International Archives of Medical Research
Volume 3, No. 1, pp.11-22, 2012.

CASE REPORT

# Reattachment of complicated crown fracture and fixation of the coronal fragment with FRCL as an alternative approach

**Sema CELENK[1], Emin Caner TUMEN[1], Buket AYNA[1], Zeki ARSLANOGLU[2], Fatma ATAKUL[1]**

*[1]Department of Pediatric Dentistry of Dentistry University of Dicle, 21280, Diyarbakir, Turkey*
*[2] Department of Pediatric Dentistry of Dentistry University of Mustafa Kemal, Hatay, Turkey*

## Abstract

***Background:*** *Because of the physical deformity and the psychological effect on the patient, a trauma with accompanying fracture of anterior teeth is a disturbing experience for a young individual which requires immediate attention.*
***Case:*** *This case report presents a clinical technique of reattachment of coronal fragment of maxillary right central incisor after trauma using direct fiber resin composite laminate systems.*
*Fiber resin composite laminate is an alternative to conventional post materials because of its aesthetic qualities, flexiblity, mechanical properties and the neutral color of the reinforcing material.*
*Reattachment treatment method at crown-root fracture cases resulting from trauma gives better results than prosthetic and surgical operations in terms of periodontal situation, aesthetic and functional aspects.*

***Keywords:*** *Dental trauma, reattachment treatment, crown-root fracture, fiber resin composite laminate.*

*This work was presented as a poster on 17th Turkish Paediatric Dentistry Congress (20-23 May, 2010,Midyat-Turkey ) poster (p-194-195).*

* Corresponding author: E-mail: ect1976@gmail.com
Tel.: + 90. 412. 2488101/ (ext. 3468), Fax: **+ 90. 412. 2488100**

## Introduction

Fractured teeth in children and young people are of great significance because of the pain, function loss, poor aesthetic appearance and psychological problems to which they give rise. [1]
The most common etiological factors of crown and crown root fractures in the permanent dentition are injuries caused by fall, contact sports, vehicle accidents, foreign body striking the teeth. These fractures subsequently lead to aesthetic, functional and phonetic problems.[2]

Aesthetic and functional rehabilitation is the primary goal of the treatment of crown-root-fractured tooth. For this purpose, reattachment of the fragment to its original position is a good choice.[3]

Choosing a treatment approach for a complicated crown fracture depends on the level and position of tooth fracture line, availability of displaced tooth fragments, type of occlusion, and prognosis.[2,4] Treatment of crown fractures includes the pulp, depending on the scale of the pulp exposure, and the timing and phasing of the root progress. In crown-root fractures, when the fracture line extends to beneath the epithelial attachment, the coronal part remains attached to the periodontal membrane and gingiva. The shape of crown-root fractures in the anterior region is correlated to force direction. Fractures may be transversal, oblique or horizontal.[5]

Currently, the preference of dentists has changed from very rigid materials to materials that have a flexural modulus similar to dentin to create a mechanically homogenous unit. Research for new, less rigid materials resulted in the marketing of new materials, such as carbon fiber post[6], composipost systems, ceramic posts[7], and fiber resin composite laminate (FRCL) systems.
A recently developed bondable reinforcement fiber resin is reported to be an alternative to conventional post materials because of its aesthetic qualities, flexible, mechanical properties and the neutral color of the reinforcing material.[6,8]

In recent years, it has been suggested that the best technique for restorative treatment in traumatic teeth consists of using the original tooth fragment.[1,9] This technique is not only successful in ordinary vital tooth cases, but also in complex fractures including the pulp and periodontium. This method is known as a reattachment and has greater advantages in terms of appearance and function compared to composite resin restorations.

This case report presents a clinical technique of reattachment of coronal fragment of maxillary right central incisor after trauma using direct fiber resin composite laminate systems.

## Case Report

The patient, a 10-year-old boy, applied to the Dicle University Faculty of Dentistry Department of Pediatric Dentistry with a complaint of fractured maxillary right central tooth. As a result of the anamnesis, the child was revealed to have fallen down from stairs of the school the previous day. The patient's medical history was unremarkable.

