

# Multidisciplinary Treatment of Complicated Crown-Root Fractures: A Case Study

IL Stojanac • BV Bajkin • MT Premovic • BD Ramic • LM Petrovic

## Clinical Relevance

The present clinical report describes the successful therapeutic treatment of complicated crown-root fractures and demonstrates the necessity of a multidisciplinary approach during the therapy of traumatized teeth.

## SUMMARY

**Traumatic dental injuries usually occur among children and adolescents, with maxillary central incisors as the most often affected teeth. Complicated crown-root fractures are particularly challenging for esthetic and functional rehabilitation and often require a multidisciplinary approach. A 21-year-old male patient came to the Dental Clinic due to fractured maxillary incisors caused by trauma during a sporting activity. Clinical examination re-**

**vealed horizontal fractures of teeth 7, 8, and 9, initiating in the labial cervical third and extending subgingivally on the palate, with exposed pulp tissues. On provisional repositioning and splinting the fragments, root canal treatment was performed. Definitive repositioning was accomplished by raising a full-thickness gingival flap, using fiber-reinforced composite posts, by an endodontist and an oral surgeon. Reattachment was accomplished under surgical conditions to ensure precise positioning of fragments by exposing the palatal aspect of the fracture lines and providing a dry operating field. Definitive composite resin veneers were performed after seven days.**

## PURPOSE

The etiology of traumatic dental injuries (TDIs) includes oral, environmental, and human factors that are additionally divided into intentional and unintentional.<sup>1</sup> Thirteen to 39% of all dental injuries are sports related, with males traumatized twice as often as females. The exposed position of upper central incisors in the dental arch makes them the most frequently traumatized teeth in both primary and permanent dentitions.<sup>2,3</sup> Basketball players are very susceptible to TDIs because of the frequent hand or elbow contact with other players.<sup>4</sup> A study

Igor Lj Stojanac, DDS, PhD, assistant professor, Faculty of Medicine, University of Novi Sad, Clinic of Dentistry, Novi Sad, Serbia

Branislav V Bajkin, DDS, PhD, assistant professor, Faculty of Medicine, University of Novi Sad, Clinic of Dentistry, Novi Sad, Serbia

Milica T Premovic, DDS, PhD student, Faculty of Medicine, University of Novi Sad, Clinic of Dentistry, Novi Sad, Serbia

\*Bojana D Ramic, DDS, PhD student, Faculty of Medicine, University of Novi Sad, Clinic of Dentistry, Novi Sad, Serbia

Ljubomir M Petrovic, DDS, PhD, full professor, Faculty of Medicine, University of Novi Sad, Clinic of Dentistry, Novi Sad, Serbia

\*Corresponding author: Hajduk Veljkova 3, Novi Sad, 21000, Serbia; e-mail: bojana.ramic@mf.uns.ac.rs

DOI: 10.2341/15-080-T

by Kumamoto<sup>5</sup> showed that the highest incidence of orofacial injuries created during sports activities was observed in basketball, baseball and unorganized football when athletes didn't wear mouthguards. Wearing a custom-made mouthguard can help prevent orofacial sport-related injuries and provide significant protection if an injury occurs.

TDIs have a great influence on a patient's quality of life since they cause esthetic, functional, and phonetic problems. Psychosocial aspects of the patient are particularly noticed if the fractured teeth are visible. Therefore, TDI requires rapid reaction of the patient and the therapist in order to achieve the best treatment option in the least traumatic way. Complete rehabilitation of traumatized teeth often requires a multidisciplinary approach, which can include oral and maxillofacial surgeons, endodontists, pediatric dentists, orthodontists, prosthodontists, and periodontists.

