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Management of traumatic injuries to the dentition poses a major challenge to the clinician. An interdisciplinary approach is often required for esthetic and functional rehabilitation of anterior teeth with crown-root fracture. Subgingival fractures with loss of coronal tooth structure are no longer primarily managed by extraction and prosthetic replacement. Current treatment philosophy aims at endodontic treatment, extrusion and/or surgical crown lengthening, followed by restoration of the lost tooth structure, taking into consideration the biologic, functional, and esthetic aspects. This paper aims to report a case, where rehabilitation of an anterior tooth with crown-root fracture has been done using endodontic, orthodontic, periodontal and prosthetic treatment modalities in concert.

Keywords: Biologic width, Crown-root fracture, Gingivectomy, Orthodontic extrusion

INTRODUCTION

Tooth fracture is considered to be the third most common cause of tooth loss and includes crown fractures, root fractures, and crown-root fractures.1 Anterior tooth trauma presents a challenging case scenario both to the patient and the dentist. Due to the associated psychological impact on the patient, effort should be made to prevent tooth loss.

Crown-root fracture is defined as a tooth fracture involving enamel, dentin and cementum, and comprises about 5% of injuries affecting permanent teeth.1 Based on the presence or absence of pulpal involvement, crown-root fractures can be further classified as complicated or uncomplicated.1

A tooth with crown-root fracture may be successfully managed with an interdisciplinary approach involving specialties such as endodontics, periodontics, orthodontics, and prosthodontics. An adequate knowledge about the restorative principles in combination with proper management of the periodontal tissues is the key to ensure the long-term survival of the tooth. The rehabilitation involves interplay of factors such as esthetics, length of the remaining tooth structure, maintenance of biologic width, and placement of margins of the restoration in a position that facilitates easy cleaning and maintenance.2

An understanding of the concept of biologic width is required in the management of crown-root fractures. The biologic width is defined as “the dimension of soft tissue that is attached to the portion of the tooth coronal to the alveolar bone crest.”3 The fractured margins of the crown must be exposed supragingivally, so that the restoration does not impinge on the biologic width. A minimum of 3 mm space is required between restorative margins and alveolar bone, allowing for 2 mm of biologic width space and 1 mm sulcus depth.4,5 Violation of the biologic width may lead to chronic gingivitis, loss of clinical attachment, periodontal pockets, and gingival recession.6

Crown lengthening is a procedure aimed at gaining sound tooth structure coronal to the alveolar crest so that an adequate area is obtained for retention of the restoration without extending the margins deep into the periodontal tissues. It is indicated in various situations: The presence of subgingival or intraosseous fracture, caries, perforation,
or resorption; isolated periodontal pockets or angular bone defects; or a restoration impinging on the biologic width. Various treatment modalities that can be employed for crown lengthening include surgical crown lengthening, orthodontic extrusion, surgical extrusion, intra-alveolar transplantation with 180° rotation, or extraction.

**CASE REPORT**

A 22-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, Government Dental College, Thiruvananthapuram, with a complaint of broken upper front teeth. He had a history of trauma due to fall from bike 2 days back. His medical and dental histories were non-contributory.

On inspection, it was found that the crown of tooth #9 was fractured with pulpal involvement. An oblique fracture of tooth #10 was seen, also involving the pulp. On the labial and distal aspects of tooth #10, the fracture line was visible, with about 2 mm of tooth structure remaining supragingivally (Figure 1). However, fracture line was not visually evident on the palatal and mesial aspects. Periodontal probing revealed physiological probing depths in all areas except on the mesial and palatal aspects, where the fracture line was found to be subgingival by 3 mm (Figure 2). Maxillary occlusal radiographs and intraoral periapical radiographs at different angulations were taken, which revealed fracture of #9 and #10. The mesial extent of the fracture in #10 was almost at the level of alveolar crest (Figure 3).

Based on the clinical and radiographic findings, the diagnosis was a complicated crown fracture of #9 and complicated crown-root fracture of #10. The patient was informed about the different treatment modalities for his condition, and the following treatment options were presented:

- Endodontic treatment of #9 and #10, crown-lengthening of #10 and restoration, or
- Endodontic treatment of #9 and extraction of #10, followed by placement of a fixed partial prosthesis or implant.

