

# Multidisciplinary Approach to Complicated Crown-root Fracture Treatment: A Case Report

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## Clinical Relevance

Multidisciplinary treatment is required in complex cases of crown-root fractures. Fragment reattachment is a viable approach, and in the case presented, the repair remained intact after two years of follow-up. Maintenance of the natural tooth has a positive impact on psychological and social issues.

## SUMMARY

Treatment of complicated crown-root fractures is one of the most challenging within the various types of dental trauma and requires a multidisciplinary approach. This paper reports the complicated crown-root fracture of

a maxillary right central incisor, in which there was esthetic, functional, and biologic (endodontic and biologic width invasion) involvement. A 15-year-old male patient presented to the dental clinic one month after suffering trauma with a complicated crown-root fracture on tooth 8. The patient had previously undergone endodontic treatment and was sent to have periodontal surgery to reestablish the biological width on the palatal surface. Following the surgery, a fiberglass post was cemented, and the fragment was reattached. This approach allows the exposure of the cervical margin, adequate isolation, and subsequent fragment reattachment in the same clinical appointment. Fragment reattachment is a viable approach as it is a simple and conservative procedure that restores the natural esthetic of the tooth and has superior resistance compared to a composite restoration. The patient's cooperation in understanding the limitations of the treatment and maintaining adequate oral hygiene are very important to achieving a good prognosis of the case. After a 2-year clinical and radiographic follow-up period, the clinical protocol was found to

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be successful, and the tooth remained functional, esthetically favorable and asymptomatic.

## INTRODUCTION

The maxillary central incisors are the teeth most affected by dental trauma, which occurs mainly in children and adolescents.<sup>1,2,3</sup> Crown-root fractures represent 5% of all trauma events<sup>1,4</sup> and can be classified as complicated when there is pulp involvement and non-complicated when they involve only enamel, dentin and cementum.<sup>1,4,5</sup> Their treatment requires a multidisciplinary approach<sup>6,7</sup> involving specialties such as restorative dentistry, endodontics and oral and maxillofacial surgery.<sup>8,9</sup> Which specialties will be involved in the treatment of a crown-root fractured tooth will depend on the fracture level.<sup>1,2</sup>

There are a number of treatment strategies for crown-root fractures, including orthodontic extrusion,<sup>1,8,9,10,11,12</sup> reattachment of the fragment,<sup>3,9,11,13</sup> surgical crown lengthening with osteotomy and/or gingivectomy,<sup>14,15,16</sup> intentional replantation -- surgical extrusion,<sup>1,11,12,17</sup> or extraction.<sup>1,18</sup>

It is important to emphasize that keeping the patient's own tooth in the alveolus favorably contributes to functional aspects, as it maintains enamel occlusion; to esthetic aspects, as it restores color, shape, texture, and alignment; and to psychological issues, maintaining the natural tooth.<sup>19</sup> The reasoning behind a conservative treatment in patients still too young for implant treatment is to allow maintenance of alveolar bone height and the possibility of surgery and prosthetic rehabilitation in the future.<sup>20</sup>

The aim of this case report is to present and discuss the multidisciplinary approach to a complicated crown-root

fracture with endodontic involvement and biological width invasion in a maxillary right-central incisor.

## CASE REPORT

A 15-year-old male patient in good general health presented to the dental clinic's emergency department reporting falling while playing sports one month previously and receiving urgent endodontic treatment in a private practice. The tooth fragment was temporally cemented to the adjacent teeth, but the fragment became loose and fell out. The patient stored it in saline solution and was referred to this treatment group. Clinical and radiographic examination led to the diagnosis of a complicated crown-root fracture involving enamel, dentin, cementum, and pulp, no alveolar fracture, and complete root development (mature tooth) with root filling material. The patient was also found to have gingivitis and biological width invasion on the maxillary right central incisor (tooth 8) (Figures 1A, 1B). The length of the fracture extended subgingivally in all surfaces of the tooth. After periodontal evaluation, it was determined that surgical crown lengthening on the palatal surface was necessary to restore biological width (Figures 2A, 2B, 2C).

