



Aesthetic rehabilitation of complicated crown fractures in single visit: Case series

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Maxillary central incisors have been identified as the most frequently injured teeth due to trauma. Using tooth fragments combined with surgical extrusion offers advantages in terms of function and aesthetics while preserving the original morphology and position. This treatment modality increases the acceptability of the treatment and positively affects the patient's psychology, as it is cost-effective and requires a shorter chair time. This case series primarily aims to present various cases treated by bonding fragments with recently introduced glass fiber posts or polyethylene fibers (Ribbond) in surgically extruded traumatized teeth.

Keywords: Fiber post, polyethylene fiber, tooth injuries, vital pulp treatment.

Introduction

Traumatic dental injuries (TDI) are common among pre-school children and adolescents due to falling and traffic or sport accidents (1). It has been reported that this rate was 25% in children and 33% in adolescents during permanent dentition (2). If the level of fracture line is in the subgingival area, various surgical, or orthodontic methods can be used to reach the fracture line. Although the tooth can be extruded by orthodontic methods, rehabilitation of the tooth can be performed faster by surgical flap elevation for a direct vision of the fracture line (3). If the tooth fragment is present, the primary treatment method should be restoration using the tooth fragments. Correct positioning and retention of the coronal fragments by adhesive techniques offers advantages such as the restoration of function, aesthetics, texture, shape, and surface gloss, and maintaining the original morphology and position of the

tooth. As it requires a shorter time and is cost-effective, treatment by natural tooth pieces can positively affect the patient psychology, thus increasing the acceptability of the treatment (4,5).

In this case series, two cases treated with fiber posts and one case treated with Ribbond (Ribbond Inc., Seattle, Washington, USA) in one visit were presented. In all cases, all procedures were performed under local anesthesia (Articaine HCL 2%). A fiber-post system (3M ESPE RelyX™ Fiber Post 3D Glass Fiber Post, Minnesota, USA) was used to improve the retention of tooth structure. Afterwards, acid (3M ESPE Scotchbond Universal Acid, Minnesota, USA), bond (3M ESPE Single Bond Universal, Minnesota, USA), and composite (3M™ Filtek™ Universal Composite Resin, Minnesota, USA) were used to bond the tooth fragments and fiber post. Prior to treatment with Ribbond, vital pulp tissue was sealed with min-

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eral trioxide aggregate (MTA) and glass ionomer cement (GIC) following pulpotomy. The patients were followed up at the first week and then at 3rd, 6th, and 12th months.

Case Report

Case 1

A 16-year-old male patient was admitted to the Department of Endodontics, complaining of fractured maxillary right and left central teeth (#11 and #21) due to trauma during sports competition (Fig. 1a). The patient was systemically healthy and had complicated fractures in teeth #21 and #11. No periapical lesion was observed in his periapical radiograph results.

Dental plaques were removed from the teeth, and coronal parts of #11 were then detached. The level of the fracture was determined. After hemorrhage control in the fracture line, root canal therapies were completed in the teeth #11 and #21. In order to prevent contamination, the access cavity of the tooth #21 was restored using composite resin. A fiber-post slot was prepared in both tooth #11 and the fractured fragment. To expose the fracture lines and to obtain an effective isolation, full-thickness mucoperiosteal flap was elevated from the buccal and palatal regions of the teeth (Fig. 1b). Fiber post, fractured fragments, and tooth compliance were then checked. An internal groove was prepared in the fracture line. Acid and bond were applied to the fractured fragment and the tooth (Fig. 1c, d). After the residual cement was cleaned in the fracture line, the fiber post and fracture fragment were cemented to the inner root surface using dual-cure resin cement. The flap was irrigated with sterile saline so-

lution and sutured using 4/0 silk (Dr. Baistra, Henan, China). The missing structures in both teeth were restored with composite resin (Fig. 1e). The figure shows clinical appearance 1 week later (Fig. 1f).

Case 2

A 28-year-old male patient with a complaint of fractures related to teeth #11 and #21 was admitted 48 hours after the traumatic injury during a football match. The patient also had an epilepsy history and explained that he has been using phenytoin. The patient preserved the tooth fragments in water since the accident. Clinical examination revealed complicated crown root fractures in teeth #11 and #21 and hyperemic areas in the related gingiva (Fig. 2a), and caries on the fractured fragments (Fig. 2b). The marginal gingiva was trauma-free, and the hyperemia on the gingiva seemed to be related to the gingivitis. An intermediate restoration was previously applied to the exposed pulp by a general practitioner, prior to admission. Radiological examination showed no lesion in the periapical areas of those teeth. After removal of residues on the teeth, the root canals were prepared using K and H files; irrigation was then performed using EndoVac (Discus Dental, Culver City, CA) with 2.5% sodium hypochlorite (Microvem, Istanbul, Turkey), 17% EDTA (Microvem, Istanbul, Turkey), distilled water, and 2% chlorhexidine (Microvem, Istanbul, Turkey). The root canals were obturated with cold lateral condensation technique, using .02 tapered Gutta-Percha cones (Diadent, South Korea) in single visit. The fiber-post slots were prepared on both teeth. The caries was removed from the teeth fragments, and grooves were prepared for the posts. Full-thickness mucoperiosteal flap was elevated

