involving teeth 21 and 22

Based on clinical and radiographic findings, tooth 11 was diagnosed with pulpal necrosis with symptomatic apical periodontitis, while teeth 21 and 22 were diagnosed with symptomatic irreversible pulpitis with symptomatic apical periodontitis associated with complicated crown fractures.

Considering the delayed presentation after trauma (8 days), pulpal involvement, and the need for functional and esthetic rehabilitation, nonsurgical root canal treatment followed by fiber post–supported restoration was planned. The patient was informed about the treatment procedure, prognosis, and alternatives, and written informed consent was obtained.

Local anesthesia was administered using 2% lignocaine with 1:80,000 adrenaline. The mobile fractured fragments from teeth 21 and 22 were carefully removed (Figure 2A and 2B). The fragments were cleaned, soft-tissue remnants were gently debrided, and the fragments were stored in sterile normal saline to prevent dehydration (Figure 2C).

A B C

Figure 2: (A) Clinical front view after removal of fractured fragment from 21 and 22 (B) Radiograph after removal of fractured fragment from 21 and 22 (C) Fractured fragment stored in saline irt 22

After achieving hemostasis, access cavity preparation was performed in teeth 11, 21, and 22. Pulp extirpation was carried out, and working length was determined using an electronic apex locator and confirmed radiographically (Figure 3A).

Biomechanical preparation was performed using the crown-down technique with hand K-files up to size #70 for teeth 11 and 21 and size #60 for tooth 22. Irrigation was performed using 2.5% sodium hypochlorite and 17% EDTA followed by saline irrigation. The canals were dried with sterile paper points, and calcium hydroxide paste was placed as an intracanal medicament. The access cavities were sealed with a temporary restorative material.

After one week, the patient was asymptomatic. Obturation was performed using the lateral compaction technique with gutta-percha and a bioceramic sealer. Master cone placement was radiographically verified prior to obturation (Figure 3B). A temporary restoration was placed following obturation (Figure 3C).

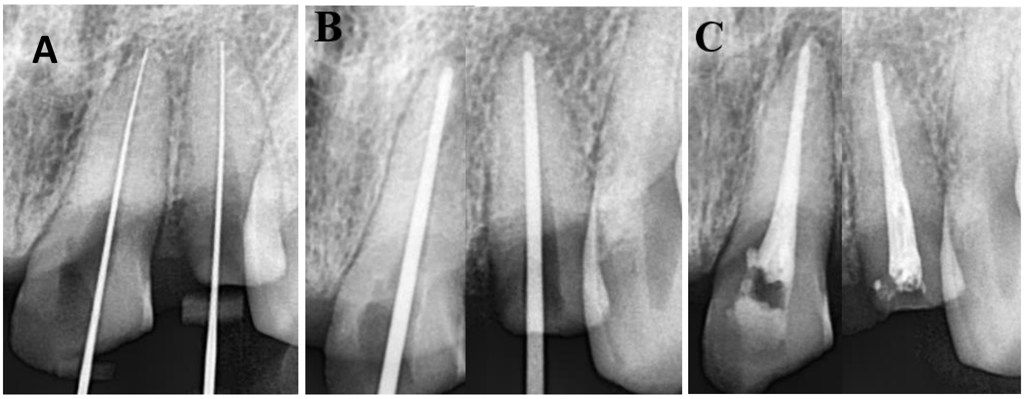

Figure 3: Radiographic (A) Working length determination (B) Master apical cone verification (C) Post-obturation evaluation of teeth 21 and 22

Two days later, post space preparation was performed in teeth 21 and 22 (Figure 4), maintaining an apical seal of approximately 4–5 mm of gutta-percha. Prefabricated fiber posts were selected.

Figure 4: Radiographic evaluation of post space preparation in teeth 21 and 22

The fiber posts were etched with 9% hydrofluoric acid for 30 seconds, rinsed, and air dried. A silane coupling agent was applied and allowed to react for 10 seconds, followed by gentle air drying. The post spaces and fractured fragments were etched with 37% phosphoric acid, rinsed, and dried, and a bonding agent was applied according to the manufacturer's instructions.

In tooth 22, a post space was prepared within the stored fractured fragment (Figure 5A), and the fiber post was positioned simultaneously into the fragment and the root canal. Fragment reattachment was achieved using dual-cure resin cement followed by light curing (Figure 5B and C).