## DESCRIPTION OF TECHNIQUE

Surgical crown lengthening started with gingival marking using a North Carolina periodontal probe (Hu-Friedy, Rio de Janeiro, Rio de Janeiro, Brazil). A beveled sulcular internal incision was made along the facial and palatal surfaces with a 15-C scalpel blade (Feather Safety Razor Co Ltd, Seki, Gifu, Japan). Mucoperiosteal flap elevation was performed with a Molt 2/4 (Hu-Friedy), and approximately 1 mm of

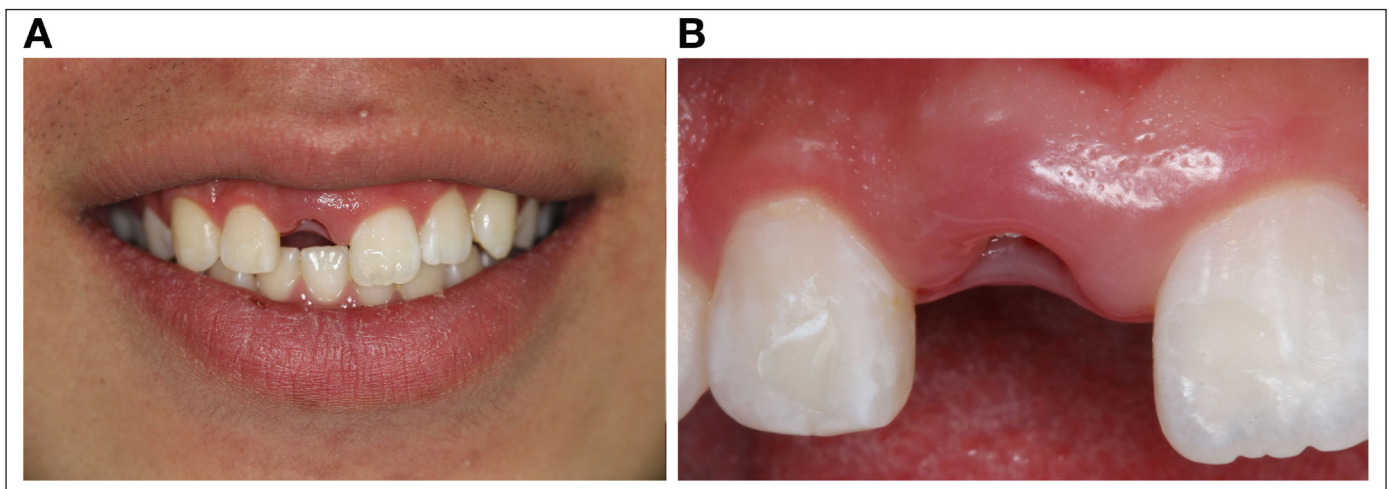


Figure 1. (A) Front view of the crown-root fracture involving tooth 8; (B) Close front view showing excessive gingival growth and irregular gingival contour at the fracture area.

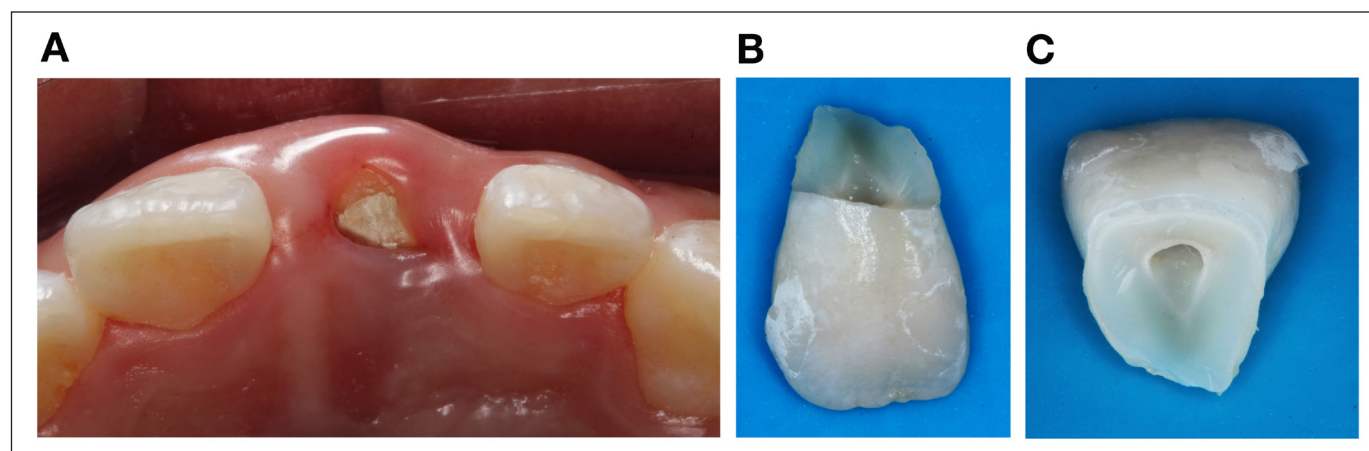


Figure 2. (A) Occlusal view, biological width invasion by gingival tissue; (B) Front view of the fragment; (C) Palatal view of the fragment.

