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Crown reattachment with complicated chisel-type fracture using fiber-reinforced post

CASE REPORT

Igor Stojanac, Bojana Ramic, Milica Premovic, Milan Drobac, Ljubomir Petrovic

Clinic of Dentistry, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia

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Correspondence to: Dr. Ljubomir M. Petrovic, Faculty of Medicine, University of Novi Sad, Hajduk Veljkova 12, 21000 Novi Sad, Serbia
Tel.: +381 63 8500 782
fax: +381 21 526120
e-mail: petns@uns.ac.rs

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Abstract – *Introduction*: Maxillary incisors and specifically their crowns are the most common teeth involved in dental trauma because of their exposed position in the dental arch. Traumatized anterior teeth require quick functional and esthetic repair. In the case of a complex crown fracture, with the necessity of endodontic treatment, fiber-reinforced posts (FRC) were used to create a central support stump to restore the dental morphology. *Case report*: A 24-year-old male patient came to the dental clinic with dental injury to the maxillary left central incisor with a chisel-type fracture that extended subgingivally with a widely open pulp chamber. The patient reported a sports injury had occurred 1 day before. Provisional reposition of the crown was completed using a composite splint and after that endodontic treatment has been performed. Two days later, a fiber-reinforced composite resin post was placed into the canal and adhesive reattachment of the fragment also completed. The tooth was prepared for a composite resin veneer in the gingival third of the vestibular surface because of a visible fracture line. *Conclusions*: The combined use of a fiber-reinforced composite resin post and the original crown fragment is a simple and efficient procedure for the treatment of traumatized anterior teeth that appears to offer pleasing esthetic and functional results that is less invasive than conventional prosthodontic treatment.

Introduction

Maxillary incisors are the most common teeth to be involved in dental trauma and their crowns are frequently damaged because of the exposed position in the dental arch (1). Traumatized anterior teeth require quick functional and esthetic repair. Several factors influence the management of coronal tooth fractures, including the extent of fracture (biological width violation, endodontic involvement, alveolar bone fracture), pattern of fracture and restorability of the fractured tooth (associated root fracture), secondary injuries (soft tissue status), presence/absence of fractured tooth fragment and its condition for use (fit between fragment and the remaining tooth structure), occlusion, esthetics, finances, and prognosis (2–4). Patient cooperation and understanding of the limitations of the treatment is of utmost importance for a good prognosis. Coronal fractures must be approached in a systematic way to achieve a successful restoration.

Crown-root fractures in anterior teeth are usually caused by direct trauma. This may result in a chisel-type fracture, with the apical extent of the fracture below the lingual gingiva. These fragments may be single or multiple, leaving the fragment or fragments loose and attached only by periodontal ligament fibers. The pulp may also be involved, depending on the depth of fracture into the dentin, further complicating a difficult traumatic injury. Crown-root fractures result in complaints of pain, particularly when the loose fragment or fragments are manipulated. The fragments are generally easy to move, and bleeding from the periodontal ligament or pulp often fills the fracture line. Because of the mobile parts, percussion is seldom useful in determining apical periodontal involvement.

When a complex crown fracture is coupled with the necessity of endodontic treatment, the space provided by the pulp chamber can be used as an inner reinforcement, thus avoiding further preparation of the fractured tooth (5). However, esthetics may become an important issue as pulpless teeth lose part of their translucency and brightness. There are several papers confirming the successful treatment achieved with fiber-reinforced posts (FRC) used to create central support and increase retention of the reattached crown fragment (6, 7).

Apart from strength and stiffness as the two important mechanical properties, satisfactory esthetic characteristics, low cost compared with a conventional crown, user-friendly technique, adaptability to different shapes, and the possibility of direct bonding to tooth structures increase the popularity of these materials (8).

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The following clinical report describes a successful treatment of a complicated crown-root fracture. The treatment includes a fractured tooth with endodontic treatment followed by adhesive reattachment of the fragment using a FRC and esthetic veneering of the labial surface in the fracture line zone.

Patient treatment report

A 24-year-old male patient came to The Department of Restorative Dentistry and Endodontics at the Dental Clinic in Vojvodina with dental injury of the maxillary left central incisor. The patient reported a sport injury that had occurred the night before during a football match (Fig. 1).

Clinical and radiographic examination revealed a complicated oblique crown fracture that extended subgingivally on the mesiopalatal area with a single fragment, attached only by periodontal ligament fibers as well as widely open pulp chamber (Fig. 2a,b).

Upon examination, the treatment options were presented to the patient, including (i) no treatment, (ii) post-and-core and crown, (iii) crown buildup restoration with a resin-based composite, and (iv) reposition of the tooth fragment. After some deliberation about the advantages, disadvantages, prognosis, and cost/benefit of every treatment option, the patient opted to have the tooth fragment repositioned. Provisional repositioning of the crown was performed using a composite resin splint and after that endodontic treatment was performed (Fig. 3).

