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# CASE REPORT

# SUCCESSFUL MANAGEMENT OF CROWN FRACTURES THROUGH FRAGMENT REATTACHMENT: TWO CASE REPORTS

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## ABSTRACT

***Background:*** Traumatic dental injuries (TDIs) are common in children and young adults, particularly involving the permanent maxillary central incisors, leading to both aesthetic and functional concerns. Fragment reattachment, an established procedure in adhesive dentistry, provides a reliable solution for restoring fractured teeth by preserving the natural anatomy and improving the aesthetic outcome. ***Case Reports:*** This article presents two cases of crown fractures treated with fragment reattachment. In Case 1, a 9-year-old patient with an Ellis Class III fracture of the maxillary right central incisor underwent reattachment after apexification, with the addition of a glass fiber post for enhanced strength. In Case 2, both maxillary central incisors were fractured, with one reattached using biopins made from the patient's own tooth fragment. Both procedures yielded favourable outcomes with regard to aesthetics and function. ***Discussion:*** These presented cases show that tooth fragment reattachment works well for restoring fractured teeth. Using biopins looks promising, but more research is needed to establish long-term reliability and clinical protocols. ***Conclusion:*** Fragment reattachment offers significant advantages in terms of aesthetics, cost-effectiveness, and psychological impact, preserving the tooth's natural form and function.



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# INTRODUCTION

Traumatic dental injuries (TDIs) are relatively common in children and young adults, affecting both the permanent and primary dentitions, and accounting for approximately 5% of all injuries[1]. In primary teeth, luxation injuries are more prevalent due to the flexible nature of the alveolar supporting structures, which help absorb and dissipate traumatic forces. In contrast, trauma to permanent teeth more frequently results in crown fractures. The most commonly affected teeth are the permanent maxillary central incisors, primarily due to their prominent position in the dental arch and greater exposure during trauma[2]. Such injuries often lead to a significantly unaesthetic appearance and can have lasting psychological effects. Therefore, it is the clinician's responsibility to focus on restoring not just the functionality and structure of the damaged teeth, but also their aesthetic appeal[3]. There are multiple approaches available for treating fractured teeth, such as composite restorations, post and core techniques, and full-coverage crowns. With advancements in adhesive dentistry, tooth fragment reattachment has emerged as a reliable and conservative treatment modality. This technique was first introduced by Chosack and Eidelman in 1964 and has since gained popularity due to its several advantages over other restorative options[3]. Reattachment preserves the tooth's original form, colour, and surface texture, providing excellent aesthetic and functional outcomes. It is relatively simple, conserves tooth structure, and may offer psychological benefits to the patient[4]. This article presents two cases of crown fractures in permanent maxillary central incisors, successfully managed by fragment reattachment.

# CASE REPORT 1

A 9-year-old male patient presented with his parents, reporting a fall while playing three days prior that resulted in a fractured upper front tooth # 11 (Figure 1a). The patient brought the fractured fragment with him (Figure 1b). A thorough clinical and radiographic examination (Figure 1c) revealed an Ellis Class III fracture of the maxillary right central incisor, with an open apex. The fragment was intact and fit well onto the remaining tooth structure. Two treatment options were discussed with the patient and his parents: (1) endodontic treatment followed by a post and core restoration, and (2) reattachment of the fractured tooth fragment. Following a detailed explanation of the advantages, disadvantages, prognosis, and cost of each approach, the family opted for the reattachment procedure. This decision was made only after confirming the fragment's structural integrity and proper fit. The dehydrated fragment was stored in milk for rehydration prior to the procedure. The procedure was initiated under local anesthesia, with rubber dam isolation to ensure a dry working field. MTA apexification was carried out on tooth 11 (Figure 2a), followed by obturation using thermoplasticised gutta-percha (Figure 2b).


