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Conservative Rehabilitation of Traumatized Maxillary Incisors Using Fragment Reattachment: A Case Series

Dr. Hiteshree Trivedi[1], Dr. Ashwini Mahale[2], Dr. Gayatri Khode[3], Dr. Veeraj Kuperkar[4], Dr. Shikha Kanodia[5]

Post Graduate Student
Email: *hdtrivedi98[at]gmail.com*

Post Graduate Student
Email: *ashwini97214[at]gmail.com*

Post Graduate
Email: *gayatri.khode4[at]gmail.com*

Post Graduate Student
Email: *veerajkuperkar5[at]gmail.com*

Professor
Corresponding Author Email: *shikhakk[a]tyahoo.co.in*

Abstract: ***Traumatic dental injuries to anterior teeth are common and often lead to crown fractures, causing functional and esthetic concerns. Fragment reattachment is a conservative treatment modality that restores the tooth with minimal loss of natural structure while providing good esthetic outcomes. This case series describes the management of complicated crown root fractures involving the maxillary right central incisor, right lateral incisor, and left central incisor following a road traffic accident. Endodontic treatment was performed followed by post placement and fragment reattachment using dual-cure resin cement after surgical exposure through a palatal crevicular incision and buccal mucoperiosteal flap. The second case involved an oblique crown fracture managed with, adhesive reattachment, and subsequent endodontic treatment. The procedures resulted in satisfactory esthetics, function, and preservation of natural tooth structure.***

Keywords: Crown-root fracture, Fragment reattachment, Dental trauma, Fiber post, Anterior teeth

1. Introduction

Crown-root fractures (CRFs) involve enamel, dentin, and cementum and account for nearly 5% of traumatic dental injuries in permanent teeth[1,2]. They may be classified as uncomplicated or complicated depending on pulpal involvement[1]. These injuries most commonly affect maxillary anterior teeth due to their position in the arch, resulting in esthetic, functional, and psychological concerns[3,4]. The fracture pattern is typically oblique, extending from the labial surface toward the palatal aspect due to shear stresses generated during trauma[5].

Management becomes challenging when fractures extend subgingivally, compromising isolation and adhesion[6]. Conventional treatment options include endodontic therapy, prosthetic rehabilitation, orthodontic extrusion, or surgical crown lengthening depending on the clinical scenario[7]. However, these approaches may be invasive and time-consuming.

With advancements in adhesive dentistry, fragment reattachment has emerged as a conservative and predictable treatment option. It preserves natural tooth structure, maintains original morphology, and provides excellent esthetic outcomes[8,9]. Recent evidence, including case series and cohort studies, supports its use in both uncomplicated and complicated crown-root fractures when proper clinical protocols are followed[10,12].

This case series presents the management of multiple complicated crown-root fractures in maxillary anterior teeth using surgical exposure, endodontic therapy, fiber post placement, and fragment reattachment.

2. Case Series

Case 1:
A 27-year old female patient reported to the Department of Conservative Dentistry and Endodontics GDCH Ahmedabad with fracture in upper front tooth region following a road traffic accident before one day. She had endured a laceration injury to upper and lower lip and was subsequently referred for the treatment of fractured teeth. The patient's medical history was unremarkable, and she denied any loss of consciousness. Thorough Clinical examination revealed crown root fractures involving the maxillary right central incisor, right lateral incisor, and left central incisor. Intraorally, a transverse fracture line was observed extending circumferentially around the cervical third of the crown of the maxillary right lateral incisor and left cental incisor (#12 and 21, Federation Dentaire Internationale). The fractured fragments showed mobility but were retained in position in #12 and #21 whereas the fragment of maxillary right central

incisor (#11) was preserved by the patient in milk. The fractures extended subgingivally with pulpal exposure, suggestive of complicated crown-root fractures. Pocket probing depth and clinical attachment levels were within normal limits (2mm) using a UNC 12 periodontal probe (Hu-Friedy, Chicago, IL, USA). Although some gingival bleeding was evident. Palpation revealed no bony fragments over that area, and occlusion was balanced.