Crown-root fractures involve enamel, dentin, and cementum; occur below the gingival margin; and are classified as complicated and uncomplicated according to the pulp tissue involvement.<sup>1</sup> The unstable position of the fractured coronal fragment, loss of tooth vitality, invasion of biological width, and problems fitting fragments together make definitive restorations of crown-root fractures difficult and challenging.<sup>6,7</sup>

The management of dental trauma has to be planned carefully, including a detailed history of the patient and careful clinical and radiological examination. The correct diagnosis and most suitable treatment options for the patient include factors such as the type, direction, and intensity of the trauma; involvement of the pulp tissue or biological width; stage of root growth; mobility of the tooth; diastasis of the fragments; and the knowledge and skills of the dentist.<sup>8,9</sup>

The following clinical report describes the management of complicated crown-root fractures, including endodontic treatment, surgically raising a full-thickness gingival flap, adhesive reattachment of fragments using fiber-reinforced composite posts, and esthetic veneering of fractured teeth.

## DESCRIPTION OF TECHNIQUE

A 21-year-old male patient was referred to the Dental Clinic of Vojvodina due to intense pain of fractured teeth caused by trauma during a basketball game the day before.

A maxillofacial surgeon examined the patient, performed debridement of the wounds, determined that there were no fractures to the facial bones,

prescribed antibiotic therapy, and referred the patient to the Department of Restorative Dentistry and Endodontics.

A clinical examination revealed horizontal fractures of the maxillary right lateral incisor and both maxillary central incisors, labially in the cervical third and extending subgingivally on the palate, with exposed pulp tissue (Figure 1). The crown fragments were highly mobile but still in place, fixed slightly on the palatal side by periodontal ligament fibers, while the root fragments were stationary and stable. Adjacent teeth had no sign of trauma. Radiographs confirmed the presence of horizontal fractures for teeth 7, 8, and 9 (Figure 2).

On presenting all treatment options, to include both risks and benefits, the patient opted for reattachment of the fragments using glass fiber posts under surgical conditions. At first, the fragments were temporarily repositioned and splinted using a composite-resin splint, from teeth 6 to 11, to stabilize the position of the teeth and facilitate root canal treatment (Figure 3). On cleaning and shaping (ProTaper, Dentsply, Maillefer, Switzerland), the canals were treated with calcium hydroxide for seven days. Definitive obturation was performed using gutta-percha points and AH plus sealer (Dentsply DeTrey, Konstanz, Germany) (Figure 4). The patient was instructed on oral hygiene maintenance and nutrition.

Considering that the fracture lines on the palatal aspect were deeply subgingival, definitive repositioning of fragments was performed two days later after raising a full-thickness gingival flap, a procedure that was performed by an endodontist and an oral surgeon. The envelope flap was elevated from the canine to the canine both buccally and palatally. The subgingival palatal fracture lines were exposed in this manner to control bleeding and ensure precise fragment repositioning. The crown fragments were gently separated from the periodontal tissue and cleaned. The previously prepared access cavities were extended to ensure a straight-line passage of posts. The fragments were fitted once more to ensure adaptation, followed by immersion of the fragments in a saline solution in order to keep them moist and prevent dehydration (Figure 5).

The post space was prepared using a Largo Peeso Reamer and Precision Drill for the X-Post No. 3, reduced to an adequate length, and cleaned with alcohol (Dentsply Post&Core System, Dentsply DeTrey). The canal spaces and surrounding tooth issue, as well as the crown fragments, were etched, rinsed, and dried in order to be prepared for the reattachment



Fig 1



Fig 2

Figure 1. Intraoral view of the patient.  
Figure 2. Preoperative retroalveolar radiograph of fractured teeth.

procedures. An XP Bond/SCA mixture was applied into the canal, the X-post, and the surfaces of the fractured fragments and gently dried, followed by application of Core-X flow into the canal. The post was set and stabilized, the crown fragment was repositioned, and the entire unit was light cured for 40 seconds from each side (Radii Plus, SDI, Bayswater, Australia). The same procedure was repeated for the adjacent teeth. Sterile