**Fig 1a- Cinical picture showing fractured tooth wrt 11; Fig 1b: IOPA showing fractured tooth wrt 11 and open opex; Fig 1c: Fractured fragment wrt 11**

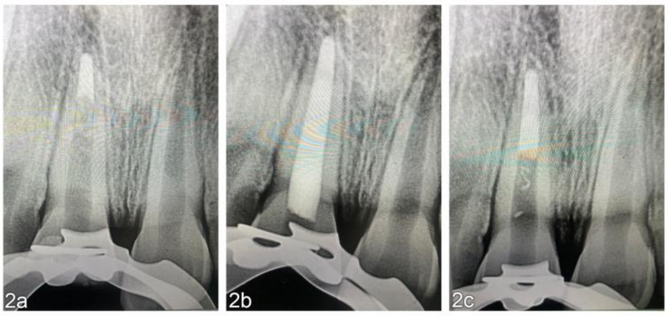


**Fig. 2a. MTA apexification wrt 11; Fig 2b- Oburation with thermoplastized gutta percha; Fig 2c- Post space preparation**

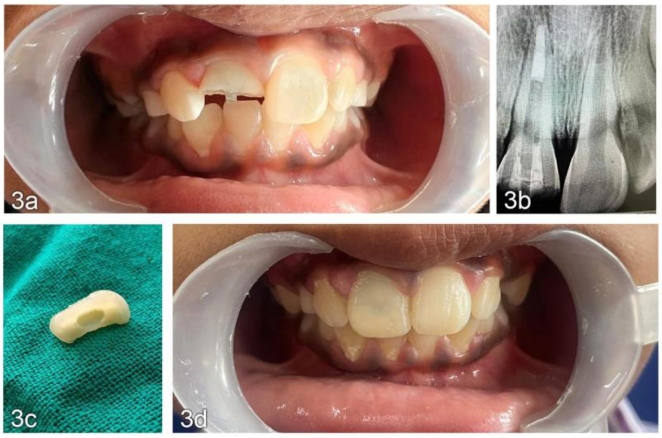


**Fig 3a and 3b- Clinical and radiographic image of glass fiber post luted into canal; Fig 3c- A hole was prepared in the fractured fragment to accommodate the post; Fig 3d- Post-op composite restoration**

Post space preparation was done using a Peeso reamer (Figure 2c), and a prefabricated glass fiber post was luted into the canal using dual-cure resin cement (Paracore, Coltene) (Figure 3a, 3b). A hole was prepared in the fractured fragment to accommodate the post (Figure 3c). The fragment was etched with 37% phosphoric acid, rinsed, blot-dried, and treated with a bonding agent (Ivoclar Vivadent). Resin cement was used to fill the post hole in the fragment, which was then accurately seated onto the tooth. Light curing was performed under firm finger pressure to ensure proper adaptation.Final restoration was completed using a light-cure composite resin (Ivoclar Vivadent), followed by finishing and polishing (Figure 3d). Follow-up evaluations at 1 month, 4 months, and 12 months (Figures 4a, 4b) showed satisfactory aesthetics and function, with no signs of pathology or failure.

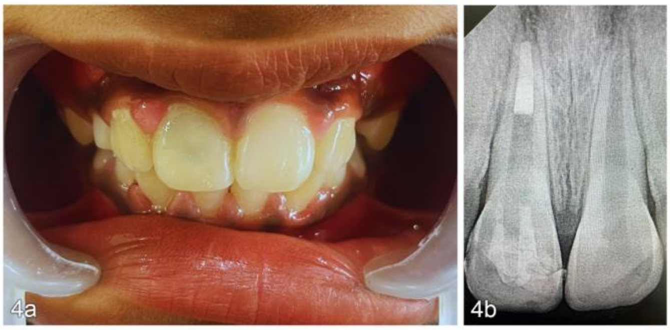


**Fig 4a and 4b- Clinical and radiographic image at 12 months follow up showing no signs or symptoms**

# CASE REPORT 2

A 9-year-old male patient presented with his father, complaining of fractures in both upper front teeth (Figure 5a). The patient gave a history of trauma that had occurred two days earlier. A thorough intraoral and radiographic examination (Figure 5b) was carried out to assess, localise, and determine the extent of the tooth fractures. Both teeth were found to be intact, firm, and immobile, with no signs of gingival inflammation. Pulp vitality was evaluated using both a thermal (cold) sensitivity test and electrical pulp testing (EPT). The results were positive, indicating a normal sensory response.


