

True Orthodontic Extrusion for Complicated Crown-Root Fracture in a Maxillary Central Incisor-A Simple and Cost-Effective Multidisciplinary Approach

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Abstract

In everyday dental practice, there are many cases a dental practitioner comes across of subgingival trauma (including fracture, perforations etc), external root resorption or root carious lesions. This case report shows the treatment of a severe traumatic tooth injury. The maxillary right central incisor had a fracture involving enamel, dentin, and cementum with loss of tooth structure and exposure of the pulp. The trauma was considered a complicated crown-root fracture. These are usually the result of a direct impact.

Keywords: Normative data; Joint range of motion; Archery; Hockey

Introduction

The level of the fracture line, the length of the remaining root segment, and the presence and condition of the tooth fragment determine the type of therapy [1]. Different treatment modalities available are [2].

- Orthodontic extrusion along with post and core followed by crown.
- Prosthetic rehabilitation through extraction and provision of resin-reinforced bridge work.
- Extraction of fractured tooth followed by Implant placement.
- Surgical lengthening of crown along with post and core followed by crown.
- Efforts must be made to avoid tooth loss and restore form and function along with preserving the gingival attachment apparatus [3].

Prosthetic Implant placement is becoming common practice for the replacement of non-preservable tooth after extraction, but implant placement is not the ultimate goal [4]. One should avoid extraction in anterior region because of the expected amount of loss of soft and hard tissue occurring post-extraction

along with loss in microesthetics like open gingival embrasures, Blunted papillae, improper zenith of gingival tissue etc [5].

Surgical crown lengthening results in the loss of soft tissue and loss of bone support of neighboring teeth bone support [6]. Increased clinical crown length may result in an unpleasant esthetic outcome which is undesirable in maxillary anterior teeth region along with impaired crown: Root ratio [7].

Best conservative treatment modality is orthodontic extrusion along with post and core followed by crown [8]. Principle aim of orthodontic extrusion is to expose the fracture line so that it can be restored following ferrule effect without violation of biological width, securing good sealing and esthetics It is done by orthodontic forces very similar to physiologic root eruption which helps in preservation of periodontal support and produces good esthetic result [9].

In 1973, Heithersay first described the orthodontic extrusion of subgingivally fractured tooth in coronal one third of root [10]. After that many clinicians performed Orthodontic extrusion through various methods like lingual brackets, J-Hook microscrew implants and beggs bracket on occlusal surface etc [11].

Indications of orthodontic extrusion include

- Subgingival or infraosseous lesion of tooth between cemento-enamel junction and coronal third of root (e.g. fracture, carious lesion, internal or external root resorption).
- Iatrogenic perforation.
- Slow extraction where surgical extractions are contraindicated (e.g. patient on chemotherapy or radiotherapy).
- Isolated osseous defects.

Instances where orthodontic extrusion should be avoided

- Vertical root fracture.
- Furcation exposure.
- Ankylosis or hypercementosis.
- Insufficient prosthetic space.
- Root proximity or premature closure of embrasures.
- Short roots not allowing adequate support of the restoration.

Of the above indications, subgingival or infraosseous lesions are within the scope of this case report [12]. Orthodontic extrusion is usually achieved with fixed appliances [13]. During orthodontic treatment 20 g-30 g of force is required for extrusion. In the present case rapid extrusion was done which was accomplished with forces higher than 50 g, this prevented the movement of bone and gingival collar along with extruded tooth facilitating prosthetic restoration with no need to reshape bone around the extruded tooth [14].

Case Presentation

Diagnosis and etiology

A 27 years-old male patient reported to our institute with pain and mobility with upper left central and fractured upper right central and left lateral incisors after 5days following road traffic accident (**Figure 1**).



Figure 1: 27 years old male patients with fractured maxillary right central, left central and lateral incisor before treatment.

Clinical examination revealed horizontal cervical fracture of left upper central incisor and mid crown fracture of left upper lateral incisor (**Figure 2**).



Figure 2: Intra-oral photograph before treatment.

Fragment of upper left central incisor attached to soft tissue was subsequently removed [15]. Radiographic examination revealed fully formed apex without any periapical lesion or any sign of additional root fracture. Extra-coronal restoration with upper left central incisor was difficult as enough tooth structure was not available to provide support (**Figure 3**) [16].



Figure 3: Pre-treatment Intraoral periapical radiograph of maxillary left central and lateral incisor showing no periapical pathology.

Treatment objectives and alternatives

In such a young patient who was diagnosed with subgingival fracture of maxillary left central incisor, our objective from long term view point was to provide esthetic and predictable outcome [17].