Electric pulp testing (Parkell, Edgewood, NY, USA) and cold testing (Endofrost, Roeko, Germany) elicited an exaggerated response in teeth #12 and #21. Radiographic assessment, including intraoral periapical radiographs and cone beam computed tomography (CBCT), revealed a transverse fracture line at the cervical third of the crown involving the maxillary right lateral incisor and left central incisor and crown structure loss in maxillary right central incisor.

The patient was informed about the nature of the injury and the available treatment options, following which informed consent was obtained. A treatment plan comprising root canal therapy followed by fragment reattachment with fiber post reinforcement for teeth #11, #12, and #21 was finalized.

Local anesthesia was administered using 2% lidocaine with 1:80,000 epinephrine. A gingival crevicular incision was made in relation to teeth #11, #12, and #21, and full-thickness mucoperiosteal flaps were reflected on both the labial and palatal aspects to provide adequate access to the fracture site. The fractured fragments were gently detached and examined to assess the fracture line's extent. The fragments were stored in normal saline for about two hours to prevent dehydration. The bleeding was managed by applying pressure packs until the operative field was clean and dry. It was confirmed that the fracture line extended to the alveolar bone level, violating the biological width. The dental split dam was applied with a retraction clamp (Coltene/Whaledent, OH, USA) on maxillary right and left first premolars.

A single visit endodontic treatment was performed on teeth #11, #12 and #21. The fragments were repositioned to verify the intimate adaptation. Following completion of root canal therapy, the post space was prepared to receive a size 1.3 glass fiber post (Tenax Fiber Trans Post, Coltène/Whaledent, Cuyahoga Falls, OH, USA). The selected fiber post was then trial-fitted to confirm proper adaptation within the canal, ensuring close contact with the canal walls while maintaining the integrity of the remaining gutta-percha. It was decided to create an access opening in the palatal region of the separated fragments to provide a conduit for excess cement to escape, thus assisting in the excellent adaptation of the fractured fragment to the post. Both the tooth and the fragment were etched with 37% phosphoric acid for 30 s and rinsed with water, and gently air-dried. Two coats of TetricN-Bond Univeral (Ivoclar Vivadent) bonding agent were applied, followed by gentle air-drying until a uniform glossy surface was observed. The adhesive was light cured (Optilux 400, Demetron Research Corp., Danbury, CT, USA). Silane Coupling Agent (Monobond N) was applied on fractured fragments and a Dual Cure Resin Cement (Variolink N) was used to reattach the fragments, Excess Resin Cement was removed and light curing was done for 30s on each surface followed by finishing and polishing and the flap were sutured back with the help of 3-0 silk interrupted sutures. A postoperative radiograph was taken to confirm treatment completion. During the follow-up clinical examination one year after the trauma, the fracture line was not discernible, and satisfactory esthetics and periodontal health were exhibited.

Case 2:
A 32-year-old male patient reported with trauma to the upper front tooth region following a road traffic accident one day prior. Clinical examination revealed an oblique fracture involving tooth #11 extending buccopalatally. The fractured fragment was mobile but intact.

Intraoral periapical radiograph revealed a fracture line extending from the incisal edge to the cervical third without subgingival involvement[6].

Pulp vitality tests showed exaggerated responses. The patient was apprised of the nature of the injury, and various treatment options. After obtaining informed consent, the treatment plan involved: A buccal crevicular incision was placed, and a mucoperiosteal flap was elevated to expose the fracture margin. The fragment was carefully retrieved and stored in normal saline to maintain hydration and preserve its mechanical properties. A retentive groove was prepared within the fragment to enhance mechanical retention. Both the tooth and fragment surfaces were etched. A universal bonding agent (Tetric N-Bond) was applied in two coats and light cured as per adhesive protocols[8]. The fragment was reattached using dual-cure resin cement (Variolink), ensuring optimal adaptation and marginal seal[9,12]. A single-visit root canal treatment was subsequently performed to ensure long-term prognosis. Postoperative evaluation showed excellent esthetic integration and functional stability.