**Fig 5a. Clinical picture showing fractured teeth wrt 11 and 21; Fig 5b- IOPA showing fractured teeth wrt 11 and 21; Fig 5c- fractured fragments retrieved by parents.**

A diagnosis of Ellis Class II fractures was established for the maxillary right # 11 and left # 21 central incisors. The fractured fragments were recovered by the patient from the site of injury (Figure 5c). The fragment from tooth 21 was intact and fit well onto the remaining tooth structure, whereas only a small portion of the fragment from tooth 11 was available, and it did not fit appropriately. A treatment plan was proposed involving biological restoration for tooth 21, which included reattachment of the fractured fragment using dentine pins (biopins) fabricated from the fragment of tooth 11 to enhance retention. For tooth 11, a direct composite restoration was advised. The dehydrated fragment of tooth 21 was stored in milk for rehydration. Informed consent was obtained from the patient's parents prior to initiating treatment. Rubber dam isolation was achieved. Biopins were fabricated by sectioning the fractured fragment of tooth 11 using diamond burs. Two cylindrical pins, approximately 1 mm in diameter and 3 mm in length, were prepared (Figure 6a). Corresponding simulated holes were then created in both the fractured tooth and the fragment of tooth 21 to accommodate the biopins (Figure 6b). Both the biopins and the fractured surfaces were etched with 37% phosphoric acid, rinsed, blot-dried, and treated with a bonding agent (Ivoclar Vivadent). The biopins were cemented into the fractured tooth using dual-cure resin cement (Paracore, Coltene) (Figure 6c). The tooth fragment was then carefully positioned and bonded onto the pins using the same resin cement (Figure 6d). Final adaptation was refined using light-cure composite resin (Ivoclar Vivadent) to achieve an optimal aesthetic result (Figure 6e). Tooth 11 was restored using light-cure composite resin, followed by finishing and polishing of the restored surfaces (Figure 6f). At 12 month follow-up appointment (Figures 7a and 7b), the patient demonstrated satisfactory aesthetics and function. Both teeth remained vital and showed no signs of pulpal or periapical pathology.

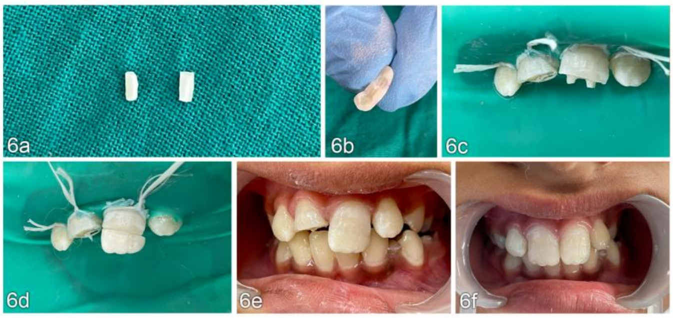


**Fig 6a. Biopins (dentin pins) made from fractured fragment of tooth 11; Fig 6b- Holes for the placement of biopins created in the fractured fragment of tooth 21; Fig 6c- Biopins cemented into tooth 21 with dual cure resin cement; Fig 6d- The tooth fragment bonded onto the pins using the same resin cement; Fig 6e- Final attachment of the fragment; Fig 6f- Restoration of tooth 11 with composite resin.**


