

Conservative Treatment of a Complicated Crown-root Fracture Using Adhesive Fragment Reattachment and Composite Resin Restoration: Two Year Follow-up

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Clinical Relevance

Tooth fragment reattachment associated with composite resin restoration can be an excellent treatment option for complicated crown-root fracture, when one of the fragments has been lost. A multidisciplinary approach can be critical for success.

SUMMARY

Crown-root fracture is one of the most challenging fracture types in the dental traumatology literature. Traumatized anterior teeth require quick functional and esthetic repair. In the case of a complex crown fracture of the

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maxillary left central incisor, requiring endodontic treatment, a fiber-reinforced post was used to create a central support stump to restore the dental morphology. This report describes the clinical procedures involved in the treatment. After two years of follow-up, the clinical and radiographic findings demonstrated that the adopted clinical protocol was successful and yielded healthy periodontal tissues with no signs of periradicular pathology.

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INTRODUCTION

Traumatic dental injuries are a common dental health problem and can result in damage to dental and periradicular structures, producing physical and psychologic discomfort, causing pain, and having a substantial impact on quality of life.¹⁻³

Traumatic injury to teeth and their supporting structures usually occurs in young people, and maxillary central incisors are the most commonly affected teeth in either permanent or primary dentition because of their exposed position in the dental arch.⁴ A crown-root fracture is a type of dental trauma, usually resulting from horizontal impact, that involves enamel, dentin, and cementum, occurs below the gingival margin, and may be classified as complicated or uncomplicated, depending on whether pulpal involvement is present or absent.⁵⁻⁷

The prognosis of traumatic injuries depends on early intervention to injured teeth and the extension of the intervention. A delay in treatment may influence the diagnostic results. There are many treatment modalities to treat teeth with a complicated crown-root fracture, depending on fracture location. It has been recommended that all involved fragments be removed to evaluate the extent of the injury.^{8,9} Restoration of a tooth with a crown-root fracture or a cervical root fracture is unfavorable and can be a difficult procedure when the fracture line extends below the marginal bone level. Restorative and functional needs are balanced with the demands for a healthy periodontium.^{10,11} Placing the margin of the restoration in the biologic width frequently leads to chronic gingivitis, the loss of clinical attachment, bony pockets, and gingival recession. Crown-root fractures extending well below the alveolar crest can require surgical repositioning of the tissues to expose the level of the fracture. Either surgical or orthodontic extrusion can also be performed to allow for better restoration of the fractured tooth. The choice of treatment is primarily determined using exact information about the site and the type of fracture, but the cost and complexity of treatment can also be deciding factors.⁹⁻¹²

This report describes a multidisciplinary approach for the treatment of a complicated crown-root fracture of a maxillary central incisor, with two years of follow-up.

CLINICAL CASE REPORT

A 23-year-old male patient came to the Dental School of Minas Gerais Federal University after falling and suffering a traumatic injury to the left central incisor



Figure 1. (A) Intraoral view of the patient before the treatment. (B) Close-up view of the fractured tooth.

Figure 2. Palatine view.

two weeks before (Figure 1A,B). He reported that he broke his tooth while playing soccer. The medical history was reviewed, and there was no remarkable report. A written informed consent form was signed by the patient for treatment and further publication of the case.

The clinical examination revealed a significant loss of tooth structure, pulp exposure, and a



Figure 3. Periapical radiograph of the fractured tooth.

Figure 4. Clinical aspect of the fragment still stuck to the gum fibers.

horizontal coronary fracture affecting the mesio-distal surface of the left central incisor (Figure 2). Intraoral periapical radiographic investigation revealed the presence of a longitudinal crown-root fracture and showed no signs of bone fracture (Figure 3). The tooth had a two-part crown fracture: one of the fragments was lost at the scene of the accident and the other fragment was still in place,

held by the gingival tissue. A coronal opening was made with removal of the entire pulp tissue to prevent contamination of the area that was to receive the fragment. The lingual fragment was mobile in the lateral direction, and the fracture extended subgingivally, with invasion of the periodontal biologic space (Figure 4).

