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Case Series

Rebuilding smiles naturally fragment reattachment as a minimally invasive solution for anterior tooth fractures: A case series

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Abstract

Trauma to anterior teeth is a common dental emergency, often resulting in complicated crown fractures that require prompt and effective management. Fragment reattachment presents a conservative, cost-effective, and aesthetically superior alternative by preserving the natural morphology, colour, and translucency of the tooth. This case series reports the management of three young patients with traumatic maxillary incisor fractures. The fractured fragments, loosely attached to the palatal gingiva, were surgically removed, preserved, and reattached following endodontic treatment. Reattachment was carried out using fibre posts, dual-cure resin cement, and self-etch adhesives, providing both structural reinforcement and aesthetic restoration. At 12-month follow-up, all cases showed excellent stability, function, and patient satisfaction. With advancements in adhesive systems and fibre-reinforced materials, fragment reattachment has become a reliable, minimally invasive treatment of choice for anterior tooth fractures when the fragment is intact and retrievable.

Keywords: Complicated crown fracture, Fiber post, Fragment reattachment, Fracture resistance, Micromechanical retention, Resin cement, Traumatic dental injury.

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1. Introduction

Traumatic dental injuries are prevalent worldwide, with anterior teeth being the most frequently affected due to their prominent position in the oral cavity.[1] Crown fractures, especially complicated ones involving the pulp, pose significant aesthetic and functional challenges and often require immediate attention to restore patient confidence and oral health.[2] The management of fractured anterior teeth has evolved considerably, with treatment options ranging from conventional composite restorations to full-coverage crowns and, more recently, fragment reattachment techniques.[3]

Fragment reattachment, first introduced several decades ago, has gained renewed interest due to advances in adhesive dentistry and restorative materials.[4] This technique involves bonding the original fractured tooth fragment back onto the remaining tooth structure, providing superior aesthetic outcomes by preserving the natural tooth morphology, colour, and translucency.[5] Compared to traditional restorative methods, fragment reattachment offers a more conservative approach that maintains tooth structure and can be completed with minimal chair time.[6]

The success of fragment reattachment largely depends on factors such as the quality and preservation of the fractured segment, the adhesive system used, and the reinforcement strategy, including the use of fibre posts to enhance structural integrity. Additionally, patient education regarding the limitations and maintenance of the reattached fragment plays a crucial role in long-term prognosis.[7]

This article presents a case series highlighting the conservative management of complicated fractures of the maxillary anterior teeth using fragment reattachment supported by fibre post and modern adhesive protocols, illustrating the technique's efficacy and aesthetic advantages.

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2. Case Report

2.1. Case 1

A 37-year-old female patient presented to the Department of Conservative Dentistry and Endodontics with a chief complaint of a broken upper right front tooth resulting from a motorcycle road traffic accident. She reported to the clinic within three days of the incident and described severe, throbbing pain exacerbated by contact with the opposing teeth.

Intraoral examination revealed that both the maxillary right central and lateral incisors had sustained labiopalatal fractures. The fracture fragments remained in position without displacement, held palatally by soft tissue, and exhibited mobility due to the incomplete nature of the fracture. An intraoral periapical (IOPA) radiograph showed no evidence of root fracture, and the alveolar bone and periapical structures appeared normal. Based on clinical and radiographic findings, a diagnosis of Ellis Class III fracture (complicated crown fracture involving the pulp) was established for both the maxillary right central and lateral incisors **Figure 1A–C**.

Given the complexity of the fracture and the intact condition of the fractured fragments, a treatment plan involving single-visit root canal therapy followed by fragment reattachment was formulated. After carefully detaching the coronal fragments, they were stored in physiological saline to maintain hydration **Figure 1D**.

Root canal treatment was completed in a single session using AH Plus sealer and Gutta-percha cones **Figure 1E–F**. Immediate post space preparation was performed, leaving 5 mm of apical gutta-percha intact. Post space was prepared using Peeso reamers, and a prefabricated glass fibre post was cemented with resin cement (Calibra, Dentsply) **Figure 1G**. To achieve optimal isolation and access, crown lengthening was performed via electrocautery, involving the excision of approximately 2 mm of palatal soft tissue **Figure 1H**.

A retentive hole was prepared within the fractured fragment, which was then etched using 37% phosphoric acid, rinsed, and lightly dried. A bonding agent (Prime and Bond NT, Dentsply) was applied, followed by resin cement (Calibra, Dentsply), which was used to fill the grooves on both the tooth and fragment. The fragment was then carefully repositioned and light-cured under firm pressure to ensure close adaptation. Excess resin was removed using a diamond finishing bur, and final polishing was completed with the Super Snap Rainbow Technique Polishing Kit (Shofu) **Figure 1I–K**.