tissue collar was removed, resulting in a new papilla formation in these surfaces. For a better adaptation of the coronal fragment, the alveolar crest was reduced approximately 1 mm on the palatal side using a Ochsenbein chisel (Hu-Friedy), and osteoplasty was later performed using a Rhodes chisel (Hu-Friedy) (Figure 3).

Next, the fragment was reattached. First, the root canal was prepared with a Largo drill 3 (Dentsply-Maillefer, Ballaigues, Switzerland) in the coronal two-thirds of the remaining root, maintaining the endodontic filling material in the apical third of the root canal for posterior cementation of a 3 fiberglass post (Angelus, Londrina, Paraná, Brazil), which was adjusted to create a groove with a diamond tip 1014 (KG Sorensen, Cotia, São Paulo, Brazil), and cemented with self-etching adhesive (Single Bond Universal, 3M, Sumaré, São Paulo, Brazil) and resin cement (RelyX Ultimate, 3M). The coronal fragment was gently cleaned, etched with

37% phosphoric acid (DFL, Curicica, Rio de Janeiro, Brazil) for 15 seconds, rinsed for 15 seconds and gently dried. A self-etching adhesive was applied (Single Bond Universal, 3M), and the fragment was reattached with the same cement used for the cementation of the fiberglass post (RelyX Ultimate 3M) (Figure 4). Once the reattachment procedure was completed and the correct adaptation of the fragment was verified, the area was closed using the mattress technique with 5.0 nylon suture (Procare, Lamedid Comercial e Serviços LTDA, Barueri, São Paulo, Brazil), Castroviejo needle holder (Hu-Friedy) and Dietrich forceps (Hu-Friedy) (Figure 5). Postoperatively, the patient was prescribed ibuprofen 600 mg every 8 hours for 3 days and mouthwash with 0.12% chlorhexidine digluconate every 12 hours for 10 days. Clinical instructions given to the patient and his guardian included warnings about harmful habits that could compromise treatment success, like biting food directly on the front teeth, especially hard food or foods like apples that require biting strength, or fingernail biting. The need to use a mouth guard during sports practice was also pointed out.

The patient underwent follow-up at 7, 14, 49, and 120 days and thereafter at 12-month intervals (Figures



Figure 3. Periodontal surgery. After mucoperiosteal flap elevation and alveolar crest bone reduction of 1 mm in the palatal region, it is possible to observe the cervical margin of the fracture.



Figure 4. Occlusal view showing correct adaptation of the coronal fragment.





Figure 5. Close-up view of the positioned fragment reattached after periodontal surgery, showing slight dental extrusion of tooth 8.

6, 7, 8, 9, 10). Clinical and radiographic examinations were performed, which indicated stability and adaptation of the fragment. The fracture line is visible on the facial surface; however, when the patient smiles naturally, it cannot be seen, due to a low smile line. A satisfactory periodontal condition was observed, with 3 mm probing depths on all surfaces, slight extrusion of approximately 0.5 mm, likely due to the lack of occlusion in the one-month period after the injury, no sign of root resorption, and no painful symptomatology. The patient was satisfied with the esthetic effect. Two years have passed, and the patient is receiving annual clinical and radiographic follow-up.

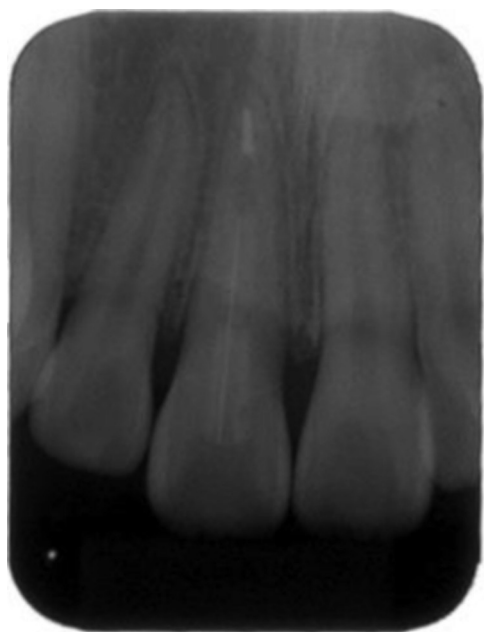


Figure 6. Radiographic follow-up 7 days after surgery and fragment reattachment.