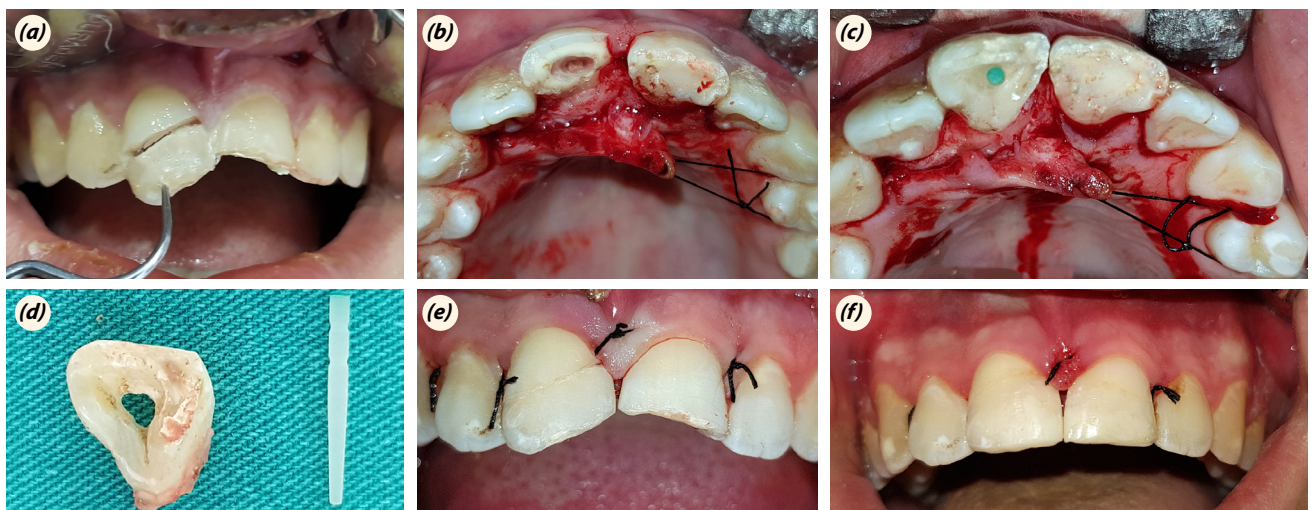


Fig. 1. (a) Pre-op buccal appearance. (b) Flap was elevated after the canal treatment was completed. (c) Coronal parts and fiber post were bonded with dual cure cement. (d) Post slot was prepared on the coronal part. (e) Post-op buccal appearance. (f) Missing parts restored composite in the follow-up.

from the buccal and palatal sides of the teeth. After hemostasis, compliance of the parts was checked. Acid and bond were applied, and residual cement was removed before polymerization. Both fragments were bonded to remnant teeth in their original anatomical position (Fig. 2d). Class 5 cavities were prepared and restored in the cervical region of fragments (Fig. 2e), and the flap was sutured to its former position using 4-0 silk (Dr. Baistra, Henan, China) (Fig. 2f). Sufficient healing of the soft tissue without any complications was observed 7 days later, and adjacent tooth decays in the cervical region were cleaned and restored with composite resin (Fig. 2g).

Case 3

A systemically healthy 19-year-old female patient presented to our clinic with uncomplicated crown fracture of tooth #21 1 hour after trauma (Fig. 3a). Because the dentin thickness was less than 0.5 mm, there was a pink spot appearance and sensitivity to cold application. Coronal pulp was amputated to prevent sensitivity and to create retention for the fragment (Fig. 3b). The access cavity was prepared under rubber dam isolation, and the pulp tissue was removed until beyond the cemento-enamel junction. The amputation site was washed with 2.5% NaOCl until bleeding stopped. MTA (White ProRoot MTA, Dentsply,

