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Abstract
Fracture of anterior teeth after trauma adversely affects the emotional well-being of a person in addition to the discomfort and pain. Complexity and extension of fracture along with the associated injury to the tooth influence the restorative design. Crown-root fracture of anterior teeth cause concomitant periodontal injury and there will be concern about appearance, and aesthetics. Clinical considerations for the management of crown-root fractures include extent and pattern of fracture, restorability of remaining tooth, availability of fractured fragment, and damage to the attachment apparatus. Sub-gingival extension of fracture raises concern about biological width violation. This report of two cases described the clinical procedures involved in the treatment of a complicated crown-root fracture in the maxillary anterior teeth.

Key-words: Complicated crown-root fracture; Extrusion; Biological width; Gingivectomy.

Introduction
Traumatic dental injuries (TDI) are caused by various factors like road traffic accidents, falls, sports injury and assaults. In permanent dentition, traumatic dental injuries (TDI) are observed frequently in children between age group of 6 to 10 years with higher predilection for maxillary central incisors (around 65.65%) by virtue of its position, projection and inappropriate lip enveloping. Crown-root fracture is a type of TDI resulting from horizontal impact in which enamel, dentin and cementum are involved with fracture line extending below the gingival margin. It accounts for 5% of all TDI and can be classified as complicated or uncomplicated depending on pulpal involvement.

Treatment of complicated crown-root fractures is often challenging due to difficulty in achieving a dry operating field and its association with soft tissue injuries. Management and prognosis of crown root fracture depend upon the extent, location and pattern of fracture, restorability of remaining tooth, availability of fractured fragment, extent of damage to the attachment apparatus and stage of root development (immature or mature root). Treatment options of a subgingival or intrasosseous fracture include orthodontic or surgical extrusions, gingivectomy, osteotomy and intentional re-plantation. The present article reported the multidisciplinary approach for the management of two cases of complicated crown-root fractures with successful clinical and radiographic follow-up.

Case report
Case1
An 18-year-old healthy boy reported to the Department of Conservative Dentistry and Endodontics for evaluation and management of his maxillary left front teeth which were fractured during a fall from his bicycle on the previous day. Intraoral investigations revealed that the maxillary left central (tooth #21) and lateral incisor (tooth #22) had a crown-root fracture extending sub-gingivally on the palatal aspect with pulp exposure [Figure 1a]. Detailed radiographic examination was done to exclude any possibility of root fracture in both #21 and #22 [Figure 1b]. The patient was explained regarding the treatment options. Taking into consideration patient’s age, amount of tooth structure remaining, the stage of root development (immature or mature root), extent and nature of crown-root fracture, orthodontic extrusion was opted. The risks, complications, and possible outcome of orthodontic extrusion were explained and patient’s written informed consent was obtained.

Root canal treatment was initiated and obturation was completed using sectional filling of gutta-percha [Figure 1c]. Two metal wires of 0.7 mm in diameter, hooked at one end, are cemented into the canals of both #21 and #22. Stainless steel arch wire was twisted, adapted and affixed with composite resin to the buccal aspect of teeth #11 and #23 for anchorage. Elastics (el) were used to connect the hooks to the rigid anchor wire to activate the
orthodontic extrusion using a low intensity force mechanism [Figure 1d]. The elastics were changed every 2 weeks. After approximately 6-8 weeks, extrusion was completed and the tooth was restored with a post-core system and porcelain fused to metal crowns [Figure 1e and f].

**Case 2**

A 39-year-old healthy female referred to the Department of Conservative Dentistry and Endodontics from a private dental clinic for the management of broken upper anterior teeth. Patient reported to the private dental practitioner after road traffic accident 4 days back for which inter-dental rigid splinting through alveolar bone was attempted. Clinical and radiographic examination revealed that the maxillary left central (tooth #21) and lateral (tooth #22) incisors were intrusively luxated with complicated crown-root fracture [Figure 2a and b]. Gingival laceration was evident in the labial vestibule of teeth #11, #21 and #22 with grade II mobility in teeth #21 and #22. The patient was explained regarding the treatment options and surgical crown lengthening was opted as a treatment option. Patient’s written informed consent was obtained.

Under local anesthesia (2% lidocaine with 1:1,00,000 epinephrine, LOX 2% Neon Lab, India), stainless steel wire was removed and teeth #21 and #22 were extruded atraumatically using a periosteum such that the fracture margin was located at least 3-5 mm coronal to the alveolar crest [Figure 1c]. A rigid splint was placed with a flowable composite (Tetric N-flow, Ivoclar Vivadent, Schaan) including one tooth on each side. Conventional endodontic therapy was completed in both #21 and #22 and analgesics and antibiotics were prescribed post-operatively. Occlusal adjustment was done and instructions about the importance of plaque control using chemical and mechanical methods were given to patient. The patient was recalled for checkup every week for 1 month and then at 3 and 6 months [Figure 1f]. Porcelain fused to metal crowns were given after 6 months of surgical extrusion after confirming that there was no mobility, bleeding on probing and pocket formation [Figures 1g and h].

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**Fig 1. a and b. Clinical and radiographic presentation of teeth #21 and #22 showing crown-root fracture. c. Root canal treatment was completed using sectional filling of gutta-percha. d. Two metal wires (0.7 mm), hooked at one end, were cemented into the root canals of both teeth and stainless steel arch wire was affixed buccally for anchorage. Elastics (el) were used to extrude both the teeth. e and f. teeth were restored with a post-core system and a prosthetic crown**

Discussion

Complicated crown-root fracture is a rare TDI. The severity of clinical presentation of crown-root fracture varies depending on the strength and vector of the impact force. Treatment success of complicated crown-root fracture is directly correlated with the crown-root ratio remaining after trauma, the degree of injury to the tooth supporting structures especially the periodontium and time lapse between incidence of trauma and presentation of case.

Orthodontic traction is suited for moderately intruded (3-7 mm) teeth and surgical extrusion is preferred in teeth with severe intrusion (>7 mm) 8. In orthodontic extrusion of a single root, 0.2-0.3 Newton of force is needed for the movements of 4–6 mm over 6–8 weeks 9. Orthodontic forces allow a biological way of extruding the tooth. It results in normal orientation of the periodontal fibers and consequently less replacement resorption as the fibers are under less tension with respect to the cementum and bone 10. Orthodontic forces should be applied parallel to the long axis of the tooth to prevent buccal or lingual tipping. However excessive orthodontic forces can lead to pain, failure of the tooth movement, root damage, tilting of the abutment teeth and subsequent impaction of the root being extruded. In addition, it is more time-consuming and requires frequent patient visits. Atraumatic surgical extrusion using a specially designed instrument called periotome is an alternative approach to orthodontic extrusion. In surgical extrusion, the tooth was restored to its original position by decompressing the injured tissues and re-establishing the normal relationship between bone and tooth. It allows early start of root canal treatment. However traumatic extrusion may result in functional or esthetic deformities especially in the anterior esthetic zone like uneven gingival margins, loss of interdental papilla, relapse etc. In the second case, delayed surgical repositioning showed favorable outcome at follow up.

Conclusion

In crown-root fracture, long-term stability of the successful treatment result can be possibly achieved when the integrity of the dento-gingival junction is respected. Plethora of treatment options is available for the management of a sub-gingival crown root fracture and various factors affect the choice of treatment. Multidisciplinary treatment approach is a key in successful functional and esthetic rehabilitation of complicated crown-root fracture.

References