Although extraoral examinations revealed no pathological findings, an oblique crown-root fracture involving the pulp at the cervical line was determined in conclusion of both intraoral examinations and radiographic evaluations (Figures 1, 2). Moreover, the fractured fragment was quite mobile and it was only hung by a periodontal attachment. Therefore, a detailed explanation about the treatment plan was given to the patient then the coronal fragment was separated from the root as soon as periapical radiography had been taken. The fractured fragment was kept in saline solution to prevent discoloration and dehydration until the tooth was reattached (Figure 3). It was determined that the remnant part of the tooth was not mobile. Subsequently, root canal treatment was initiated under local anaesthesia. Firstly, the length of the root was determined, and root canal was drilled with the step-back technique using K-type files (Kerr, Romulus, MI, USA). During the

instrumentation, the root canal was irrigated only with % 2 chlorhexidine gluconate (Drogsan, Ankara, TURKEY) after each file then dried with paper points. The dual polymerizing resin luting agent (Panavia F, Kuraray, Osaka, Japan) was mixed according to the manufacturer's recommendations. Then it was applied to the surface of the remnant part of the tooth and crown fragment was reattached. Excess cement was removed with a brush and an excavator, and the restoration was then polymerized for 40 seconds from mesial and distal directions using a lightcuring unit (Curing Light XL 3000; 3M, St Paul, MN, USA). Oxyguard II gel (Kuraray, Osaka, Japan) was applied to reattachment sites for 3 minutes then removed with cotton rolls and water spray.

Reattached tooth was splinted until intracanal and coronal fixation finished (Figure 4). Later, a new entrance cavity was opened on the reattached tooth, and 1/3 of the root canal was obturated with AH Plus (Dentsply De Trey GmbH, Konstanz, Germany) and gutta-percha (Kerr, Romulus, MI, USA). The FRCL (Construct-KerrLab) with 2 mm width was selected. A periodontal probe was inserted in the canal space to measure the post space. This measurement was tripled, and the length of fiber was measured. Two pieces of fiber were then cut with special scissors. The fiber pieces were then coated with a dual-curing resin (Liner Bond II V, Kuraray Co., Ltd., Osaka, JAPAN) and set aside under a light-protective container. The internal surfaces of the root canal and pulp chamber were treated with the primer of the same system for 30 seconds (Liner Bond II V, primer A and B mixture, Kuraray Co., Ltd., Osaka, JAPAN) and dried with a gentle air stream for 15 seconds. One piece of FRCL, which had been coated with bonding agent, was wrapped and condensed as tightly as possible into the canal space with an endodontic plugger. The other piece was then condensed into the canal space perpendicular to the first place (Figure 5). The excess resin was removed, and the free ends of the fiber were twisted and condensed into the root canal. The entire FRCL was cured for 20 seconds (Curing Light XL 3000; 3M, St Paul, MN, USA).

Finally splint was removed after having filled the cavity entrance with light-cured composite resin material. The fracture line labially was then masked using composite resin (EsthetX, Dentsply). The tooth was polished with polishing discs (Figure 6). Occlusion was checked and post operative instructions to the patient were given to deter from loading the anterior teeth. The patient was advised to use a mouth-wash to promote the healing of the gingival tissues. Moreover, the patient was given appropriate advice and invited to attend periodic check-ups. Both intraoral examinations and control radiographies which applied 30 months later revealed no symptoms or extension in the fracture line (Figures 7,8).

## Discussion

Reconstruction of crown fractures has developed through the years. Elaboration in the field of adhesive dentistry gives opportunity to the clinicians to have minimal invasive approach and achieve aesthetic and functional restoration of the fractured tooth.[10]

The use of natural tooth substance clearly eliminated problems of differential wear of restorative material, unmatched shades and difficulty of contour and texture reproduction associated with other restorative techniques.[11-13]

Previously, posts were cast in a precious alloy, or prefabricated posts made of stainless steel, titanium were used. The construction of post core castings is relatively more time consuming and demands extra clinic and laboratory time.14 Prefabricated posts allow fast, cheap and easy techniques15, but they do not take into account the individual shape of the root canal and their adaptation is not always ideal.[16]

Since 1978, the technique has been modified to avoid the use of pins and posts, replacing them with the use of acid-etch and enamel-bonding techniques.11 It is a conservative restoration which

does not preclude the use of other types of restorations later on should it fail.17 Moreover, it is well known that resin restorations are cytotoxic materials.[18]

The aesthetics that can be achieved by tooth fragment reattachment are far more superior to those achieved by any other type of restoration. This is mainly because the fragment is the same colour as the rest of the tooth and the incisal edge translucency is maintained, as are the original tooth contours. The occlusal contacts are preserved and the wear pattern is the same as for the other teeth. The reattachment of the fragments may be necessary to reduce the area where the resin is exposed to the periodontal tissue. Therefore, regeneration of periodontal ligament might be expected because of little resin overflow and small cement space.[19] Reattachment of the fragments in oblique fractures is a proper treatment alternative for obtaining healthy periodontal attachment and preventing periodontal pocket formation. However, bond strengths of the luting materials must be improved for long time retention of the fractured segments.[20]