3. Discussion

Crown-root fractures present a multidisciplinary challenge, requiring careful integration of endodontic, restorative, and periodontal considerations. The prognosis of such cases

largely depends on the location and extent of the fracture line, as subgingival involvement complicates isolation and restoration procedures[2]. Therefore, treatment strategies primarily focus on relocating or exposing the fracture margin to a supragingival or juxtagingival position to facilitate adequate moisture control and adhesive bonding[2].

From an endodontic and restorative perspective, the International Association of Dental Traumatology guidelines recommend treatment based on fracture extent and root maturity[7]. Conventional approaches such as orthodontic extrusion or surgical crown lengthening, although effective, may be time-consuming and may compromise periodontal health. Adhesive fragment reattachment, traditionally considered a provisional approach due to concerns regarding moisture control and bonding durability[2], has gained acceptance with advancements in adhesive systems and resin cements[9, 10].

Fragment reattachment represents one of the most conservative treatment modalities, preserving natural tooth morphology, translucency, and occlusion while providing immediate functional and esthetic rehabilitation[3, 10]. A recent systematic review has suggested that fragment reattachment can be a viable treatment option in complicated crown-root fractures when favorable clinical conditions exist[7]. Success rates as high as approximately 78% at one-year follow-up have been reported in cases involving endodontic treatment and adhesive reattachment[7].

The use of fiber posts plays a crucial role in reinforcing the reattached fragment. Due to their elastic modulus being similar to dentin, fiber posts allow uniform stress distribution and reduce the risk of root fracture[5]. Additionally, the use of dual-cure resin cement is advantageous in post space regions where light penetration is limited, ensuring adequate polymerization and improved bonding[5, 10].

Hydration of the fractured fragment is another critical factor influencing treatment success. Storage of the fragment in a moist environment helps maintain collagen integrity and optical properties, thereby preserving fracture strength and ensuring optimal esthetics[3]. Flowable or dual-cure resin cements with low viscosity facilitate better adaptation and marginal seal, while also improving esthetic outcomes due to their color stability[4].

Various techniques have been proposed to enhance fracture resistance following reattachment. Studies have shown that placement of bevels, chamfers, or internal dentinal grooves can significantly improve the strength and retention of the reattached fragment[8, 9, 10]. These modifications also help in masking the fracture line, resulting in superior esthetic integration[3].

From a periodontal standpoint, preservation of biologic width is essential for long-term success. Violation of biologic width may lead to gingival inflammation, recession, or alveolar bone loss[4]. In the present case, surgical exposure using a crevicular incision and mucoperiosteal flap allowed access to the fracture line while maintaining bone architecture and papillary integrity. This conservative approach avoided the need for osseous recontouring and minimized periodontal trauma.

Well-finished adhesive restorations with proper marginal adaptation have been shown to be biocompatible with periodontal tissues and do not induce inflammation[4]. Conservative approaches such as minimal enameloplasty or coronal relocation of margins can be preferred over invasive procedures like osteotomy or osteoplasty, which may compromise esthetics and periodontal stability.

Overall, successful management of complicated crown-root fractures depends on achieving proper isolation, durable adhesive bonding, and preservation of periodontal health. The favorable outcome observed in this case highlights the effectiveness of combining surgical exposure, endodontic therapy, fiber post reinforcement, and adhesive fragment reattachment as a minimally invasive and predictable treatment approach

4. Conclusion

Fragment reattachment is a predictable, minimally invasive option for managing complicated crown-root fractures, restoring esthetics and function while preserving natural tooth structure. Its success relies on proper case selection, effective isolation, and adherence to adhesive and periodontal principles.

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