- Treatment options presented to patient with their pros and cons were-
- Orthodontic extrusion along with post and core followed by crown.
- Prosthetic rehabilitation through extraction and provision of resin-reinforced bridgework.
- Surgical crown lengthening along with post and core followed by crown.
- Extraction of fractured tooth followed by Implant placement.

The fracture line violated the biologic width [18]. We decided to expose the whole fracture line by displacing it above the gingival margin [19]. Therefore, significant orthodontic extrusion was necessary [20].

After discussing all the treatment options a final treatment plan of orthodontically extruding the tooth along with post and core followed by crown was formulated with the patient's consent [21].

Treatment progress

It was decided to perform a conventional root canal treatment with maxillary left central and lateral incisors before orthodontic extrusion [22]. After isolation using a rubber dam, an endodontic access opening was made under magnification and illumination with a dental operating microscope [23]. The root canal was shaped and cleaned by endodontic rotary files, and was irrigated with sodium hypochloride solution [24]. During the root canal preparation, vital pulp tissue was found. The root canal was filled with gutta-percha point and Orthodontic extrusion was planned subsequently. After both the teeth became asymptomatic, patient was referred to Department of Orthodontics and Dentofacial Orthopedics for extrusion with respect to maxillary left central incisor [25].

An intracoronary metal post was cemented prior to initiation of orthodontic extrusion which was utilized for applying force as well as for restoring fractured crown. The post was customized to allow direct application of extrusive force. A composite button was built to the post head. An eyelet was made within the composite button to engage elastic thread (**Figure 4**).

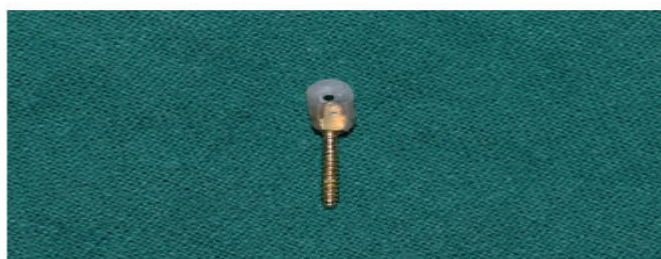


Figure 4: Composite button with an eyelet.

0.022" x 0.028" slot brackets were bonded on 11, 12, 13, 23, 24 and 0.017" x 0.025" Stainless steel wire was passively engaged within the brackets with vertical bends given corresponding to upper left central incisor to obtain a larger length of elastic thread for adequate generation of force. Horizontal bend was given towards the palatal aspect so that horizontal segment of wire lied in line with the long axis of upper left central incisor. Thus force was applied along the long axis passing through center of resistance achieving true extrusion (**Figure 5**).

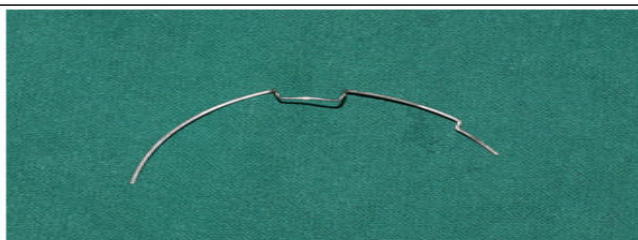


Figure 5: Stainless steel wire with vertical and horizontal bends.

50 gms of Extrusive force was applied through elastic thread tied between eyelet of post and wire (**Figure 6**).



Figure 6: Extrusion force applied through elastic thread tied between eyelet of post and wire.

Elastic thread was changed every week and amount of extrusion was assessed through radiograph and measurement of distance of end of post and base wire.

After 1st week supracrestal fiberotomy was performed and 2nd supracrestal fiberotomy was performed after desired amount of extrusion was achieved. After 4 weeks, an extrusion of approximately 3mm was observed both clinically and radiographically (**Figures 7 and 8**).



Figure 7: Radiograph showing approximately 3mm of extrusion.



Figure 8: Pre-extrusion and post-extrusion intraoral photographs.

Before final restoration, composite build up was done for esthetic purpose, maintenance of space as well as to facilitate placement of lingual bonded retainer to stabilize the extruded tooth in the new position passively for the period of 5 weeks. After completion of retention period lingual bonded retainer was removed carefully and finally, full coverage porcelain fused to metal crown was placed with maxillary left central and lateral incisor (**Figures 9 and 10**).



Figure 9: Before final restoration composite buildup for esthetic purpose.