Considering the various clinical factors and giving due importance to the patient’s preference to retain the tooth, an interdisciplinary treatment approach was planned as follows:

- Endodontic treatment of #9 and #10
- Orthodontic extrusion of #10
- Periodontal management-gingivectomy
- Prosthetic management-post-retained core and full crown on #10 and full crown on #9.

Root canal treatment of #9 and #10 was done, and the coronal two-thirds of gutta-percha was removed from the root canal of #10 (Figure 4). A J-shaped hook was made from a 22 gauge stainless steel wire and luted into #10 using zinc phosphate cement. Edgewise brackets were fixed from #6 to #12. Traction was applied to the tooth for extrusion using a 0.014 inch nickel-titanium wire, which was engaged to the J-shaped hook using a ligature wire (Figure 5).

After 2 weeks, about 3 mm of extrusion was achieved (Figures 6 and 7). The tooth was then stabilized for 8 weeks by holding the...
NiTi wire passively. Coronal migration of gingival tissue was observed, particularly on the mesial and palatal aspects, and therefore, surgical crown lengthening was planned. Since there was the adequate width of attached gingiva and around 3 mm of tissue coronal to the alveolar crest, osseous recontouring was not necessary. Therefore, external bevel gingivectomy alone was carried out (Figures 8 and 9).

A glass fiber post (Tenax Fiber Trans, Coltène/Whaledent Inc., USA) was luted into the root canal of #10 (Figure 10) using resin cement (Variolink N, Ivoclar Vivadent, Liechtenstein), core build-up was done with composite resin (Tetric N-Ceram, Ivoclar Vivadent, Liechtenstein) and all ceramic crowns (IPS e.max, Ivoclar Vivadent) were placed on both the teeth (Figures 11 and 12). The patient is under regular follow-up. Clinical and radiographic examination after 18 months revealed healthy periodontal tissues and no evidence of apical periodontitis (Figures 13 and 14).
Infringement of a restoration into the physiological dimensions of the periodontium is one of the major factors that make the management of crown-root fractures challenging. Therefore, a combined periodontal-restorative treatment plan is essential. The margins of a restoration, especially in the esthetic zone, must be critically managed, so that the restoration is in harmony with the periodontal tissues. Supragingival and equigingival margins are tolerated well by the periodontium. However, the placement of margins subgingivally may adversely affect the supporting structures of the tooth. If placed deep into the gingival attachment apparatus, the restoration may violate the biologic width. Furthermore, subgingival margins are difficult to finish and may act as areas of plaque retention. Hence, crown lengthening becomes mandatory for good long-term prognosis of crown-root fractures.

In the present case, orthodontic extrusion was the method of choice for crown lengthening due to its relative advantages over other procedures. It is a conservative procedure which is relatively simple and does not sacrifice periodontal ligament or supporting alveolar bone. Moreover, the esthetic outcome following surgical crown lengthening may be difficult to predict.

Depending on the amount of force applied and duration, orthodontic extrusion can be rapid or slow. In rapid extrusion, coronal migration of supporting structures such as gingiva and alveolar bone is less pronounced when compared to slow extrusion. However, rapid extrusion must be followed by a prolonged stabilization phase to prevent relapse. Various authors have suggested different
stabilization periods after extrusion ranging from 7 to 14 weeks.\textsuperscript{15}

In this case, coronal migration of gingiva was noted, especially on the mesial and palatal aspects, necessitating periodontal surgery. However, orthodontic extrusion precluded the need for osseous recontouring, and therefore, external bevel gingivectomy alone was required to provide adequate room for crown preparation and establishment of biologic width.

**CONCLUSION**

Restoration of traumatized teeth requires a critical evaluation. The treatment should be planned in accordance with the needs and expectations of the patient, after explaining the various treatment options and the potential risks and benefits. The importance of an interdisciplinary approach cannot be overemphasized to restore and rehabilitate the teeth to their normal esthetics and function.

**REFERENCES**


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