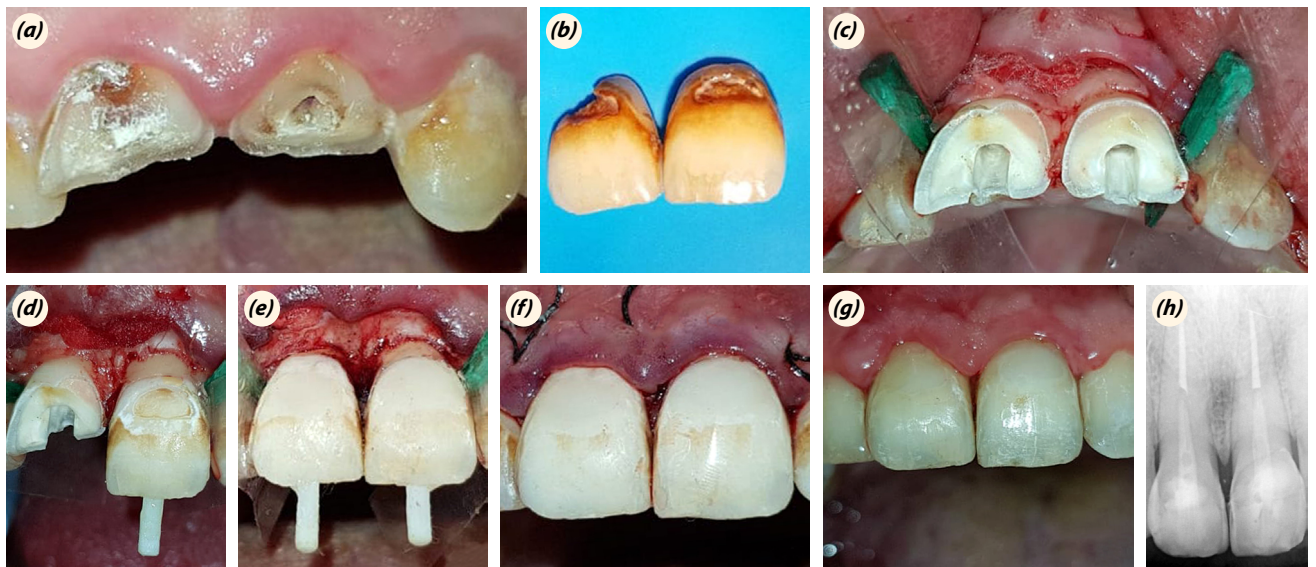


Fig. 2. (a) Pre-op buccal appearance. (b) Pre-op appearance of fractured fragments. (c) Canal treatment is completed. After flap elevation, the teeth were isolated from the adjacent teeth. (d) The fragments' compliance were checked. (e) Coronal parts were bonded with dual cure cement. (f) Post-op buccal appearance (g) buccal appearance at three months follow up (h) radiograph at three months follow up.

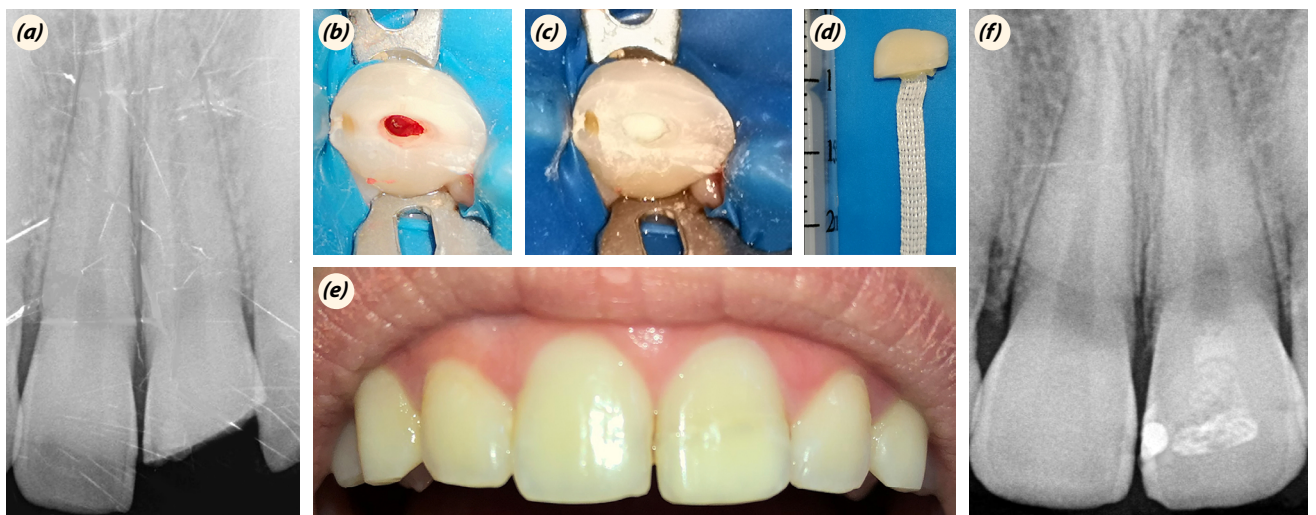


Fig. 3. (a) Pre-op radiograph. (b) Coronal pulp tissue was removed. (c) MTA was placed after hemostasis. (d) Ribbon was bonded to the fractured fragment. (e) Post-op buccal appearance (f) post-op radiograph.