The endodontic post was placed and fragments were repositioned after 2 days. Isolation was achieved using cheek retractor, cotton rolls, and saliva ejector placed in position. The post space was prepared to the required depth using the reamer size #3 red (Ivoclar Vivadent AG, Schaan, Liechtenstein) and irrigated with EDTA, 1% NaOCl, and distilled water, respectively. Drying the post space was completed using sterile paper points, and a light-transmitting fiber post size #3 red FRC Postec (Ivoclar Vivadent AG) was tried in the canal and cut at the desired length. After that, the post was cleaned with phosphoric acid etching gel (Total Etch, Ivoclar Vivadent AG, Schaan, Liechtenstein). After try-in, the post was cleaned with phosphoric acid etching gel (Total Etch, Ivoclar Vivadent AG). The etching gel was allowed to react for 60 s, and then it was thoroughly rinsed with water and dried. The post was silanated with Monobond-S (Ivoclar Vivadent AG). After a reaction time of 60 s, it was carefully dry with an air syringe. Equal amounts of AdheSE Bond (Ivoclar Vivadent AG) and AdheSE DC Activator (Ivoclar Vivadent AG) were mixed. The activated AdheSE Bond was applied to surfaces of the fractured fragments. Excess material was removed in such a way that the activated AdheSE Bond completely covered the enamel and dentin without pooling, a process was achieved by applying a weak stream of air. The mixed Multilink Primer A/B (Ivoclar Vivadent AG) was applied in the root canal for about 15 s and excess material was removed from the root canal using paper points. The endodontic post was coated with the mixed Multilink cement (Ivoclar Vivadent AG) and placed, thus expressing excess cement that was removed with an explorer. The post was then light-polymerized for 40 s (SmartLite IQ 2, Dentsply/Caulk, Milford, DE, USA). The occlusion was adjusted and the surfaces were polished.

Fig. 1. Image of fractured tooth taken immediately after trauma with mobile phone camera.

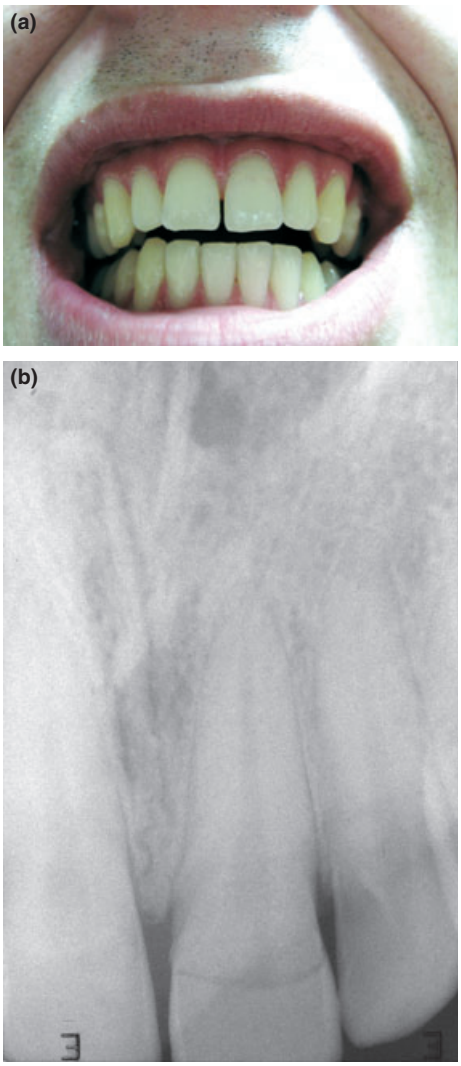

Fig. 2. (a) Preoperative view of fractured tooth. (b) Radiograph of fractured tooth.

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Fig. 3. Radiographic aspect of endodontic treatment.

Preparation for a composite resin veneer was performed in the gingival third of tooth's vestibular surface because the fracture line remained visible and was esthetically unacceptable. The cervical tooth zone was roughened with a diamond bur, and a slight finish line was created just below the gingival margin. The preparation was kept strictly in enamel. A contoured anatomical matrix was placed and wedged loosely. The matrix extended slightly into the sulcus and provided the smoothest possible surface to finish the composite resin. After the tooth was etched with 36% phosphoric acid (DeTrey® Conditioner 36 Conditioning&Etching Gel/Dentsply/De Trey, Konstanz, Germany), it was rinsed thoroughly, and a dentin bonding agent (Prime&Bond® NT/Dentsply/De Trey, Konstanz, Germany) was applied and air thinned, and then polymerized using an LED curing unit (Prime&Bond® NT/Dentsply/De Trey) for 10 s. Composite resin (Esthet.X® Dentsply/De Trey, Konstanz, Germany) was placed, adequate contoured, and polymerized. A No. 3 10-blade SafeEnd series carbide finishing bur (SS White Burs, Inc., Lakewood, NJ, USA) that has a noncutting tip designed to trim and to finish without damaging gingival tissue was used to remove excess resin composite in the area of the gingival sulcus. The composite resin was then reduced to proper contours along the gingiva and middle thirds using a No. 7 10-blade SafeEnd series carbide finishing bur (SS White Burs, Inc.). Final carbide polishing was completed using a No. 7 20-blade SafeEnd series carbide finishing bur (SS White Burs, Inc.) (Fig. 4).

Clinical examination after 12 months revealed a stable reattachment of the fragment, acceptable esthetics, satisfying function, and periodontal health with no bleeding on probing (Fig. 5).

Fig. 4. Intraoral view of the patient after the treatmant.

Fig. 5. Intraoral view of the patient one year after treatment.

Discussion

Using improved restorative materials that simulate the physical properties and other characteristics of natural teeth in combination with the proper design principles, the clinician can develop a tooth-restorative complex with optimal functional and esthetic results (9). With the materials available today, in combination with an appropriate technique, esthetic results can be achieved with predictable outcomes of crown reattachment complicated crown-root chisel-type fractures of the anterior teeth have occurred, especially in younger patients (1).

The combined use of a FRC and an original crown fragment is a simple and efficient procedure for the treatment of traumatized anterior teeth that appears to offer pleasing esthetic and functional results. Fiber-reinforced resin posts have been suggested as a group of materials which offers stiffness equal to that of dentin, as well as high durability and therefore have some advantages over metal posts (10, 11). A modulus of elasticity similar to that of dentin may increase the strength of the remaining tooth structure and reduces the risk of tooth fractures (12, 13). The use of FRC restorations along with adhesive technology may be a rational restorative alternative and less invasive procedure than conventional crown.

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