

Multidisciplinary approach for cervical crown fracture: Orthodontic extrusion followed by prosthetic rehabilitation

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Abstract

Introduction: Fractured maxillary anterior teeth often lead to esthetic, functional and phonetic problems. Crown-root fractures at cervical third area result in biological width violation and are challenging to treat. The treatment modalities involve exposing the cervical margins by means of surgical crown lengthening and/or orthodontic extrusion.

Case Report: This paper reports a case of fractured maxillary anterior tooth at the coronal third level that was managed by forced orthodontic extrusion and intentional root canal therapy followed by esthetic rehabilitation.

Conclusion: Out of the two available options, orthodontic extrusion, a much forgotten technique was utilized and proved to be a conservative and cost effective technique.

Keywords: Biological Width, Cervical Third Fracture, Esthetic Rehabilitation, Orthodontic Extrusion.

Introduction

The frequency of traumatic dental injuries ranges from 5%-35% in different age groups. The prevalence of trauma was found to be 33.33% and 20-30 % among 5 year and 12 year age groups respectively.⁽¹⁾ In both age groups, boys were more commonly affected than girls.^(2,3) The most common etiology for dental trauma in the permanent dentition is fall, followed by traffic injuries, acts of violence and sports.^(4,5)

Traumatic injuries to the teeth especially in the esthetic region pose a great challenge to a dentist. Restoring such teeth to proper health and function is troublesome. At times, when the fracture line is below the level of gingiva, the prognosis is considered questionable or hopeless. Hence extraction remains the common treatment modality owing to the recent trend and attitude towards dental implants. However, the implants should be considered as a last resort. As the best replacement of nature is nature itself, every attempt should be made to preserve and restore the natural tooth structure, especially in adolescents.⁽⁶⁾

Treatment of such cases is done by multidisciplinary approach including periodontal crown lengthening which involves the removal of supporting crestal alveolar bone, or forceful orthodontic extrusion of fractured tooth. These attempts are made to expose sufficient coronal tooth structure that provides a sound tissue margin for ultimate restoration and to create a periodontal environment (biological width) that will be easy for the patient to maintain.

Case Presentation

A 14 years old male patient reported to the Department of Pedodontics and Preventive Dentistry, Modern Dental College and Research Centre in Indore State with the chief complaint of fractured front tooth

region of upper jaw. History revealed that patient was pushed by his classmate in the school from back causing his anterior teeth to hit the front bench one day back. Clinical examination showed oblique coronal fracture of upper right central incisor with exposed pulp tissue (Fig. 1a). The fractured line extended sub-gingivally on the distal side, while on the mesial side around 2 mm of tooth structure was intact supra-gingivally. The coronal portion was not mobile. Radiographic examination revealed a fully formed apex without any periapical lesion or root fracture (Fig. 1b).

As the separated coronal tooth fragment could not be located; the option of re-attachment was ruled out. As a large portion of coronal structure was lost, post and core was planned. Intentional root canal therapy was started on the same appointment. As the patient reported late in the OPD, the access opening was done followed by dressing to lessen the chances of infection and canal was obturated on the next day. Patient was recalled after a week and orthodontic extrusion was carried out. For extrusion of upper right central incisor, a J hook was made by a hard round stainless steel wire (21 gauge). The hook was placed in the obturated canal by creating a 3mm space. It was then cemented in the prepared canal space with the help of zinc phosphate cement (Dentsply DeTrey GmbH, Konstanz Germany) (Fig. 2a).

A stainless steel wire (21 gauge) was bonded to adjacent five anterior teeth with a coil lying just below the J hook. Based on the depth of the distal fracture line, it was planned to extrude the tooth to about 2-3 mm. The distance between the coil and J hook was adjusted so as to get the desired extrusion. An elastic chain (Orthoplus, USA) was stretched between the J hook and the coil of the stabilizing wire (Fig. 2b and 2c). The force applied by elastic chain extruded the fractured tooth. Elastic chain was replaced weekly to get the desired extrusion. The desired extrusion was achieved in 2 weeks (Fig. 3a and 3b), but the appliance was sustained for another

week to achieve retention. During the removal of J hook, zinc phosphate cement within the canal was removed with ultra-sonic scaler tip and the stabilizing wire removed with deboning pliers.