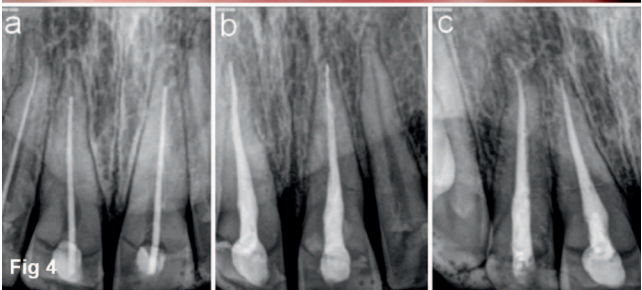


Figure 3. (a): Temporarily repositioned and splinted teeth. (b): Prepared access cavities for root canal treatments.  
Figure 4. (a): Retroalveolar radiograph on working length determination. (b, c): Definitive root canal treatments.

gauze was placed beneath the flap with additional suction used to achieve a dry operating field. On completion of the reattachment procedure, the flap was repositioned, fixed, and sutured using black-silk suture 3-0 (Figure 6).

Preparation for composite resin veneers was kept strictly in enamel except at the fracture line area, where the preparation was deeper. The teeth were etched with 37% phosphoric acid for 20 seconds (Super Etch, SDI) and thoroughly rinsed and dried, and the dentin bonding agent (Stae, SDI) was

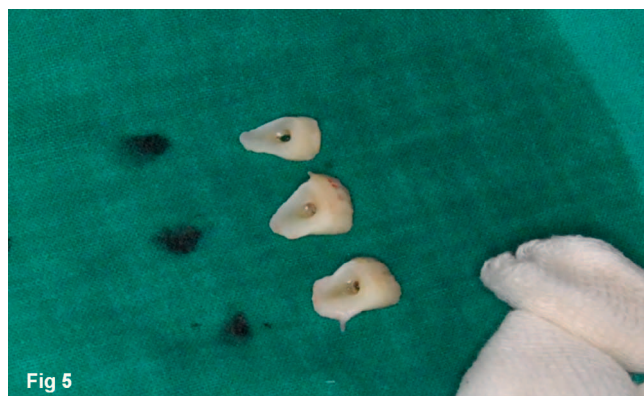


Fig 5



Fig 6



Fig 7

Figure 5. Separated and cleaned coronal fractured fragments.

Figure 6. Repositioned and sutured lifted gingival flap and temporarily made composite resin veneers.

Figure 7. Clinical view on complete treatment.

applied and light cured for 10 seconds. Nanohybrid composite resin (Ice, SDI), shade A2, was applied, contoured for a natural look, and polymerized for 20 seconds for each layer. Removal of the excess of material in the area of the gingival sulcus was performed using a No. 3 10-blade SafeEnd series carbide finishing bur (SS White Burs, Inc, Lakewood, NJ, USA) with a noncutting tip, designed to trim without damaging the gingival tissue. The remaining area was finished and polished with a

No. 7 10-blade and a No.7 20-blade SafeEnd series carbide bur, respectively (SS White Burs). After seven days, the sutures were removed, composite resin veneers were checked, and additional polishing was performed (Figure 7).

On completion of the restorative procedures, the patient was instructed on the importance of maintaining adequate oral hygiene, implementation of precautions, and the necessity of using a mouth-guard during sports activity. The patient had no complaints at follow-up examinations.

Seven months later, the patient was referred to the Dental Clinic due to fractured previously restored teeth 8 and 9, which again occurred during a basketball game. Tooth 7 had no sign of trauma (Figures 8 and 9). Considering that the patient did not heed instructions about necessity of wearing a mouthguard, two previously reconstructed teeth were indicated for extraction.

### POTENTIAL PROBLEMS

The esthetic, functional, and biological rehabilitation of traumatic injured teeth is a real challenge for every dentist, often requiring an interdisciplinary/multidisciplinary approach. Various treatment modalities have been proposed for crown-root fractures: coronal fragment removal followed by prosthetic restoration, fragment reattachment, gingivectomy and osteotomy (crown lengthening), orthodontic extrusion of a root fragment, forced surgical extrusion, and extraction followed by implants or fixed partial denture.<sup>10,11</sup> Techniques that shorten and simplify treatment, that provide natural-looking restorations, and that ensure long-term success rates are preferred.<sup>12</sup>

The reattachment procedure is not convenient if the fracture line is positioned subgingivally, a dry operating field is difficult to achieve, and the whole treatment can be finished unsuccessfully. Therefore, the reattachment procedures in the present case were performed after raising a full-thickness gingival flap, under surgical conditions, in order to expose the fracture line, control bleeding, and ensure the precise repositioning of fragments.