After routine collection of the patient's dental/medical history and examination, a treatment plan was established. Because of the loss of one of the crown fragments, the proposed treatment was surgery for augmentation of the remaining clinical crown, the reattachment of the retrieved fragment, endodontic treatment, and a fiberglass post associated with composite resin restoration.

Under local anesthesia, an intrasulcular incision was made on the palatal gingival tissue of both maxillary central incisors and the maxillary left lateral incisor with a no. 15 scalpel blade for removal of the displaced fragment and exposure of the fracture line (Figure 5). In this case, the vertical difference between the alveolar bone crest and the fracture line was 1 mm (ie, there was a violation of the biologic space; Figure 6). Then, osteotomy and osteoplasty were performed, so that the fracture line stayed at a 2-mm bone margin. The coronal fragment (Figure 7) was rehydrated by immersing in normal physiologic saline solution and cleaned to remove foreign debris prior to the absolute isolation of the operative field (Figure 8).

After rubber dam isolation, again the fragment was positioned to check its perfect adaptation to the remaining structures (Figure 9). The enamel surface and both the remaining tooth structure and the fractured segment were etched with 37% phosphoric acid for 30 seconds. Following the etching, the etchant was removed by washing for 60 seconds, and the excess water was removed using paper towels. The fragment was adapted and reattached with resinous auto-adhesive cement. All margins were light cured for 40 seconds (Figure 10), and all subgingival margins were polished using a composite polishing kit (Astropol Composite polishing kit - Ivoclar Vivadent, Liechtenstein).

A commercially prepared antibiotic-corticosteroid product was placed in the canal space. The tooth was provisionally sealed with glass ionomer cement. The rubber dam was removed, and suturing was performed. An alginate impression and plaster model were used for establishing the contours of the maxillary left central incisor with diagnostic waxing (Figure 11). After seven days, the suture was