A B C

Figure 5: (A) Post space was prepared within the stored fractured fragment (B) Postoperative radiograph irt 22 (C) Postoperative clinical photograph after finishing and polishing irt 22

In tooth 21, the fiber post was cemented into the prepared post space using dual-cure resin cement and light cured. Core build-up was subsequently performed using resin composite (Figure 6).

Figure 6: Radiographic Evaluation After Post Placement and Core Build-Up

Crown preparation was then carried out in teeth 11 and 21. An intraoral digital scan was obtained for impression making. Zirconia crowns were fabricated and cemented the following day, thereby restoring both esthetics and function (Figure 7).

Figure 7: Clinical view after placement of zirconia crown irt 11 and 21

At the final evaluation, the patient was asymptomatic and demonstrated satisfactory esthetic and functional outcomes. Radiographic examination confirmed adequate obturation, appropriate post placement, and successful fragment reattachment. The patient was advised periodic follow-up for long-term evaluation.

CASE REPORT 2

Figure 8: Fractured fragments stored in saline

A 42-year-old male patient presented to the Department of Conservative Dentistry and Endodontics, K.D. Dental College and Hospital, Mathura, approximately 8 hours after sustaining trauma. The patient complained of pain in the maxillary anterior region, particularly on exposure to air, associated with fractured anterior teeth. The patient reported accidental trauma while attempting to prevent his child from falling from a bed, during which the corner of the bed struck the maxillary anterior teeth, resulting in crown fractures. The patient presented with the fractured tooth fragments preserved and brought at the time of examination (Figure 8). The medical history was non-contributory.

Extraoral and intraoral soft-tissue examination revealed no swelling, laceration, or other signs of injury. Intraoral examination revealed complicated crown fractures involving teeth 11 and 21, with clinically exposed and severely inflamed pulp tissue (Figure 9A). Both teeth showed severe pain on air stimulation and gentle probing and were tender to percussion. Pulp vitality testing using electric pulp testing and cold testing elicited an early exaggerated response in both teeth, suggestive of acute pulpal inflammation.

Intraoral periapical radiographs revealed enamel–dentin fractures with pulpal exposure in teeth 11 and 21 without evidence of root fracture or periapical pathology (Figure 9B). Based on the clinical and radiographic findings, a diagnosis of symptomatic irreversible pulpitis associated with complicated crown fractures was established for teeth 11 and 21.

A B

Figure 9: Peroperative (A) Clinical and (B) Radiographic images of complicated crown fracture involving teeth 11 and 21

The patient was informed about the available treatment options, including root canal treatment followed by fractured fragment reattachment or root canal treatment followed by full-coverage crown restoration. Considering the intact condition of the fragments and the patient's preference for a conservative and esthetic approach, root canal treatment followed by fractured fragment reattachment was planned. Written informed consent was obtained before initiating treatment.

Local anesthesia was administered using 2% lignocaine with 1:80,000 adrenaline, and isolation was achieved using a split rubber dam technique. Pulp extirpation was performed in teeth 11 and 21 using barbed broaches (Figure 10A). Working length determination was performed radiographically (Figure 10B).

Biomechanical preparation was carried out using hand K-files up to size #70 with the crown-down technique. Irrigation was performed using 2.5% sodium hypochlorite followed by normal saline. The canals were dried with sterile paper points, and calcium hydroxide was placed as an intracanal medicament. The access cavities were sealed with a temporary restorative material.

After one week, the patient was asymptomatic. The intracanal medicament was removed, and master apical cone fit was verified radiographically (Figure 10C). Obturation was performed using the lateral compaction technique with gutta-percha and a bioceramic sealer (Figure 10D). A temporary restoration was placed after obturation.

A B C D

Figure 10: (A) Pulp extirpation was performed in teeth 11 and 21 using barbed broaches. Radiographic (B) Working length determination (C) Master apical cone verification (D) Post-obturation evaluation of teeth 11 and 21

Two days later, the patient was recalled for restorative rehabilitation. Gutta-percha was removed to approximately 2 mm apical to the cementoenamel junction (Figure 11A). The fractured fragments were examined and verified for proper adaptation. A retentive groove was prepared on the fractured fragments using a long flat-ended tapered fissure bur (Figure 11B). Both the fractured fragments and the corresponding tooth surfaces were etched and bonded according to the manufacturer's instructions. Bonding agent was applied over Ribbond fiber. (Figure 11C).