## DISCUSSION

The treatment of complicated crown-root fracture may involve a multidisciplinary approach, including oral and maxillofacial surgery, endodontics, orthodontics, pediatrics, radiology, and restorative dentistry.<sup>8,9</sup> Several factors should be considered during the treatment of traumatically injured teeth, such as length and shape of the fracture, pulp involvement, stage of root development, alveolar bone fracture, biological width invasion, gingival laceration, presence or absence of the coronal fragment, secondary traumatic injuries, occlusion, lip sealing, and esthetics.<sup>1,21</sup> The patient presented a favorable Class I occlusion with moderate overbite, complete root development, and an adequate crown-root ratio (<1:1), allowing endodontic treatment, intracanal post cementation, and fragment reattachment.

The determination of the treatment plan for crown-root fractures depends on the length of the fracture line.<sup>1</sup> Oblique fractures that extend below the gingival margin make restoration treatment difficult or impossible due to biological width invasion<sup>22,23</sup> and may extend below the bone level.<sup>3,9,13</sup> Thus, it is necessary to expose the fracture line either by means of orthodontic extrusion or by surgical access in order to facilitate rehabilitation treatment and reestablish the biological width. Surgical exposure of the fracture line in the present case allowed us to confirm the crown-root fracture diagnosis during the procedure; it was the preferred option over orthodontic extrusion since the attachment of an orthodontic button to the root fragment would be challenging because of the lack of tooth tissue available for an effective bonding procedure and the difficulty in isolating the surface to be bonded from gingival crevicular fluid and blood.<sup>24,25</sup>

Gingivectomy was performed on the palatal surface due to excessive gingival growth and the extensive oblique fracture in this region. As Olsburgh and others<sup>1</sup> have pointed out, in cases where there is a good adaptation of the fragment to the remnant, it is possible to perform gingivectomy and osteotomy only in areas where there is biological width invasion, removing just



Figure 7. Removal of suture 14 days after surgery.