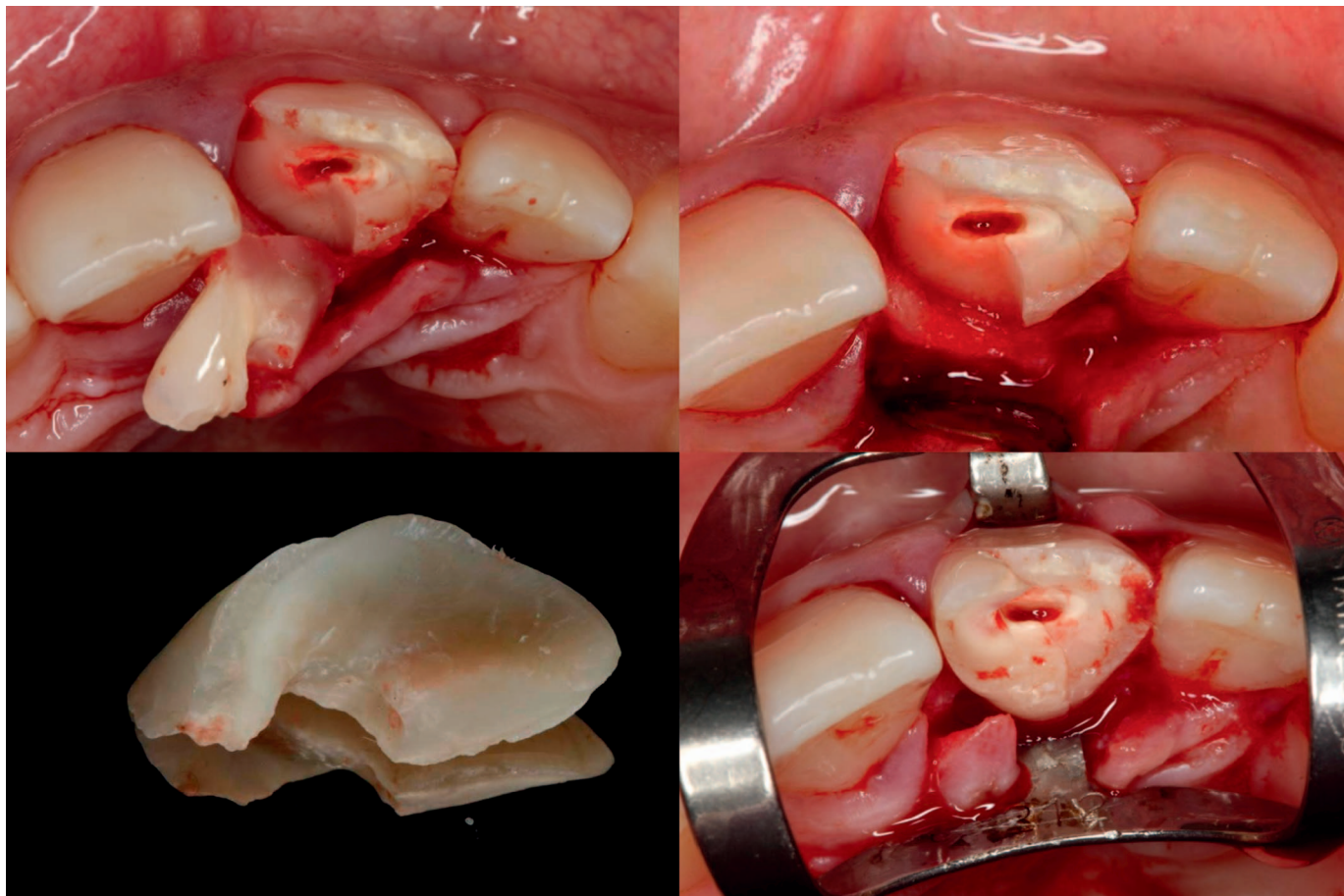


Figure 5. *Fragment being shifted.*

Figure 6. *Clinical aspect showing the extension of the complicated crown-root fracture, invading the biologic width.*

Figure 7. *Tooth fragment.*

Figure 8. *Retractor clamp and fragment positioned, certifying the perfect adaptation to the remaining dental structure.*

removed, and the patient was referred for endodontic therapy. Two days later, total removal of pulp tissue from the remaining root portion was accomplished under copious 1% NaOCl irrigation and with a Ni-Ti rotary instrument. After instrumentation, the canals were filled with 17% EDTA for three minutes, flushed with saline, and dried with absorbent paper points. Root canal obturation was performed with a thermoplastic obturation technique—System B plus canal sealer. The endodontic therapy was completed in one session.

The patient was scheduled to return at 90 days after reestablishment of the biologic width to perform the final restoration.

A silicone guide was created, from the diagnostic waxing, to assist the intraoral reconstruction with composite resin. After removal of the temporary restoration of glass ionomer cement, the guide was held to the occlusal contacts in the maximum

intercuspsation and disocclusion guides (Figure 12). Under a rubber dam, the treatment continued with post space preparation. A previously selected fiber-glass post was used. This was reduced coronally, taking into account the previously positioned silicone guide (Figure 13). The radicular portion was washed with distilled water and then dried. The post was cemented inside the root canal with resinous auto-adhesive cement, according to the manufacturer's instructions. The coronal portion corresponding to the fragment lost during the traumatic injury was built with composite resin, using the silicone guide previously created. The restoration was adjusted, respecting the contacts previously made. After 20 days, the restoration was polished using diamond stones and a composite polishing kit. Occlusion was checked and adjustments were made as necessary. Then, the restoration was completed (Figures 14, 15 and 16).

All materials used are listed in Table 1.