Periodontal structures should be preserved as much as possible; therefore, repositioning must be done gently and atraumatically in order to provide desirable wound healing and acceptable biological restorations. Complications such as gingival inflammation, clinical attachment loss, and bone loss are frequent, especially in patients who do not comply with instructions given by the therapist.<sup>1,13</sup>



Figure 8. Intraoral view of the fractured previously reattached dental structures.

Figure 9. Extraoral view of the fractured previously reattached dental structures.

Treatments of choice for converting subgingival fractures into supragingival fractures include some of the following treatment options. Gingivectomy and osteotomy (crown lengthening) are simple and rapid procedures, but they are not indicated in esthetic areas.<sup>14-16</sup> Orthodontic extrusion is favorable for maintaining periodontal health and preserves the crown-root ratio, but the procedure is time consuming, requiring five weeks to achieve 2-3 mm of extrusion and a retention period of about 8-10 weeks.<sup>11,14,17</sup> Surgical extrusion of the tooth is a less time consuming procedure, but there is a risk of root resorption and compromising the integrity of the periodontal ligament.<sup>14</sup>

During the reattachment of separated fragments, they should be kept out of the mouth for as little time as possible so that they can remain moist and prevent dehydration; in this way, they maintain an adequate bond strength and their original esthetic appearance.<sup>18</sup> In the present case, the fractured

fragments were preserved in a saline solution until reattachment (approximately 10 minutes), which was necessary to prepare and set the posts.

### SUMMARY OF ADVANTAGES AND DISADVANTAGES

Advances in the development of adhesive materials and restorative techniques have made the selection of reattachment procedure the most preferred treatment option for tooth fracture whenever the coronal tooth fragment is intact and available and precise repositioning between fragments is possible. Although technically sensitive, the reattachment procedure has significant advantages: it is a conservative approach and a rapid procedure, it immediately restores the natural appearance and function of the tooth, and it results in positive emotional and social responses from the patient.<sup>7,9</sup>

Tooth-colored glass fiber posts were used to fix the tooth fragments, enhance retention, and strengthen the remaining tooth structure. Glass fiber posts were chosen to reinforce the fractured teeth due to their excellent esthetics, ability to bond to tooth structure, stiffness and elasticity similar to dentin, high durability, and fracture resistance.<sup>19,20</sup>

Composite resin veneers were used to strengthen the area of the fracture line and make the teeth esthetically pleasing. A thin layer of composite resin was applied, respecting the original tooth form and color and providing natural-looking restorations. Minimally invasive direct composite restorations are more preferable than more extensive indirect restorations.

The present clinical report describes the successful therapeutic treatment of complicated crown-root fractures and demonstrates the necessity of using a multidisciplinary approach during the therapy of traumatized teeth. Additionally, it emphasizes the importance of wearing a mouthguard during sports activity in order to prevent TDIs as well as preserve previously reattached dental structures.

### Acknowledgement

This research was supported by a grant from the Ministry of Science of Serbia, Grant No. 174005, for research on the viscoelasticity of fractional type and optimization of shape in rod theory.

### Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of the Faculty of Medicine, University of Novi Sad, Clinic of Dentistry, Serbia.

**Conflict of Interest**

The authors of this article 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.