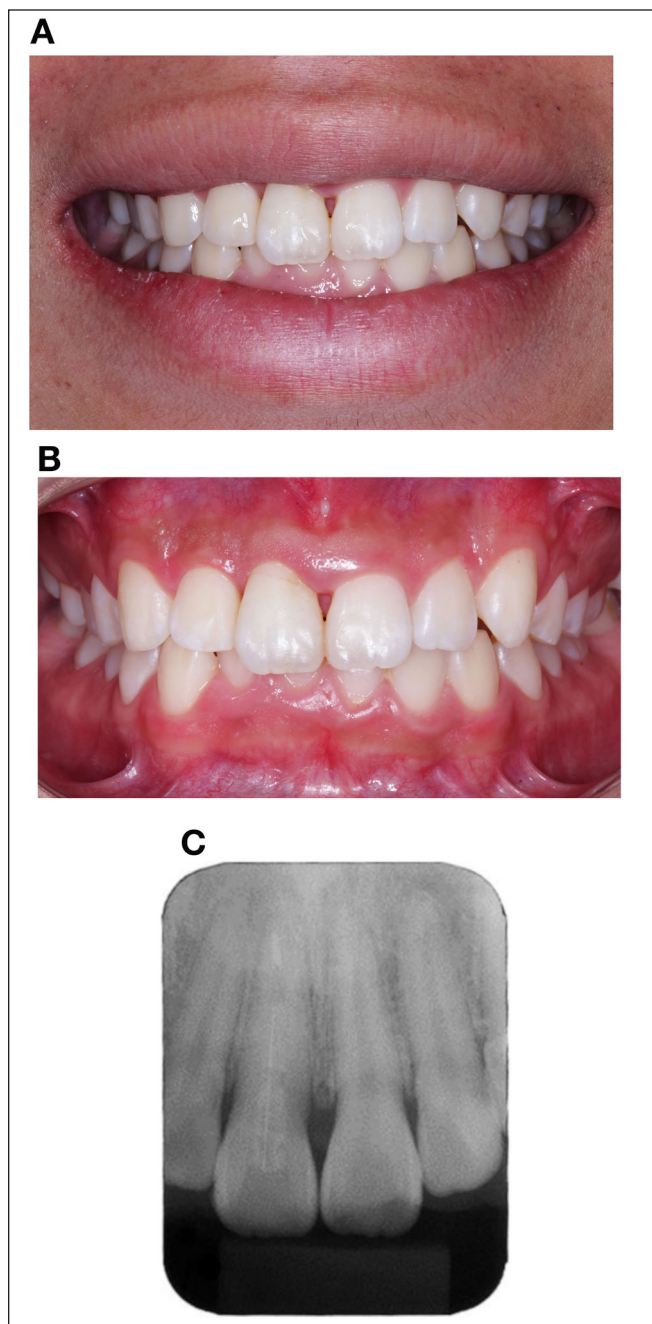


Figure 8. Follow-up at 49 days. (A) Front view of the smile: the fracture line does not appear significantly; (B) Close front view; (C) Radiographic follow-up.

enough bone to keep the cementation line 1 mm inside the bone. This approach allows the fragment to be reattached in the same appointment because it allows exposure of the cervical margin of the fractured tooth and adequate isolation of the operative field.<sup>1</sup>

The loss of the crown of a permanent incisor in a young patient can cause esthetic and functional problems, which in turn can lead to serious emotional



Figure 9. Follow-up at 120 days. Front view.

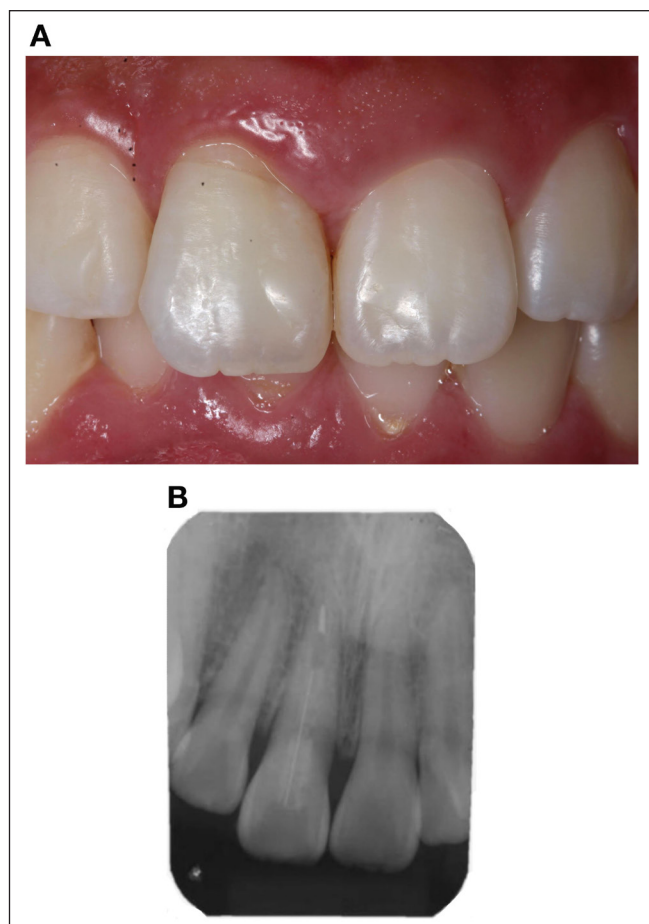


Figure 10. Follow-up at 12 months. (A) Close-up front view showing subtle fracture line; (B) Periapical radiography attesting normality of the periapical tissues and good adaptation of the fiberglass post.

problems.<sup>24,25</sup> Thus, when the fragment is present, reattachment is a viable approach<sup>26,27</sup> as it is a simpler, faster, and more conservative alternative that restores the natural esthetic of the tooth<sup>3,21</sup> and has better resistance than a composite restoration.<sup>28,29,30</sup> However, the patient should be informed about disadvantages and potential problems, such as the need to limit the function of the anterior teeth, the possibility of fracture

recurrence, and the possibility that a visible line between the fragment and the remnant tooth structure will be noticeable<sup>30,31</sup>; the latter occurred in this case, but as the patient had a low smile line, the fracture line did not show when the patient smiles. Despite the limitations, fragment reattachment was the patient's preferred treatment option as it offered the possibility of maintaining his own tooth.<sup>30</sup>