Resin based restorative materials are frequently used in restoration of the fractured teeth. Because of the poor mechanical resistance of these materials, different approaches have been developed to strengthen resistance of composite resin, such as fiber posts. Tooth-colored fiber posts were introduced in the 1990's and has several advantages, such as esthetics, bond to tooth structure, have a modulus of elasticity similar to that of dentin, but still require dentin preparation to fit into the canal.[21]

The increasing popularity and widespread use of fiber-reinforced posts is changing the restorative procedures for endodontically treated teeth. Retention of posts in the root canal is primarily sought through the use of a luting agent. Zinc phosphate cement has been the luting agent of choice for many years. The progress within adhesive dentistry and the advent of ceramic and fiber-reinforced resin composite posts have prompted questions of the usefulness of resin cement for the luting of posts. After appropriate pretreatment of the respective surfaces, resin cements provide retention not only by mechanical interlocking but also by micromechanical and chemical adhesion. In vitro studies have found improved retention, less and more favorable stress formation, and improved fracture resistance with resin cements than with zinc phosphate cement.[22,23] Considering that only adhesive luting systems are recommended for cementation of fiber reinforced posts.[24]

The new generation of post systems is designed to be biocompatible, corrasion resistant, able to bond to tooth structure, aesthetic, and allow retrievability when the post and core system fails.[6,8] The post core system includes components of different rigidity. Because the more rigid component is able to resist forces without distortion, stress is expected to be transferred to the less rigid substrate. In spite of the low values achieved for all these fiber-reinforced composite posts when compared to other metal or ceramic post [6,8,25], their performance should be considered as favorable because non of the aesthetic post failures resulted in root fracture.

The provision of a prosthetic restoration for a young patient is delayed, and this is favourable because the earlier the restorative cycle is instituted, the greater the number of times this restoration will be replaced throughout the years.[17]

This technique employed in our patient has advantages over composite resin restorations. It gives better results in terms of natural appearance, a smooth surface and brightness than do composite resins. Better function was obtained due to the incisal edge having same level of abrasion. In addition, this method is faster, is easy to perform and does not restrict other treatments. Moreover, reattachment of the fractured fragment to the remaining root by using dual-curing resin cement and fixation of the coronal fragment with FRCL could provide satisfactory aesthetics, reliable strength, durability and improved function.

**Conclusion**

This presentation describes a conservative and aesthetic approach and reattachment technique that incorporates fixation of the coronal fragment with FRCL. The final result is a aesthetic, morphologic and conservative restoration that requires little time to complete.

Clinical studies of fiber-reinforced restorations have shown a relatively high success rate over a short evaluation period. Therefore, the use of these new generation post system is promising; however, controlled clinical studies showing their performance in a long-term situation are required.

