

Post Endodontic management of a critically traumatized Central Incisor :An extreme save

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Abstract :

The management of adult 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.

This report describes the restoration of an endodontically treated tooth, with a complicated crown-root fracture along with crown prosthesis that extended below both the gingival cuff and the alveolar crest, by using remaining tooth tissue. The restoration was completed after root extrusion with a fiber post core, and porcelain crown. In order to expose the sound tooth structure for prosthodontic intervention, orthodontic extrusion was performed after endodontic treatment. Forced eruption may serve as an alternative treatment modality since its introduction in 1973. To avoid extraction of the involved teeth, the multidisciplinary approach was adopted and finally the teeth were restored prosthodontically. The final result was aesthetically satisfying and periodontically sound.

Keywords: Coronal tooth fracture, forced tooth extrusion, orthodontic extrusion, subgingival crown fracture

Introduction

A crown-root fracture is defined as a fracture involving enamel, dentin and cementum and may be classified as either complicated or uncomplicated according to the pulpal involvement.¹ In permanent dentition crown fractures occur most frequently than root fracture.² The most susceptible tooth is the maxillary central incisor, which sustains approximately 80% of dental injuries followed by the maxillary lateral, the mandibular central and lateral incisors.³ At times when fracture line lies below the gingiva, the prognosis is questionable.¹ With the recent trend and attitude towards dental implants, extraction remains a common treatment modality. However, implant should be considered as the last option, and every attempt should be made to preserve and restore the remaining natural tooth structure

Therefore, treatment modalities involve a multi-disciplinary approach including endodontics, periodontal crown lengthening and orthodontic extrusion followed by prosthetic rehabilitation.⁴ Orthodontic extrusion of roots was described more than 20 years ago by Heithersay, Ingber and Simon. Cook reported that ideal rapid extrusion of a single root requires forces of the magnitude of 0.7 N to 1.5 Tooth movements of between 4–6mm over 6–8 weeks can be achieved using these light orthodontic forces. The most frequently described technique follows root canal obturation and uses a post made from orthodontic wire at its coronal end. The wire cemented to the abutment teeth should ideally be bent so that traction is through the long axis of the root and not labially.⁵ Retention of the root in its new position is advisable for at least few weeks prior to restoration.⁶ The purpose of this paper is to exhibit this multi-disciplinary treatment approach and to present a case of traumatized endodontically treated maxillary central incisor tooth with sub-gingival fracture and its management maintaining the healthy periodontal tissue and alveolar bone.

Case Report :

A 20 year old male patient presented with the chief complaint of fractured upper front tooth to the Department of Conservative Dentistry and Endodontics DAPM RV Dental college and hospital. The past dental history revealed, root canal treated right central incisor with post endodontic restoration/ crown six years back. The tooth along with the crown was fractured six months back following a trauma. Clinical examination revealed horizontal coronal fracture line in relation to #11 that extended below the gingival level. The remaining tooth structure showed blackish discoloration with thinned out edges. The adjacent marginal gingiva was seen enclosing the fractured remaining tooth structure. Generalized spacing was seen with obvious midline diastema in the maxillary arch. The intra-oral Periapical radiograph of the involved tooth showed normal root length, wide root

canal with open apex, which also showed satisfactory obturation with very dense radiopacity suggestive of probable use of MTA as the obturation material. There was no associated fracture of the root and lamina dura remained intact with normal peri apical findings. Radiographic finding was co-relating the clinical findings.

Patient was explained with all the possible treatment plan including orthodontic correction and prosthetic rehabilitation after extraction and implant and the other option of retaining the natural root by periodontal treatment or forced eruption. The patient agreed for the latter as it was more physiological, no need for any surgical procedure and most importantly, cost-effective.

A definitive treatment plan was designed with multidisciplinary approach for plaque control, conservative and endodontic treatment, orthodontic extrusion, periodontal surgery and prosthodontic restoration.

Gingival recontouring was done using high frequency electrosurgery system (PerFect® TCS II, coltene) in order to remove the gingival over growth covering the tooth structure. Orthodontic extrusion of the tooth was required as the fracture level was below the gingival margin. The orthodontic treatment consisted of forced eruption of the root of the fractured central incisor. By evaluating the estimated crown root ratio and the extension of the fracture, 3 mm extrusion was considered as adequate to provide sufficient biologic width as well as to provide a ferrule for the final restoration.

As the tooth was asymptomatic orthodontic extrusion was initiated. Post space was created by removing MTA leaving 6mm of the material apically. For the orthodontic extrusion, 0.022-inch standard brackets were attached from the permanent maxillary first premolar to premolar on each side i.e from #14 to #24. After which a rectangular stainless steel arch wire was bent to achieve the tooth extrusion. A steel “J” hook was cemented in the root canal within the post space using universal microhybrid composite material (Spectrum® Syringe Starter Kit, Densply). A power chain was applied axially from the steel hook to arch wire with 75 gram force. The power chain was changed every week. An extrusion of approximately 3 mm was obtained within a month. The extruded tooth was retained and stabilized with the same arch wire for 15 days to prevent any relapse.