Tulsa, OK, USA), which was prepared according to the manufacturer's instructions, was placed 2 mm below the enamel cement junction and covered with a GIC. Later, 2 mm deep grooves were prepared on fractured tooth fragments. The bonding agent (3M ESPE Single Bond Universal) was applied, and the polyethylene fibers (Ribbond, Ribbond Inc., Seattle, WA) were placed vertically into the fractured fragments (Fig. 3d) and crown with dual-cure cement (RelyX U 200). Overflowing cement residues were then cleaned with polishing disks (Sof-Lex Extra-Thin Disks, 3M; Clearfil Twist Dia, Kuraray) (Fig. 3e).

Discussion

One of the elements that create the first impression in interpersonal relationships is the teeth. It is known that trauma-induced mouth, tooth, and jaw injuries disrupt the continuity of psychosocial well-being and, in turn, negatively affect interpersonal communication (6). It should be considered that dental problems can significantly affect the facial aesthetics and well-being of individuals. Considering that dental traumatic injuries can especially affect the anterior aesthetic region; it is important to treat the problems resulting from the traumatic injuries in a short time. In a study by Wong et al. (7) conducted in the UK, it was found that high costs of TDI therapy and its long treatment process, which can result in school absenteeism, have been shown to adversely affect patient psychology. In the cases presented in this article, all procedures were completed in one visit, and the negative effects of trauma in daily life were reduced compared to the alternative treatment approaches.

In case of a subgingival location of the fracture line, the isolation required to bond the fragments to the remaining tooth structure may not be achieved ideally and may compromise the success of treatment due to microleakage. Orthodontic extrusions are an option to reveal the fracture line (8). However, there are some disadvantages such as long treatment duration, high cooperative necessity, possibility of microleakage in root canal during orthodontic movement, necessity of prosthetic treatment afterward, increase of crown/root ratio, and loss of output profile due to narrowing of cervical diameter (9). Surgical exposure method was preferred in the presented cases due to ease of application and direct and immediate intervention as soon as possible. The fact that the fracture lines were in subgingival area ensured that the desired aesthetic appearance was achieved in a short time with the reconstruction of the fractured fragment.

Reattachment of the fragments using various adhesive techniques is a convenient method for TDI involving crown fractures. Using the remaining tooth tissue provides

several advantages in terms of color, morphology, translucency, patient acceptance, and cost. Using the original structure in the rehabilitation of fractured teeth should be preferred to mimic its natural properties (4,5). Fluid absorption, smoking, and tea and coffee consumption may produce staining on composite restoration easily, unlike in natural teeth; this can negatively affect the long-term aesthetic results. Polymerization shrinkage is another factor that may compromise the prognosis of large composite restorations. These disadvantages may be eliminated by using porcelain materials; however, this treatment modality may require additional time and expenses from patients.

Restoration of porcelain is difficult to repair when intervention is required. In addition, fixing porcelain restorations is difficult, and composite restorations extending to the subgingival region can increase plaque accumulation and the incidence of periodontal disease (10). Utilizing the fracture fragments, as in the presented case, has been determined to restore the anatomical structures of the teeth and minimize the amount of composite in the subgingival, thus promoting gingival health as well as satisfying aesthetic results. These factors increased the acceptability of the treatment compared to tooth extraction and implant treatment. Vital pulp therapy was not preferred in tooth #21 due to elapsed posttraumatic time, low oral hygiene, and smoking habit of the patient in case 1.

Use of a post-core system is recommended in case of a loss in coronal structure more than 50% (11). In order to distribute the incoming forces equally to the root surface and prevent root fractures, the fiber-post with improved elastic and retentive properties were preferred in presented cases for additional fracture resistance. Studies have shown that the length of the post is most important than its diameter for retention (12,13). Therefore, only gutta-percha was removed during post slot preparation, and caution was exercised not to remove any root dentin in the presented cases. Ribbond is a relatively new material that increases fracture resistance similar to post systems and allows vital pulp treatment after trauma. Compared to prefabricated posts, there is no additional tooth removal, thus eliminating the possibility of root perforation. The Ribbond does not cause any stress at tooth-post interface, as it is in an elastic state and adapts to the tooth morphology. This maintains the natural strength of the tooth. In our first two cases, vital pulp therapy could not be applied due to conditions such as posttraumatic time, oral hygiene, etc.

Conclusion

Treatment using fiber post and original tooth fragments in the fractured anterior teeth is a simple and effective technique when applied correctly. It can be used in com-

plicated crown fracture cases when supported with surgical approach. In this method, optimum aesthetics and function can be achieved at low cost in a short period of time, compared to other expensive and time-consuming methods.

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