

Multidisciplinary Approach in the Rehabilitation of Complicated Crown-root Fracture: A Case Report

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ABSTRACT

The management of patients with traumatic injuries to their dentition poses a serious challenge in everyday general dental practice. For the rehabilitation of the complicated subgingival crown fracture of anterior teeth, multidisciplinary approach is often indicated. A combination of endodontic, orthodontic, periodontal and prosthodontic approach may be required. Orthodontic or periodontal intervention becomes an integral part for the exposure of the sound tooth structure of fractured anterior teeth with fracture line extending subgingivally.

The aim of this paper is to discuss the immediate endodontic management followed by orthodontic extrusion of traumatized upper anterior teeth with fracture at the subgingival level. In order to expose the sound tooth structure for prosthodontic intervention, orthodontic extrusion was performed after endodontic treatment. To avoid extraction of the involved teeth, the multidisciplinary approach was adopted and finally the teeth were restored prosthodontically. The final result was aesthetically pleasant and periodontically sound.

Keywords: crown fracture, endodontic treatment, orthodontic extrusion, subgingival, traumatic injuries

INTRODUCTION

Dental traumatic injuries are mostly unanticipated events that pose serious consequences for the patient if not managed timely with the appropriate treatment. Traumatic dental injuries (TDIs) occur most commonly in preschool, school-age children, and young adults comprising 5% of all injuries for which people seek treatment.¹ In primary dentition luxation injuries are the most common TDIs whereas crown fractures are more commonly seen with the permanent dentition.^{1,2} It has been reported that the most TDIs occur during the first two decades of life (around 8-12 years) and 70% of such injuries involve the maxillary central incisors followed by maxillary lateral incisors and mandibular incisors.³ Among permanent dentition, crown fractures accounts for the highest percentage of all TDIs between 26-76% while root fracture occur at a much smaller rate between 0.5% to 7%.⁴ Injuries due to falls, car crashes, contact sports or foreign bodies hitting the teeth are the most common causes of crown or crown-root fractures in the permanent dentition.⁵

TDIs can result in damage to both dental and periradicular structures. It may cause pulpal injury with or without crown and/or root fracture. TDIs have been classified on the basis of several factors such as etiology, anatomy, pathology, therapeutic considerations and degree of severity.⁶ In 1955, the World Health Organization (WHO) published the Application of the International Classification of Diseases to Dentistry and Stomatology, with a comprehensive classification of fractures of the teeth⁷ which includes:

1. Enamel infraction and enamel fracture only
2. Fracture of enamel and dentin (uncomplicated crown fractures)
3. Fracture of crown of the tooth with pulp involvement (complicated crown fracture)

According to Backland and Andreason,^{5,8} TDIs can be of following types:

1. Enamel infraction
2. Enamel fracture
3. Enamel-dentin fracture

4. Complicated crown fracture
5. Crown-root fracture
6. Root fracture
7. Luxation injuries (Concussion, Subluxation, Extrusive luxation, Lateral luxation, Intrusive luxation and Avulsion)

Various other classifications have also been proposed by Ellis (1961), Andreasen (1981), International association of dental traumatology (2001), Berman, Blanco and Cohen (2007) etc.⁹⁻¹²

The clinician should accurately diagnose and choose the appropriate treatment for the long term prognosis of traumatized teeth. The diagnosis and treatment plan depends upon the two specific levels: at the pulpal level and at the restorative level. Hence, clinician should not only have a good knowledge of the pulpal responses to the trauma and the associated effects induced by the clinical procedure but also be aware of the new developments in adhesives and restorative materials.¹³

Simple enamel infraction does not require treatment except in severe cases where multiple infraction lines are visible. In order to prevent these lines from taking up stains, bacteria and its byproducts, sealing the enamel surfaces with adhesive resins is recommended.¹⁴ Similarly, treatment modality of uncomplicated crown fractures is defined by the amount of tissue lost ranging from simple contouring, reattachment to more complex restoration.⁵ Moreover, the treatment modality of complicated crown fracture involving pulp is determined by the stages of root formation, size of the exposure, presence and the absence of the concomitant luxation injuries, pulpal health before trauma and the age of the pulp. Vital pulp therapies such as pulp capping and pulpotomy procedures are strongly recommended whenever possible in cases with immature apices with crown fractures that expose the pulp. Complicated crown fractures in teeth with mature apices but with non-vital pulp can be successfully treated with conventional endodontic therapy.¹⁵