**Fig. 7a and 7b- clinical and radiographic image at 1 year follow up**

# DISCUSSION

Advancements in dental bonding technology have significantly improved the outcomes of reattaching dislodged tooth fragments, assuming that biological considerations, appropriate materials, and clinical techniques are thoroughly assessed and properly applied. Utilizing the patient's own tooth structure helps avoid common complications like inconsistent wear patterns, esthetic mismatches, and challenges in recreating anatomical form and surface texture. Several factors influence the success and longevity of tooth fragment reattachment, including the extent and location of the fracture line, the alignment of the fragment with the remaining tooth structure, and the need for endodontic therapy. Two critical factors for successful reattachment are: (1) timely retrieval of the fragment from the injury site and (2) its storage in an appropriate medium to prevent dehydration and discoloration. Dehydration can lead to discoloration and a significant decrease in fracture resistance of the tooth fragment. However, proper rehydration can help restore both color and mechanical strength. A study by Shirani *et al*.[1] demonstrated that storing fragments in milk or saliva for 24 hours prior to reattachment significantly increased bond strength compared to storage in water. In the first case report, the fragment was stored in milk for 24 hours prior to reattachment to the tooth; however, in the second case report, the fragment was stored in milk for only one hour, yet no shade mismatch was observed. Farik *et al*.[2] found that drying fragments for longer than one hour markedly reduced fracture resistance, emphasizing the need to maintain adequate moisture.

Fragment reattachment cannot be considered in isolation; the severity of the injury, the type of tissues involved, and the time factor must all be taken into account to ensure an appropriate management approach. When a fracture is extensive, as seen in the first case, endodontic treatment and the placement of intracanal posts may be necessary to support the reattachment. In this case, a glass fiber post was used, which helps distribute stress evenly by interlocking the fragments. Adanir and Belli[3] in their study highlighted the importance of the post's physical properties in stress distribution, noting that glass fiber posts offered more favourable outcomes under functional load. These posts bond well to dentin and have a modulus of elasticity similar to dentin, leading to better biomechanical behavior and improved esthetics. Additionally, the first case incorporated MTA apexification, as the fractured central incisor was at Nolla's developmental stage 9. MTA was selected due to its superior sealing ability and biocompatibility. Similar approaches were reported by Nagarajan *et al*.[4] in an 8-year-old patient, and by Akyuz and Erdemir[5], who described multiple cases using fiber posts for fragment reattachment. In the second case report, autogenous biopins were used to enhance the retention of the reattached fragment. Biopins provide both mechanical stability and biocompatibility, closely mimicking the properties of natural dentin in terms of thermal expansion and resilience[6]. Studies have shown that dentin posts possess physical properties—such as modulus of elasticity, compressive strength, and viscoelastic behavior—that closely resemble root dentin, contributing to improved stress distribution and increased fracture resistance [7,8]. Kathuria *et al*.[9] found that teeth restored with dentin posts demonstrated greater fracture resistance than those restored with fiber-reinforced composite (FRC) posts. These findings suggest that similar advantages may apply to biopins. In a report by Nogueira *et al*., successful reattachment using homologous biopins was observed at a one-year follow-up[10]. Another case by Ghorai *et al*. also utilized homologous biopins with positive results[6]. In the present case report, autogenous biopins prepared from the patient's own tooth fragment were used. From an ethical standpoint, it is essential to inform the patient or their guardians about the origin of the biopins and to address any potential biosecurity concerns. Biological restoration using dentin-derived biopins offers a promising, yet underutilized, treatment alternative for vital teeth. However, the technique is technically demanding. The small size of biopins makes them challenging to prepare, and there is a risk of pulp chamber perforation during pin placement[6]. Thus, further clinical research is warranted to evaluate the mechanical properties, safety, and long-term outcomes of biological restorations involving biopins.

# CONCLUSION

Fragment reattachment is a quick, cost-effective, and aesthetically pleasing procedure that minimises psychological and social trauma for patients. This report presents two successful cases involving the management of both complicated and uncomplicated crown fractures in permanent maxillary central incisors. Although several factors influence the choice of reattachment technique, the use of biopins, despite limited evidence in the literature—produced satisfactory aesthetic and functional outcomes in our case. Further research is required to evaluate the clinical performance and long-term outcomes of biological techniques such as biopin use.

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