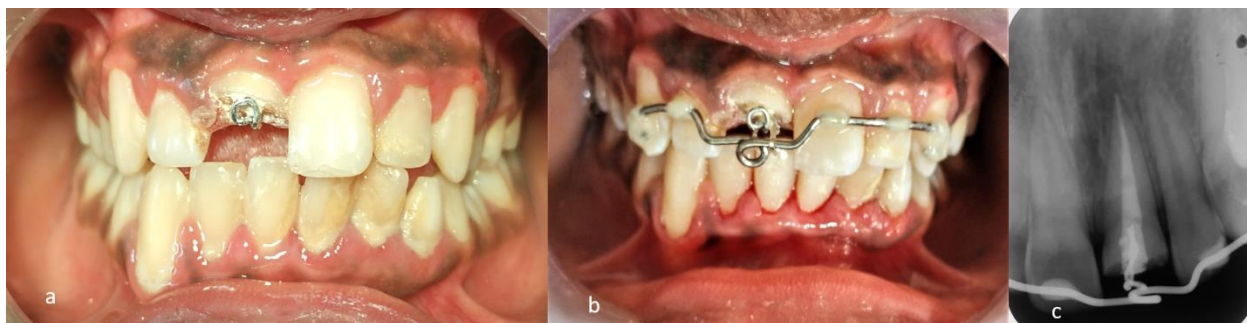
Since coronal structure was insufficient for prosthetic rehabilitation, post and core was planned. After the removal of appliance, a space was created in root canal to receive fiber post (Hi-Rem post, Over fibres, Via selice, Italy) followed by core build up with composite (Fluorocore 2+, Dentsply DeTrey GmbH, Germany) (Fig. 3c). Patient was recalled on the next day.

Tooth preparation with a radial-shoulder finish line resting on enamel was done for receiving Zirconia crown (3M ESPE, LAVA premium crown) (Fig. 4a). The impression was made using putty wash technique (Fig. 3b). Temporization was done with the help of tooth colored acrylic on the same day. Then the patient was recalled after 4 days. Trial was done and crown was delivered on the same appointment (Fig. 4b). The tooth was asymptomatic and was in harmonious relationship with the supporting structures at one, six and ten months follow up (Fig. 4c).



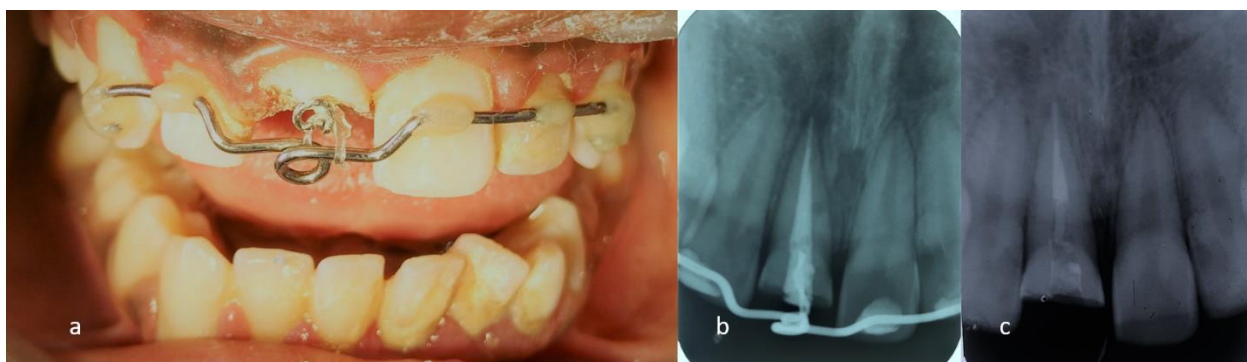
Pre-operative photographs

Fig. 1a: Fractured upper right central incisor with exposed pulp tissue
Fig. 1b: IOPA showing fully formed apex with no peri-apical lesions or root fracture



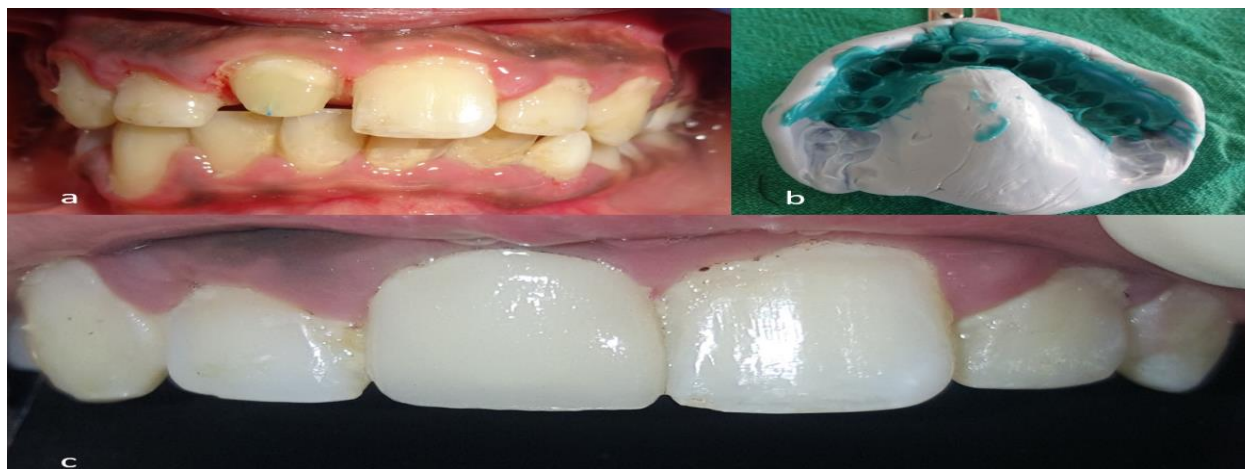
Insertion of the appliance

Fig. 2a: Intra-oral photograph showing J hook inserted in upper right central incisor
Fig. 2b: Elastic chain stretched between J hook and coil of the stabilizing wire
Fig. 2c: IOPA showing stabilizing wire and J hook in the canal