However, the rehabilitation of the teeth with crown-root fractures involving the enamel, dentine and part of the root (cementum) with fracture line passing subgingivally, is more complicated, time consuming and needs multidisciplinary approach. The exposed pulp can be endodontically treated.¹⁶ A number of treatment alternatives are available depending upon the position, extent and the severity of the fracture. Moule and Heithersay¹⁷ gave the various treatment options for crown-root fractures which include: crown lengthening surgery to expose crown margins, orthodontic extrusion,

surgical repositioning (intentional replantation), restorative management with the subgingival margins, decoronation (root submergence), autotransplantation, extraction and replacement with fixed prosthesis or implant, or orthodontic space closure. Despite all the difficulties and the complexities most teeth with crown root fracture can be saved with the combined effort of endodontists, orthodontists, periodontists and prosthodontists. The following case reports a clinical case of rehabilitation of complicated crown-root fracture with multidisciplinary approach.

CASE REPORT

A 32 year old male patient reported to the Department of Conservative Dentistry and Endodontics, Universal college of Dental Science, Bhairahawa, with a fractured right and left upper central incisors and missing right lateral incisor, subsequent to the road traffic accident 3 weeks back. On clinical examination, both upper central incisors had a horizontal fracture at the cervical one third at the palatal aspect (Figure 1). There were no alveolar bone fractures or periodontal tissues injuries found during the examination. The fractured teeth revealed no swelling or associated sinus tract. The tooth was slightly tender on percussion with the absence of tenderness on palpation or associated mobility. The vitality tests (thermal and electric pulp test) of the fractured central incisors showed no response while the other teeth responded normally.



Figure 1: Horizontal fracture of upper central incisors with the fracture line extending subgingivally on palatal side and missing right lateral incisor.

The periapical radiograph was taken to confirm the clinical findings and to exclude the root/bone fracture, if present. Radiographic examination verified the presence of the fractured maxillary right and left central incisors with the fracture line extending subgingivally and missing right lateral incisor. On the basis of the clinical and radiographic findings, a diagnosis of crown root fracture was made. In this case, due to subgingival location of the fracture line, there was not enough tooth structure palatally, in order to provide a proper ferrule

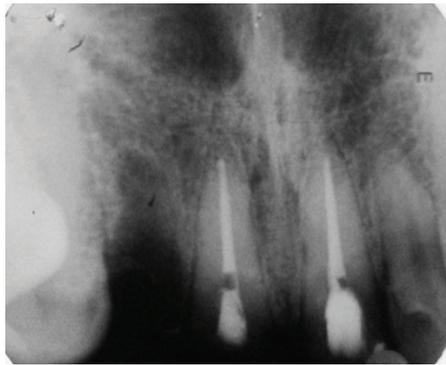


Figure 2: After completion of the root canal treatment of the fractured upper central incisors

for a post and core that consequently could lead to the poor sealing of final prosthetic suprastructure, making maintenance of the oral hygiene very difficult. Hence, different treatment plans were discussed with the patient, including crown lengthening surgery, or orthodontic extrusion after endodontic intervention and replacement by a fixed prosthesis and extraction of the fractured teeth and replacement by a fixed partial denture or implant prosthesis. After thorough descriptions of the pros and cons of each treatment options, cost and prognosis to the patient, he preferred the orthodontic extrusion of the teeth after endodontic therapy and replacement of the missing structure with post core and fixed partial denture.

The fractured teeth were then endodontically treated using hand ProTaper hand files till F2 (Maillefer, Dentsply). 2.5% sodium hypochlorite solution was used as an irrigant and 17% EDTA solution was used to remove the smear

layer. The canals were then dried with sterile paper points and calcium hydroxide paste was used as an intracanal medicament. The teeth were then temporized with temporary filling material (Cavition, Septodont) and patient was recalled after a week for obturation. In the subsequent follow up, the teeth were asymptomatic, hence obturation was performed with ProTaper single cone gutta percha of the corresponding size and the teeth were temporized (Figure 2). The patient was then referred to department of orthodontic and dentofacial orthopedics for the extrusion of the fractured teeth before prosthodontic intervention.