At a 10-month follow-up, the restored tooth demonstrated excellent aesthetics and functional integrity, with no clinical or radiographic signs of failure or complications **Figure 1L**.

Figure 1:(A)Preoperative IOPAR, (B) Preoperative photograph, (C) photograph showing the retrieval of a broken tooth fragment, (D) Retrieved fragment stored in normal saline, (E)working length IOPAR, (F)Postobturation IOPAR, (G) IOPAR illustrating the luting of the fiber post, H)Crown lengthening done using Electrocautary, (I)Postoperative IOPAR, (J) Postoperative Frontal clinical photograph, (K) Postoperative occlusal clinical photograph, (I) IOPAR at 10 month follow up.

2.2. Case 2

A 23-year-old male reported with pain in his upper front teeth following a fall from a bicycle two days earlier. Clinical and radiographic evaluation identified an Ellis Class III fracture involving the maxillary right lateral incisor and an Ellis Class II fracture of the maxillary right central incisor, with no associated soft tissue damage or periapical involvement **Figure 2A–C**. The patient had preserved the broken fragment in milk, which helped maintain its integrity and made it suitable for reattachment. Prior to the procedure, the fragment was disinfected with 2% chlorhexidine and subsequently stored in normal saline to prevent dehydration **Figure 2D**.

Endodontic treatment was initiated immediately. After access cavity preparation and establishing the working length, biomechanical shaping of the canal was performed using the crown-down technique with ProTaper rotary files, progressing up to size F3. Irrigation was done with 5.2% sodium hypochlorite followed by saline to ensure thorough decontamination. The canal was then dried and obturated using Gutta-percha cones in conjunction with AH Plus sealer **Figure 2E–F**.

Post space preparation was carried out using Peeso reamers, and a prefabricated glass fibre post was cemented into place using a dual-cure resin cement (Calibra, Dentsply) **Figure 2G–H**. A retentive hole was created in the fractured fragment to receive the post, and an enamel bevel was made along the margins of both the tooth and the fragment to enhance micromechanical retention.

The fragment was then etched with 37% phosphoric acid, rinsed, and lightly dried. A bonding agent (Prime and Bond NT, Dentsply) was applied, followed by the

application of resin cement for bonding the fragment. The fragment was carefully aligned and light-cured in position. A flow able composite was applied to the bevelled areas, cured, and the restoration was subsequently finished and polished to achieve optimal aesthetic integration **Figure 2I–K**.

At the one-year follow-up, the tooth showed excellent aesthetic and functional outcomes, with the patient reporting no complaints or complications **Figure 2L**.

Figure 2: (A)Pre-operative IOPAR, (B) Preoperative frontal photograph, (C) Preoperative occlusal photograph, (D) Fractured segment stored in normal saline, (E) Working length IOPAR, (F) Post obturation IOPAR, (G)IOPAR illustrating the luting of the fibre post, (H)Photograph illustrating the luting of the fibre post, (I)Post-operative IOPAR, (J) Postoperative Frontal view, (K)Postoperative occlusal view, (L)IOPAR at 12 month follow up.

2.3. Case 3

An 18-year-old female presented with a fractured upper anterior tooth resulting from trauma sustained two days earlier. Clinical assessment revealed a complicated crown fracture (Ellis Class III) of the maxillary right central incisor, with the coronal fragment still partially attached palatally and no signs of displacement. Intraoral periapical (IOPA) radiographic imaging confirmed an intact root and normal periapical bone structures **Figure 3A–C.**

Given the viable condition of the fractured segment, a single-visit root canal treatment followed by fragment reattachment was planned. The coronal fragment was carefully retrieved and stored in physiological saline to prevent desiccation **Figure 3D**. Under local anaesthesia, endodontic access was achieved through the fracture site, and pulp extirpation was performed. The canal was irrigated using 5.25% sodium hypochlorite and 17% EDTA. Cleaning and shaping were completed with ProTaper rotary instruments, and obturation was carried out using an F3 Gutta-percha cone with AH Plus sealer **Figure 3E–G**. Crown lengthening was accomplished using electrocautery, with 2 mm of palatal soft tissue excised for proper exposure **Figure 3H**.

For the reattachment, both the fractured tooth and the fragment were etched with 37% orthophosphoric acid, followed by the application of a bonding agent (Adper Single Bond, 3M Oral Care). The fragment was then accurately repositioned and bonded using resin cement, which was light-cured from both the labial and palatal aspects. A 1-mm chamfer was prepared along the fracture margin and restored using a micro hybrid composite resin (Filtek Z250, 3M Oral Care). Final finishing and polishing were performed using Sof-Lex™ discs (3M Oral Care). Occlusion and aesthetics were carefully evaluated, and the patient was advised to avoid excessive force on the anterior teeth **Figure 3I–K**.