Orthodontic extrusion at 3 weeks recall followed by post placement

Fig. 3a: Extrusion of upper right central incisor at 3 weeks recall
Fig. 3b: IOPA of extruded upper right central incisor at 3 weeks recall
Fig. 3c: Fiber post placed in the canal space of upper right central incisor



Esthetic rehabilitation

Fig. 4a: Tooth preparation for Zirconia crown

Fig. 4b: Putty wash impression after crown preparation

Fig. 4c: Zirconia crown cementation showing excellent esthetics and integrity of supporting structures

Discussion

The high prevalence of dental trauma caused several severe teeth to be lost or extracted. These teeth should be preserved for esthetics and function while maintaining the integrity of supporting structures whenever possible.

Dentistry of the modern era is dominated by restorative procedures that not only restore function of lost structures but also esthetics. Functional and esthetic restorations can gain complete patients' and dentists' satisfaction only when these restorations exist in harmonious relationship with the surrounding structures. Maintenance of biologic width is essential to preserve the periodontal health and to remove any irritation that may damage the periodontium.^(7,8) Biologic width is defined as the dimension of the soft tissue, which is attached to the portion of the tooth coronal to the crest of alveolar bone.⁽⁹⁾ It acts as a barrier and prevents penetration of microorganisms into the periodontium.⁽¹⁰⁾

While dealing with complicated crown fractures at cervical third area along with biological width violation, surgical or orthodontic extrusion is recommended to obtain optimal biological width and retention form. Yiğit Özer et al (2011)⁽¹¹⁾ suggested that orthodontic treatment render a more biological and simpler way of extruding the tooth. However it is more time consuming than surgical exposure. In the current case considering the age and compliance of the patient, orthodontic extrusion was planned.

Movement of a tooth by extrusion involves applying tractional forces in all regions of the periodontal ligament to stimulate marginal apposition of crestal bone.⁽¹²⁾ Because the gingival tissue is attached to the root by connective tissue, the junctional epithelium follows the vertical movement of the root during the extrusion process.⁽⁷⁾ Similarly, the alveolus is attached to the root by the periodontal ligament and is in turn pulled along by the movement of the root. Extrusion is easiest

of all orthodontic movements because it closely resembles natural tooth eruption.⁽⁶⁾

We opted for orthodontic extrusion in this case. The orthodontic forced eruption is considered better than traditional surgical crown lengthening that leads to unaesthetic outcomes like crown lengthening of a single tooth in the esthetic region.^(13,14)

In the present case, the fracture line in upper right central incisor was oblique and was very close to the cervical margin on the distal side. The gingival margin level was same as the adjacent teeth. Esthetic considerations in this 14 years old patient contraindicated surgical crown lengthening, so orthodontic forced eruption was done in which the level of gingival margin remained unaltered while the clinical crown length was increased without impairing the biologic width. Johnson RH(1981)⁽¹⁵⁾ and Fournier A (1990)⁽¹⁶⁾ also found stable results with similar type of forced orthodontic extrusion.

Since there was extensive loss of coronal tooth structure, post and core was needed. A review paper by American Association of Endodontics discussed that there is no significant difference in success of cases whether post space is created immediately or in the next appointment.⁽¹⁷⁾ In this case, obturation including post and core build-up was completed within two days minimizing the canal infection.

American Academy of Endodontics recommends fiber posts as they distribute the stresses more evenly throughout the tooth compared to other posts, making the root less susceptible to fracture, also known as monoblock effect.⁽¹⁷⁾ Accordingly, fiber post was preferred in this case owing to similar modulus of elasticity as that of dentin, which allows them to flex with the root when under stress.

The outcome of the treatment showed that extrusion of the tooth was obtained successfully without hampering the supporting structures and good esthetic

results was achieved post crown placement. After ten months follow up the results were favorable.

Conclusion

The rule of nature is to conserve as much of tooth structure as possible. Preservation of the remaining natural and healthy tooth structure have a positive psychological impact on the patient. The present case proved orthodontic extrusion to be a conservative procedure that allowed retention of a tooth without the disadvantages of a fixed bridge or implants. As well, extrusion did not involve loss of bone or periodontal support, as commonly occurs during extraction. Thus, this simple technique of a relatively easy extrusive movement of tooth, helped in subsequent restoration of the fractured tooth, therefore can be considered as a savior for both the natural tooth and its supporting tissues.

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