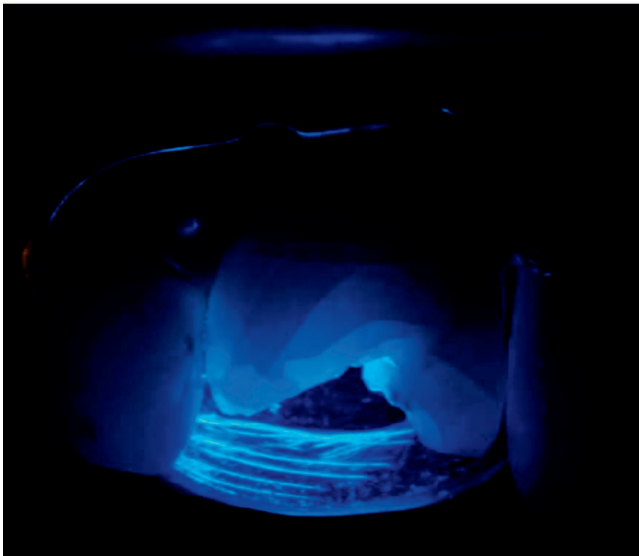
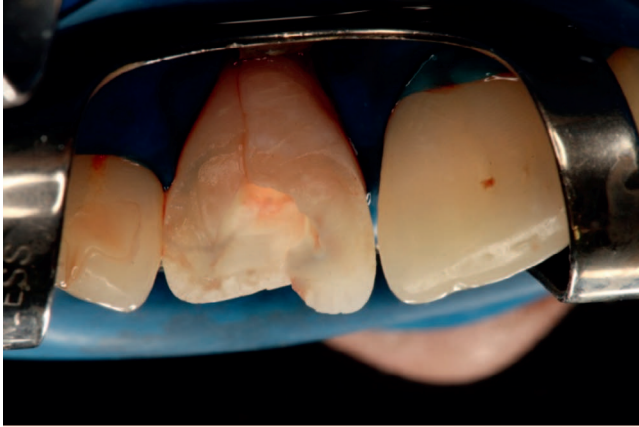


Figure 9. Perfect fragment adaptation to the remaining dental structure.

Figure 10. Set fragment/remaining dental structure light cured for 40 seconds.

After two years of follow-up, clinical examination showed good function and esthetics for the restored tooth.

POTENTIAL PROBLEM

The main causes of traumatic dental injuries reported in the literature are violence, collisions, falls, sports, leisure activities, and traffic accidents. Male individuals suffer significantly more traumatic dental injuries in the permanent dentition than females, probably because they are more frequently engaged in physical activities involving physical contact.¹ Additionally, the literature suggests that most traumatic dental injuries involve the maxillary central incisors, followed by maxillary lateral incisors and mandibular incisors. The prominent and open position of the upper teeth in the face is

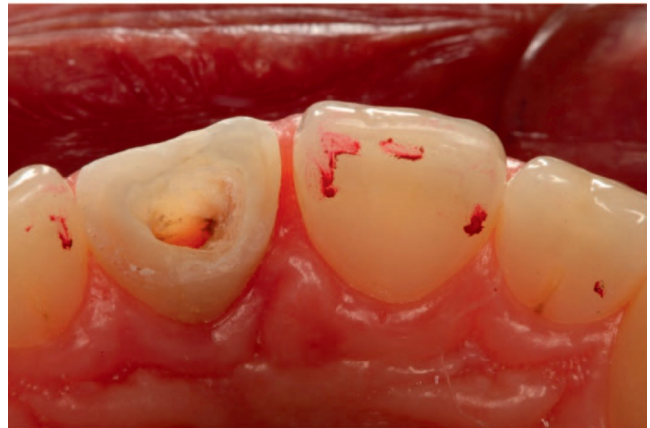


Figure 11. Diagnostic waxing.

Figure 12. Record of occlusal contacts before restoration.

Figure 13. Fiber post with your specified length, from restoration dimensions previously planned.

responsible for their more frequent involvement in fractures than the lower teeth.^{1-4,13}

Crown fracture restorations localized in the superior incisor area need to be evaluated from several perspectives, including the topography, tissues involved, quality and the quantity of the remaining tooth structures, adaptation of the fragment to the



Figure 14. Restoration completed: incisal view.