In a fracture involving two-thirds or more of the crown, intracanal post systems are commonly used to increase resistance and reduce stress in the coronal fragment, since they interlock the crown and root fragments.<sup>11,30,33</sup> The fiberglass post has been recommended as effective in reducing tensile stress, which can lead to root fracture of endodontically treated teeth.<sup>34,35,36</sup> Fiberglass posts have a modulus of elasticity similar to dentin and are therefore preferable to cast metal posts.<sup>11</sup>

The patient's cooperation in understanding the limitations of the treatment and the need to maintain adequate oral hygiene is very important for a good prognosis of the case.<sup>3</sup> The patient described returned for follow-up after 7, 14, 49, and 120 days and 12 and 24 months; however, it has sometimes been a challenge to recall patients and keep them under observation for longer follow-up periods after crown-root fracture.<sup>7</sup>

## CONCLUSION

In the present case, after 2-years of clinical and radiographic follow-up, the treatment protocol proved to be successful, and the tooth remains functional, esthetically favorable, and asymptomatic. Periodontally, there is no mobility, and probing depths are normal. Radiographically, the lamina dura is intact and there is normality of the periodontal tissues.

## Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of the Dentistry Department, State University of Maringá.

## Conflict of Interest

The authors have no financial interest in any of the companies or products mentioned in this article.

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## REFERENCES

- Olsburgh S, Jacoby T, & Krejci I (2002) Crown fractures in the permanent dentition: Pulpal and restorative considerations *Dental Traumatology* 18(3) 103-115.
- Andreasen JO, Andreasen FM, & Andersson L (2007) *Textbook and Color Atlas of Traumatic Injuries to the Teeth* 4th edition Blackwell, Oxford, England.
- Macedo GV, Diaz PI, Fernandes CAO, & Ritter AV (2008) Reattachment of anterior teeth fragments: A conservative approach *Journal of Esthetic Restorative Dentistry* 20(1) 5-18.
- Castro JCM, Poi WR, Manfrin TM, & Zina LG (2005) Analysis of the crown fractures and crown-root fractures due to dental trauma assisted by the Integrated Clinic from 1992 to 2002 *Dental Traumatology* 21(3) 121-126.
- Andreasen FM (2007) Reattachment of subgingivally fractured central incisor with an open apex: Letters to the editor *Dental Traumatology* 23(4) 263-264.
- Öz IA, Haytaç MC, & Toroglu MS (2006) Multidisciplinary approach to the rehabilitation of a crown-root fracture with original fragment for immediate esthetics: A case report with 4-year follow-up *Dental Traumatology* 22(1) 48-52.
- Castro JCM, Poi WR, Pedrini D, Tiveron ARF, Brandini DA, & de Castro MAM (2011) Multidisciplinary approach for the treatment of a complicated crown-root fracture in a young patient: A case report *Quintessence International* 42(9) 729-735.
- Poi WR, Cardoso L, de Castro JC, Cintra LT, Gulinelli JL, & de Lazari JA (2007) Multidisciplinary treatment approach for crown fracture and crown-root fracture — A case report *Dental Traumatology* 23(1) 51-55.
- Liebenberg W (2008) Reattachment of anterior teeth fragments: A conservative approach *Journal of Esthetic Restorative Dentistry* 20(1) 5-18.
- Koyuturk AE & Malkoc S (2005) Orthodontic extrusion of subgingivally fractured incisor before restoration. A case report: 3-years follow-up *Dental Traumatology* 21(3) 174-178.
- Wang J & Li M (2010) Multidisciplinary treatment of a complicated crown-root fracture *Pediatric Dentistry* 32(3) 250-254.
- Emerich-Poplatek K, Sawicki L, Bodal M, & Adamowicz-Klepalska B (2005) Forced eruption after crown/root fracture with a simple and aesthetic method using the fractured crown *Dental Traumatology* 21(3) 165-169.
- Saito CT, Guskuma MH, Gulinelli JL, Sonoda CK, Garcia-Júnior IR, Magro Filho O, & Panzarini SR (2009) Management of a complicated crown-root fracture using adhesive fragment reattachment and orthodontic extrusion *Dental Traumatology* 25(5) 541-544.
- Valceanu AS & Stratul SI (2008) Multidisciplinary approach of complicated crown fractures of both superior central incisors: A case report *Dental Traumatology* 24(4) 482-486.
- Fournier A (1981) Orthodontic management of subgingivally fractured teeth *Journal of Clinical Orthodontics* 15(7) 502-503.
- Brown GJ & Welbury RR (2000) Root extrusion, a practical solution in complicated crown-root incisor fractures *Brazilian Dental Journal* 189(9) 477-478.
- 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.