To achieve the extrusion of the roots and move the fracture line above the alveolar bone in order to restore physiological periodontal attachment, a "J" shaped hook was fabricated using 0.7 mm stainless steel wire. After oral prophylaxis and etching with 37% orthophosphoric acid the 0.022" MBT brackets were bonded on the upper teeth from tooth #14 to tooth #23 except the teeth to be extruded on a straight line fashion to minimize the base arch deflection (Figure 3 and 4). For the application of extrusive force, 'J' hook was cemented on right central incisor with composite into the root canal whereas beg bracket was bonded on left central incisor with vertical slot facing occlusally. A radiograph was taken to confirm the position of the hook (Figure 5). 0.018" × 0.025" stainless steel wire was placed and extrusive mechanics was applied via closed elastic chain. Patient was advised for follow up after 4 weeks.



Figure 3 and 4: Orthodontic extrusion using J hook

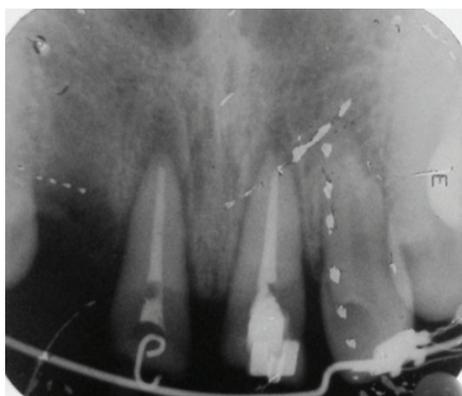


Figure 5: Radiograph after attachment of the J hook

On every follow up visit, the elastic chain was changed and the distance from the hook to base wire was measured to assess the amount of extrusion. After second follow up, the j hook was further bent and position of Beg attachment was moved apically to facilitate unobstructed force application. After 4 months of the active orthodontic treatment, an extrusion of approximately 3 mm was observed clinically as well as radiographically. In order to prevent the relapse, the orthodontic appliance was further worn by the patient for the next 4 weeks without activation to stabilize the teeth in their new position. After the desired amount of orthodontic extrusion, debonding was done and J hook was removed (Figure 6).



Figure 6: Clinical Picture after orthodontic extrusion



Figure 7 and 8: Post space preparation and fiber post and core cementation



Figure 9: Final result after metal ceramic crown cementation

Finally the tooth was prosthodontically restored with a fiber post and a resin cement core (Paracore, Coltene, Whaledent, USA), and porcelain fused metal bridge from tooth # 13 to 22 (Figure 7 and 8). Final result after placement of the final restoration after orthodontic extrusion was aesthetically pleasant and resulted in good periodontal health postoperatively (Figure 9).

DISCUSSION

The treatment of complex crown root fracture is always a challenging job. There should be the involvement of different specialties like endodontics, orthodontics, prosthodontics as well as periodontics. While treating such cases different factors such as age of the patient, level of fracture, root form, periodontal condition of the affected tooth as well as affordability of the patient should be well considered.¹⁸ Depending upon those factors treatment modalities can be different.^{17,19}

There should be some guiding factor which helps in determine what kind of treatment should be done in case of complex crown root fracture. The main aim should be to save the natural dentition and to maintain it in mouth for good prognosis. Long term prognosis is guaranteed only when we maintain the good ferrule on the prosthesis, do not violate the biological width and preserve the accepted crown root ratio of the tooth.²⁰⁻²²

Regarding the extrusion methods of fractured tooth, orthodontic extrusion is the most bio favorable method

followed by surgical repositioning. However on surgical repositioning, there is always a chance of ankylosis.²³ It is important not to apply excessive force on recently traumatized tooth. Overzealous force may lead to external root resorption jeopardizing the life of tooth.²⁴ Various authors have tried different techniques for the orthodontic extrusion of fractured root ranging from simple removable orthodontic appliance to complex magnetic appliances.²⁵⁻²⁸ If the root is totally submerged below the gingival line, magnetic appliance can be a good option for extrusion. If there is some tooth material exposed into oral cavity orthodontic attachments can be bonded and extrusive force can be applied. In our case, upper left central incisor had some amount of dentine present supra-gingivally so we could bond the Begg's Bracket however in right central incisor as there was not any tooth material left above the gingival level, we took the help of root canal to attach the J hook for orthodontic force application. At the end of the orthodontic treatment we could extrude both the teeth 3 mm supra gingivally.

CONCLUSION

If properly diagnosed, multidisciplinary management of complex crown root fracture is possible with long term prognosis. Orthodontic extrusion can be a good option in cases of sub gingival fracture of tooth for better prosthetic management.

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