At the end of the retention period, functional gingivectomy was performed to expose the buccal and palatal margin of the fracture line. After 7 days of healing the “J” hook was carefully removed from the post space and a glass fiber post (3M™ RelyX™ Fiber Post 3D Glass Fiber Post) was placed using a dual-cure composite (ParaCore® 5 ml, Coltene). The post core was built up with a composite system (Spectrum® Syringe Starter Kit, Densply Sirona). The excess composite material was removed using a high-speed, water cooled diamond bur to maintain approximately 2.0 mm incisal, 1.5 mm buccal, and 1.5 mm palatal space for the Porcelain fused metal (PFM) crown.

A retraction cord (Ultrapak 0, Ultradent Products Inc) was used to obtain clear margins. For the impression light viscosity silicon material (DENTSPLY, Reprosil VPS Impression Light Body Tube Blue) was used for a definitive impression and an irreversible hydrocolloid material was used for the opposing arch impression. The shade selection was carried out using VITA shade guide (VITA 3-D master shade guide). During the time it took to construct the PFM crown, the tooth was restored with a temporary acrylic crown. The PFM crown was cemented with luting Glass ionomer cement (Fuji I - Glass ionomer luting cement, GC Gold label). The outcome of the treatment fulfilled the esthetic expectations of the patient. The patient was evaluated clinically and radiographically for one- and three-months post treatment.



Figure: a. Fractured right maxillary incisor b. Pre-operative radiograph c. Gingival recontouring followed by orthodontic extrusion of 1-week d. 3 weeks post extrusion and functional gingivectomy e. Glass fiber post bonded to tooth f. Core build up and tooth preparation for PFM crown g. One-month follow-up post crown cementation h. post-operative radiograph

Discussion

Horizontal tooth fractures are observed quite frequently in maxillary anterior teeth and in young male patients.⁷ The location of the fracture line not only affects the treatment options but also the prognosis.¹ The clinical outcomes and prognosis of teeth that are fractured in the subgingival area have been found to be the most bleak because of the loss of the coronal fragment stability and pulpal vitality.⁸ Currently, several alternative treatments for teeth with subgingival fractures have been proposed. The main objective of the treatment consists in exposing the fracture margin to a supragingival level, so that clinical restoration procedures can be conducted without contamination with blood and saliva.⁹

Surgical extrusion is rather an invasive technique that may cause complications related to surgical procedure or postoperative marginal bone loss. Osteotomy would affect the esthetics in the anterior region due to retraction of the gingival tissues, Orthodontic extrusion is the most biofavourable method of restoring the fractured tooth as compared to extraction and prosthesis or surgical reposition.⁴

In the present case, rapid extrusion concept was chosen with customized fixed orthodontic appliance consisting of brackets bonded on to the adjacent teeth using a “j hook” cemented within the canal of the tooth to be extruded. Anchorage from the adjacent teeth including the first premolar teeth on either side was taken to evenly distribute the exerted force on the anchor teeth and minimized any untoward movement of the tooth. Orthodontic extrusion was accompanied with crown lengthening procedure that involves the removal of supporting alveolar bone for management of subgingival fracture of crown of single-rooted tooth.¹⁰ The average biologic width is 2- 2.04 mm with gingival connective tissue attachment of 1mm and epithelial attachment of 1mm.¹¹ An additional 1-2 mm of the sound tooth structure should be available coronal to the epithelial attachment to place the margin of a restoration.¹⁰ The tooth movement by extrusion involves applying tractional forces in all regions of the periodontal ligament to stimulate marginal apposition of crestal bone. Since the gingival tissue is attached to the root by connective tissue, the gingiva follows the vertical movement of the root during the extrusion process. Similarly, the alveolus is attached to the root by the periodontal ligament and is in turn pulled along by the movement of the root.¹²

In rapid extrusion when stronger traction forces are exerted, coronal migration of the tissues supporting the tooth is less pronounced because of the rapid movement that exceeds their capacity for physiologic adaptation. Thus, rapid extrusion is necessary to prevent movement of the gingival collar and alveolar bone with the elevated tooth.¹³

In this case, before final restoration, a glass fiber post was placed inside the tooth to provide retention of the core and also to strengthen the root as there was extensive tooth loss. According to the findings of finite element analysis of stresses in endodontically treated teeth restored with posts, flexible glass post systems give the most benign stressing condition as compared to carbon or steel posts.^{14,15} They possess inherent flexibility as of natural dentin, allowing the post to absorb stress and prevent root fracture. Other advantages include aesthetics, corrosion resistance, biocompatibility and modulus of elasticity being similar to that of dentin.¹⁶ These adhesive systems transmit the stresses between the post and the root structure, reducing stress concentration and preventing fracture.^{14,15} Composite core was built up over the glass fiber post. The tooth was successfully restored with a PFM crown constructed over the post core. Here, apart from achieving the goal of extrusion for crown ferrule and long-term restorative success, we have attempted to achieve esthetics during the course of treatment.

Conclusion

A multidisciplinary approach is necessary for the restoration of tooth fractured at subgingival level, because the margin of restoration should ideally be supragingival. A definite treatment protocol should be followed to restore fractured anterior teeth functionally and esthetically. This case report described one such case report with desirable outcome.

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