18. Adanir N, Ok E, & Erdek Y (2008) Re-attachment of subgingivally oblique fractured central incisor using a fiber post *European Journal of Dentistry* **2**(2) 138-141.
19. Andreasen FM, Noren JG, Andreasen JO, Enfelhardt S, & Lindh-Stromberg U (1995) Long term survival of fragment bonding in the treatment of fractured crowns: A multicenter clinical study *Quintessence International* **26**(10) 669-681.
20. Sharma D, Garg S, Sheoran N, Swami S, & Singh G (2011) Multidisciplinary approach to the rehabilitation of a tooth with two trauma episodes: Systematic review and report of a case *Dental Traumatology* **27**(4) 321-326.
21. Sargod SS & Bhat SS (2010) A 9 year follow-up of a fractured tooth fragment reattachment *Contemporary Clinical Dentistry* **1**(4) 243-245.
22. Padbury A Jr, Eber R, & Wang HL (2003) Interactions between the gingiva and the margin of restorations *Journal of Clinical Periodontology* **30**(5) 379-385.
23. Planciunas L, Puriene A, & MacKeviciene G (2006) Surgical lengthening of the clinical tooth crown *Stomatologija, Baltic Dental and Maxillofacial Journal* **8**(3) 88-95.
24. Caliskan MK (1999) Surgical extrusion of a cervically root fractured tooth after apexification treatment *Journal of Endodontics* **25**(7) 509-513.
25. Arhun N, Arman A, Ungor M, & Erkut S (2006) A conservative multidisciplinary approach for improved aesthetic results with traumatised anterior teeth *British Dental Journal* **201**(8) 509-512.
26. Yilmaz Y, Zehir C, Eyuboglu O, & Belduz N (2008) Evaluation of success in the reattachment of coronal fractures *Dental Traumatology* **24**(2) 151-158.
27. Sapna CM, Priya R, Sreedevi NB, Rajan RR, & Kumar R (2014) Reattachment of fractured tooth fragment with fiber post: A case series with 1-year followup *Case Reports in Dentistry* **2014**(2) 1-5.
28. Farik B, Munksgaard EC, Andreasen JO, & Kreiborg S (2002) Fractured teeth bonded with dentin adhesives with and without unfilled resin *Dental Traumatology* **18**(2) 66-69.
29. Segun A, Ozer F, Unlu N, & Ozturk, B (2003) Shear bond strengths of tooth fragments reattached or restored *Journal of Oral Rehabilitation* **30**(1) 82-86.
30. Demarco FF, Fay R-M, Pinzon LM, & Powers JM (2004) Fracture resistance of reattached coronal fragments - Influence of different adhesive materials and bevel preparation *Dental Traumatology* **20**(3) 157-163.
31. Villat C, Machtou P, & Naulin-Ifi C (2004) Multidisciplinary approach to the immediate esthetic repair and long-term treatment of an oblique crown-root fracture *Dental Traumatology* **20**(1) 56-60.
32. Baratieri LN (1998) *Esthetics – Direct adhesive restoration on fractured anterior teeth* Quintessence Publishing Company Ltd, United Kingdom.
33. Kumar A & Jyothi KN (2010) Reattachment of fractured tooth using self-etching adhesive and esthetic fiber post *Journal of Dental Science Research* **1**(2) 75-83.
34. Nakamura T, Ohyama T, Waki T, Kinuta S, Wakabayashi K, Mutobe Y, Takano N, & Yatani H (2006) Stress analysis of endodontically treated anterior teeth restored with different types of post material *Dental Materials Journal* **25**(1) 145-150.
35. Zorba YO & Özcan E (2007) Reattachment of coronal fragment using fiber-reinforced post: A case report *European Journal of Dentistry* **1**(3) 174-178.
36. Altun C & Guven G (2008) Combined technique with glass-fibre-reinforced composite post and original fragment in restoration of traumatized anterior teeth--A case report *Dental Traumatology* **24**(6) 76-80.