## References

**1.** Burke FJT. Reattachment of a fractured central incisor tooth fragment. Br Dent J 1991; 170: 223-25.
**2.** Villat C, Machtou P, Naulin-Ifi C. Multidisciplinary approach to the immediate esthetic repair and long-term treatment of an oblique crown-root fracture. Dent Traumatol 2004; 20: 56-60.
**3.** Dogan MC, Akgun EO, Yoldas HO. Adhesive tooth fragment reattachment with intentional replantation: 36-month follow-up. Dent Traumatol 2012; doi: 10.1111/j.1600-9657.2012.01144.x. [Epub ahead of print].
**4.** Aggarwal V, Logani A, Shah N. Complicated crown fractures - management and treatment options. Int Endod J 2009; 42: 740-53.
**5.** Özalp N, Sarı Ş, Gökalp H, Kavlak HE. A case report of a multidisciplinary treatment approach in traumatic complicated crown-root fracture. AU Dis Hek Fak Derg 2002;29:87-91.
**6.** Sidoli GE, King PA, Setchell DJ. An in vitro evaluation of a carbon fiber-based post and core system. J Prosthet Dent 1997;78: 5-9.
**7.** Asmussen E, Peutzfeld A, Heitmann T. Stiffness, elastic limit, and strength of never types of endodontic posts. J Dent 1999; 27:275-78.
**8.** Rosentritt M, Furer C, Behr M, Lang R, Handel G. Comparison of in vitro fracture strength of metallic and tooth-coloured posts and cores. J Oral Rehabil 2000;27:595-601.
**9.** Baratieri LN, Monteiro SJ, Cardoso AC, Filho JCM. Coronal fracture with invasion of the biologic width: A case report. Quint Int 1993;24: 85-91.
**10.** Belcheva A. Reattachment of fractured permanent incisors in schoolchildren (review). Journal of IMAB- Annual Proceeding (Scientific papers) Book 2008; 2: 96-99.
**11.** Baghdadi ZD. Crown fractures: new concepts, materials and techniques. Compend Contin Educ Dent 2000;21: 831-36.
**12.** Reis A, Loguercio AD, Kraul A, Matson E. Reattachment of fractured teeth: a review of literature regarding techniques and materials. Oper Dent 2004;29: 226–33.
**13.** Saha SG, saha MK. Management of a Fractured Tooth By Fragment Reattachment: A Case Report. Int J Dent Clinics 2010; 2: 43-47.
**14.** Desort KD. The prosthodontic use of endodontically treated teeth: theory and biomechanics of post preparation. J Prosthet Dent 1983;49:203-6.
**15.** Kern SB, Von Fraunhofer JA, Mueninghoff LA. An in vitro comparison of two dowel and core techniques for endodontically treated molars. J Prosthet Dent 1984;51:509-14.
**16.** Chan FW, Harcourt JK, Brockhurst PJ. The effect of post adaptation in the root canal on retention of posts cemented with various cements. Aust Dent J 1993;38:39-45.
**17.** Worthington RB, Murchison DF, Vandewalle KS. Incisal edge reattachment: the effect of preparation utilization and design. Quint Int 1999;30: 637-43.
**18.** Darmani H, Al-Hiyasat AS, Milhem MM. Cytotoxicity of dental composites and their leached components. Quint Int 2007;38: 789-95.
**19.** Kawai K and Masaka N. Vertical root fracture treated by bonding fragments and rotational replantation. Dent Traumatol 2002;18: 42-5.
**20.** Keçeci AD, Adanır N. Comparison of the fracture strength of various materials used to bond the fragments of oblique fractured pulpless teeth. SU Dishek Fak Derg 2008;17:35-8.
**21.** Baratieri LN, Monteiro S. Tooth fracture reattachment: Case reports. Quint Int 1990; 21: 261 - 270.
**22.** Asmussen E, Peutzfeldt A, Sahafi A. Finite element analysis of stresses in endodontically treated, dowel-restored teeth. J Prosthet Dent 2005; 94:321-29.
**23.** Chan FW, Harcourt JK, Brockhurst PJ. The effect of post adaptation in the root canal on retention of posts cemented with various cements. Aust Dent J 1993; 38:39-45.

**24.** Valandro LF, Filho OD, Valera MC, de Araujo MA. The effect of adhesive systems
on the pullout strength of a fiberglass-reinforced composite post system in bovine teeth. J Adhes Dent 2005;7:331-36.
**25.** Martinez-Insua A, da Silva L, Rilo B, Santana U. Comparison of the fracture resistances of pulpless teeth restored with a cast post and core or carbon-fiber post with a composite core. J Prosthet Dent 1998;80:527-32.

**FIGURE LEGENDS**

**Figure 1. Periapical radiography after injury.**

**Figure 2. Intraoral view showing the maxillary right central incisor after the removal of its crown portion.**

**Figure 3. The view of fractured tooth fragment.**

**Figure 4. Intraoral view of reattached and splinted tooth.**

**Figure 5. The view after fiber resin composite laminate placed.**

**Figure 6. Clinical view of the tooth after reattachment.**

**Figure 7. Final periapical radiography taken 30 months post-treatment.**

**Figure 8. Clinical view after 30 months, showing good aesthetics, retention and healty gingiva.**

**Figure 1. Periapical radiography after injury.**

**Figure 2. Intraoral view showing the maxillary right central incisor after the removal of its crown portion.**

**Figure 3. The view of fractured tooth fragment.**

**Figure 4. Intraoral view of reattached and splinted tooth.**

**Figure 5. The view after fiber resin composite laminate placed.**

**Figure 6. Clinical view of the tooth after reattachment.**

**Figure 7. Final periapical radiography taken 30 months post-treatment.**

**Figure 8. Clinical view after 30 months, showing good aesthetics, retention and healty gingiva.**