(Accepted 14 April 2016)

**REFERENCES**

1. Glendor U, Marcenes W, & Andreasen JO (2007) Classification, epidemiology and etiology In: Andreasen JO, Andreasen FM, Andersson L (eds) *Textbook and Color Atlas of Traumatic Injuries to the Teeth* Wiley-Blackwell, Oxford 217-254.
2. Olin WH (1996) Dentistry and sport: Meeting the needs of our patients *Journal of the American Dental Association* **127**(6) 809-818.
3. Altun C, Cehreli ZC, Güven G, & Acikel C (2009) Traumatic intrusion of primary teeth and its effects on the permanent successors: A clinical follow-up study *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontics* **107**(4) 493-498.
4. Cohenca N, Roges RA, & Roges R (2007) The incidence and severity of dental trauma in intercollegiate athletes *Journal of the American Dental Association* **138**(8) 1121-1126.
5. Kumamoto DP (1996) Sports dentistry at the state level. *Journal of the American Dental Association* **127**(6):816.
6. Cvek M, Tsilingaridis G, & Andreasen JO (2008) Survival of 534 incisors after intra-alveolar root fracture in patients aged 7-17 years *Dental Traumatology* **24**(4) 379-387.
7. Stojanac I, Ramic B, Premovic M, Drobac M, & Petrovic L (2013) Crown reattachment with complicated chisel-type fracture using fiber-reinforced post *Dental Traumatology* **29**(6) 479-482.
8. Macedo GV, Diaz PI, De O Fernandes CA, & Ritter AV (2008) Reattachment of anterior teeth fragments: A conservative approach *Journal of Esthetic and Restorative Dentistry* **20**(1) 5-20.
9. Sargod SS, & Bhat SS (2010) A 9 year follow-up of a fractured tooth fragment reattachment *Contemporary Clinical Dentistry* **1**(4) 243-245.
10. Trushkowsky RD (1998) Esthetic, biologic, and restorative considerations in coronal segment reattachment for a fractured tooth: A clinical report *Journal of Prosthetic Dentistry* **79**(2) 115-119.
11. Olsburgh S, Jacoby T, & Krejci I (2002) Crown fractures in the permanent dentition: Pulpal and restorative considerations *Dental Traumatology* **18**(3) 103-115.
12. Murchison DF, Burke FJ, & Worthington RB (1999) Incisal edge reattachment: Indications for use and clinical technique *British Dental Journal* **186**(12) 614-619.
13. Pama-Benfenati S, Fugazzotto PA, Ferreira PM, Ruben MP, & Kramer GM (1986) The effect of restorative margins on the postsurgical development and nature of the periodontium. Part II. Anatomical considerations. *International Journal of Periodontics and Restorative Dentistry* **6**(1) 64-75.
14. Kulkarni VK, Sharma DS, Banda NR, Solanki M, Khandelwal V, & Airen P (2013) Clinical management of a complicated crown-root fracture using autogenous tooth fragment: A biological restorative approach *Contemporary Clinical Dentistry* **4**(1) 84-87.
15. Turgut MD, Gönül N, & Altay N (2004) Multiple complicated crown-root fracture of a permanent incisor *Dental Traumatology* **20**(5) 288-292.
16. Wang Z, Heffernan M, & Vann WF Jr (2008) Management of a complicated crown-root fracture in a young permanent incisor using intentional replantation *Dental Traumatology* **24**(1) 100-103.
17. Fidel SR, Fidel-Junior RA, Sassone LM, Murad CF, & Fidel RA (2011) Clinical management of a complicated crown-root fracture: A case report *Brazilian Dental Journal* **22**(3) 258-262.
18. Capp CI, Roda MI, Tamaki R, Castanho GM, Camargo MA, & de Cara AA (2009) Reattachment of rehydrated dental fragment using two techniques *Dental Traumatology* **25**(1) 95-99.
19. Krishna A, Malur MH, Swapna DV, Benjamin S, & Deepak CA (2012) Traumatic dental injury—An enigma for adolescents: A series of case reports *Case Reports in Dentistry* ID 756526 doi:10.1155/2012/756526.
20. Qualtrough AJ, & Mannocci F (2003) Tooth-colored post systems: A review *Operative Dentistry* **28**(1) 86-91.