Follow-up evaluations at 1, 6 and 12months demonstrated that the reattached fragment remained stable, with satisfactory aesthetics and no signs of clinical failure throughout the observation period **Figure 3L**.

Figure 3: (A)Preoperative IOPAR, (B)Pre-operative frontal photograph, (C)Preoperative occlusal photograph, (D)Retrieved segment stored in normal saline, (E)working length IOPAR, (F)Post-obturation IOPAR, (G) IOPAR illustrating the luting of the fibre post, (H)Crown lengthening done using Electrocautary, (I)Post-operative IOPAR, (J) Post-operative Frontal photograph, (K) Post-operative occlusal photograph, (L) IOPAR at 12 month follow up.

3. Discussion

The restoration of anterior teeth fractured due to trauma, particularly Ellis Class III injuries, remains a significant clinical challenge in aesthetic and conservative dentistry. Tooth fragment reattachment, when feasible, offers a biologically superior, cost-effective, and minimally invasive approach that restores original tooth morphology, texture, translucency, and shade parameters difficult to replicate with artificial materials alone.[8] In all three presented cases, single-visit endodontic therapy followed by reattachment using fibre-reinforced posts and adhesive protocols yielded favourable aesthetic and functional outcomes.

Recent advances in adhesive dentistry have significantly improved the reliability of reattachment techniques. The selection of luting agents and surface treatments influences

the bond strength and fracture resistance of reattached fragments. Studies demonstrate that dual-cure resin cements, such as Calibra, provide enhanced polymerization and mechanical strength, making them suitable for cases involving fibre post placement and fragment reattachment.[9]

The integration of glass fibre posts in all three cases is particularly noteworthy. These posts provide internal support, distribute functional stress, and reduce the risk of fracture propagation due to their elastic modulus, which closely matches that of dentin.

Albar et al. (2024) confirmed through systematic analysis that the use of fibre-reinforced posts significantly improves the fracture resistance of reattached anterior teeth, particularly under dynamic loading conditions.[10] Furthermore, Tonini (2017) introduced a conservative approach that avoids excessive removal of tooth structure, reinforcing the trend toward biomimetic reattachment protocols that preserve natural dentition while optimizing biomechanical stability.[11]

Preservation of the fragment is another critical factor influencing treatment success. In one case, the tooth fragment was stored in milk, maintaining its hydration and preventing discoloration. According to Sharma et al. (2023), effective rewetting using agents such as rice water can significantly improve the bond strength and longevity of reattachments by rehydrating the dentinal tubules and preventing collagen matrix collapse.[4] This highlights the importance of patient education regarding the immediate care of avulsed or fractured tooth fragments.

The preparation design and surface treatment before bonding also impact the mechanical behaviour of the reattached tooth. In all three cases, the preparation of bevels, internal grooves, and chamfer margins contributed to an increased surface area for bonding and enhanced mechanical interlocking. Acid etching with 37% phosphoric acid followed by application of a compatible adhesive system was performed in line with contemporary adhesive protocols. Garg et al. (2023) employed computational modelling and found that resin cements used in combination with bevelled preparations generate lower stress concentrations than flow able composites alone, suggesting superior fracture resistance under load.[12]

The potential for fragment detachment or adhesive failure continues to be a concern. Tewari et al. (2024) conducted a meta-analysis which showed a measurable incidence of bonded fragment loss, particularly in cases lacking mechanical reinforcement or involving compromised bonding techniques.[13] Therefore, clinical success hinges on meticulous execution of adhesive protocols, use of fibre reinforcement, appropriate occlusal adjustments, and regular follow-up to detect early signs of failure.

All three cases collectively demonstrate that, with careful case selection, effective bonding protocols, and reinforcement through fibre posts, the reattachment of fractured anterior teeth offers a predictable, aesthetic, and conservative treatment option. Continued advancements in adhesive technology, fibre post materials, and minimally invasive techniques are vital to further enhancing clinical outcomes and patient satisfaction in the management of dental trauma.

4. Conclusion

This case series demonstrates that biologic reattachment, supported by fibre post reinforcement and modern adhesive protocols, offers a conservative, aesthetically pleasing, and functionally reliable treatment for complicated crown fractures. In all presented cases, immediate endodontic management followed by fragment reattachment achieved favourable clinical and radiographic outcomes over extended follow-up periods. The use of dual-cure resin cements, internal dentinal grooves, and bevelling techniques enhanced the micromechanical retention and fracture resistance of the restored teeth. These results highlight the importance of timely intervention, careful fragment preservation, and adherence to adhesive principles in optimizing outcomes. This biologic restorative approach is particularly beneficial for young patients, preserving natural tooth structure and delivering long-term satisfaction with minimal intervention.

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None.

6. Conflict of Interest

None.

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