A B C

Figure 11: (A) Removal of GP 2 mm below CEJ for ribbond (B) A retentive groove was prepared on the fractured fragments (C) Bonding agent application over prepared ribbond

The Ribbond fiber was positioned vertically within the prepared groove along with dual-cure resin cement, and the fractured fragments were repositioned onto the teeth **(**Figure 12). Proper adaptation was verified clinically. Excess resin cement was removed carefully, and light curing was performed from both buccal and palatal aspects to ensure complete polymerization.

Figure 12: Adaptation of Ribbond with the help of dual cure resin

Following fragment reattachment, the incisal third of tooth 21 was additionally restored using dual-cure resin composite to achieve optimal form, contour, and esthetics. Final finishing and polishing were performed to obtain appropriate occlusion and surface smoothness.

At the completion of treatment, satisfactory esthetic and functional rehabilitation was achieved. (Figure 13). The patient remained asymptomatic, and clinical evaluation demonstrated stable fragment reattachment with acceptable marginal adaptation. The patient was advised periodic follow-up to evaluate the long-term clinical outcome.

A B

Figure 13: Postoperative (A) Clinical photograph and (B) Radiograph

DISCUSSION

The present article discussed a series of 2 cases of complicated crown fractures treated with tooth fragment reattachment 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 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. [6]

Complicated crown fractures represent a significant clinical challenge, as they require simultaneous management of pulp pathology, structural damage, and esthetic concerns. [7,8]. The decision to perform vital pulp therapy or pulpectomy in complicated crown fractures is primarily governed by the pulpal status, time elapsed since trauma, degree of bacterial contamination, and extent of fracture. Vital pulp therapy may be considered when the pulp exposure is recent, bleeding is controllable, and there are no signs of irreversible inflammation. However, delayed presentation, extensive pulp exposure, or clinical symptoms suggestive of irreversible pulpitis significantly reduce the success of conservative pulp procedures, thereby necessitating root canal treatment prior to definitive restoration [9, 10]

In the present case series, pulpectomy was selected in both cases due to pulpal involvement and the nature of traumatic injury, which could compromise long-term pulp vitality.

Fragment reattachment has emerged as a conservative and biologically favorable restorative option for fractured anterior teeth when the fractured fragment is available. This technique preserves natural tooth morphology, translucency, surface texture, and wear characteristics, offering superior esthetic outcomes compared to conventional composite restorations or full-coverage crowns. Literature supports fragment reattachment as a predictable treatment modality when adequate bonding protocols are followed and occlusal stresses are appropriately managed [11, 12]

The choice between fiber post–assisted reattachment and simple adhesive rebonding depends on fracture configuration, amount of remaining tooth structure, and need for internal reinforcement. Fiber posts have an elastic modulus similar to dentin and help distribute functional stresses evenly along the root, thereby reducing the risk of catastrophic root fracture. Their use has been advocated particularly in endodontically treated teeth with significant coronal structure loss, as they enhance retention and fracture resistance of the reattached fragment [4,13]. In the first case of this series, fiber post reinforcement was employed due to greater structural compromise following traumatic impact, whereas in the second case, rebonding alone was sufficient because of favorable fracture adaptation and adequate remaining tooth structure.

Despite its advantages, fragment reattachment is not without limitations. Technique sensitivity, moisture control, and the possibility of debonding under functional or traumatic forces must be carefully considered. Long-term studies have reported variable survival rates, with gradual reduction over time, emphasizing the importance of patient education, occlusal adjustment, and regular follow-up.

Nevertheless, even in cases of failure, fragment reattachment does not preclude future restorative options and can be considered a valuable interim or definitive treatment [12,14].

Overall, fragment reattachment following endodontic management represents a minimally invasive and esthetically superior approach for complicated crown fractures. The present case series highlights the importance of individualized treatment planning and supports the use of both fiber post–assisted and adhesive rebonding techniques based on clinical requirements, in accordance with current evidence-based literature.

CONCLUSION

The management of complicated crown fractures in these cases highlights the effectiveness of ultraconservative fragment reattachment combined with fiber reinforcement. Preservation of the original tooth structure and fragments allowed for excellent esthetic integration and maintenance of function. Fiber posts or polyethylene fibers enhanced fracture resistance and long-term stability. These cases demonstrate that adhesive fragment reattachment is a viable, predictable, and minimally invasive alternative to full-coverage restorations in the treatment of complicated anterior crown fractures.

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