Figure 15. Restoration completed: anterior view.

dental remnant, and the patient's age.¹³⁻¹⁵ The choice of clinicians regarding the restorative treatment of fractured teeth directly affects the treatment prognosis and requires a careful consideration of several factors, such as the extent and pattern of the fracture, the endodontic and periodontal involvement, and the possibility of using the fragment in the reattachment process.^{15,16}

A study of the literature shows that coronal restoration of teeth with crown-root fractures is usually challenging, especially when the fracture extends below the bone level, as occurred in the present case.^{9,13,15,16} One of the determinant factors for the functional and esthetic success in the management of complicated crown-root fractures is the adoption of a multidisciplinary approach involving surgery, endodontics, periodontics, and prosthodontics.^{9,13,16,17} The reconstruction of extensively destroyed anterior teeth has become a true challenge for restorative dentistry because dental materials do not effectively substitute for dental tissues. According to this case, two techniques are possible for treatment of complicated crown-root fractures, and

the advantages and disadvantages of these techniques are listed in Table 2.

Root treatment carried out in a single visit is preferable in trauma cases such as this; the prognosis is extremely good for a vital pulp extirpation. In a case with a necrotic pulp or if the tooth has already been root treated, an evaluation of the individual tooth should be made to determine whether one or more appointments are appropriate.³

Materials	Supplier
Rubber dam	SSWhite, Rio de Janeiro, RJ, Brazil
Phosphoric acid 37%	Dentalville do Brasil LTDA, Joinville, SC, Brazil
212 Retractor clamp	SSWhite, Rio de Janeiro, RJ, Brazil
Rely-X Unicem	3M/ESPE, St. Paul, MN, USA
Astropol Composite polishing kit	IvoclarVivadent, Liechtenstein
Otosporin	Farmoquímica S/A, Rio de Janeiro, RJ, Brazil
Vidrion R	SSWhite
EDTA	Odahcan-Herpo Produtos Dentários Ltda, Rio de Janeiro, RJ, Brazil
Filtek Z350XT	3M/ESPE, Ribeirão Preto, SP, Brazil
Whitepost Fiber post	FGM, Joinville, SC, Brazil



Figure 16. Radiographic view after intra-radicular fiber post cementation and composite resin reconstruction.

Table 2: *Advantages and Disadvantages for Each Technique*

Techniques	Advantages	Disadvantages
Tooth fragment reattachment associated to composite resin restoration	<ul style="list-style-type: none"> • Maintenance of dental substrate • Insertion of periodontal fibers in natural structure • Reduced cost • Fewer clinical sessions 	<ul style="list-style-type: none"> • Possibility of remaining color change • Superficial staining of the composite resin
Ceramic crowns	<ul style="list-style-type: none"> • Color stability • Surface smoothness • Longevity 	<ul style="list-style-type: none"> • Increased wear of tooth structure • Higher costs • Need for a greater number of treatment sessions • Need for orthodontic traction and additional surgeries

The technique of tooth fragment reattachment has advantages over direct composite resin restorations, namely, procedural simplification, less clinical chair time, and immediate reestablishment of aesthetics and function.^{9-13,15} However, in this case, one of the fragments had been lost during the traumatic injury, which determined the need for associating the reattachment technique with a composite resin restoration.

With the adhesive materials and composite resins available today, in combination with an appropriate technique, esthetic results can be achieved with predictable outcomes of crown reattachment if complicated crown-root chisel-type fractures of the anterior teeth have occurred, especially in younger patients.^{11,16,18} The retention of the restored portion and fragment to the masticatory effort was compensated for by the cementation of an intracanal post with fiber-reinforced resin posts. Such resin posts have been suggested as a group of materials that offers stiffness equal to that of dentin, as well as high durability and, therefore, have some esthetic advantages over metal posts.¹⁹ A modulus of elasticity similar to that of dentin may increase the strength of the remaining tooth structure and reduce the risk of tooth fractures.¹³

Traumatic injuries can require a multidisciplinary treatment approach. The combined use of adhesive materials and a tooth fragment is a simple, low cost, and efficient procedure for the treatment of traumatized anterior teeth. This report provides a highly conservative approach that combines the esthetics, function, and health of periodontal tissues, postponing the use of a more aggressive prosthetic solution.

Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of the Dental School of Minas Gerais Federal University, Brazil.

Conflict of Interest

The authors of this manuscript certify that they have no proprietary, financial or other personal interest of any nature or kind in any product, service and/or company that is presented in this article.

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