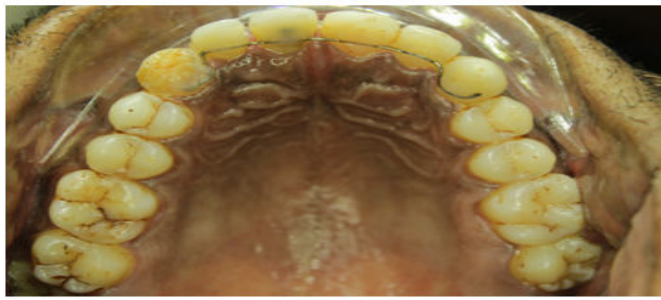


Figure 10: Extrusion Retained with lingual bonded retainer.

Treatment result

An extrusion of approximately 3mm was achieved both clinically and radiographically due to which fracture line was exposed above the gingival margin and Crown preparation with outline of the preparation was placed apical to the fracture line without compromising the biologic width to obtain good sealing. Full coverage porcelain fused to metal crown was placed with maxillary left central and lateral incisor resulted in good anatomic proportions and optimal hard and soft tissue esthetics (Figure 11).

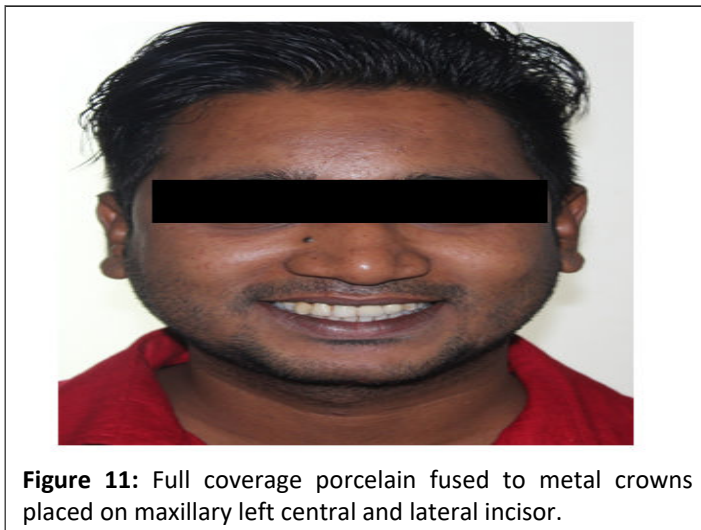


Figure 11: Full coverage porcelain fused to metal crowns placed on maxillary left central and lateral incisor.

Results and Discussion

Complex crown–root fractures involving cervical third of root are usually result of road traffic accidents, sports injuries, fall or fight. The maxillary central incisors are involved most commonly in traumatic dental injuries i.e. 65.65% and complicated crown root fracture are present in about 1.35% of cases

Treatment of tooth with fracture line positioned below alveolar crest and free gingival margin is difficult. It involves multiple specialties like Endodontics, Orthodontics, Prosthodontics and Periodontics.

This case report demonstrates a successful multidisciplinary approach of a subgingivally fractured tooth. In a subgingivally fractured tooth, if root length is sufficient to support a coronal restoration, then Orthodontic extrusion of root fragment is carried out after endodontic treatment. These procedures enable more favorable Prosthodontic coronal restoration

following ferrule effect without violation of biological width, securing a good seal and esthetics.

Ingber et al suggested that there should be 3 mm of distance present from the restorative margin to the alveolar crest to permit biologically acceptable restoration of tooth. Therefore, in this case we had extruded the tooth up to 3 mm so that restorative margin would be within biological limit.

Light continuous forces have been recommended for slow Orthodontic extrusion which stimulates marginal apposition of crestal bone along with gingival tissue. In case of rapid extrusion coronal migration of supporting tissues is less pronounced because in rapid movement periodontal fibres stretch and re-adjust and bone does not have time to remodel as rapid movement exceeds their capacity for physiologic adaptation. Thus, rapid extrusion is necessary to prevent the movement of bone and gingival collar along with extruded tooth facilitating prosthetic restoration with no need to reshape bone. Hence, in this case rapid extrusion was carried out to eliminate requirement of periodontal plastic surgery.

However, coronal migration of gingival tissue can be stimulated under extrusive force. In order to prevent this occurrence, some authors indicate supracrestal fiberotomy during active extrusion period. We extruded the tooth with rapid movement along with supracrestal fiberotomy, where 1st fiberotomy was performed after 1week of active orthodontic treatment and 2nd fiberotomy was performed after desired extrusion was achieved.

Orthodontic extrusion for restoration of traumatized teeth is not new. Various techniques have been performed. In most cases there was an unwanted buccal or palatal movement of tooth along with extrusion due to line of application of force passing buccal or palatal to the center of resistance. In the present case, we achieved true extrusion by applying force along with the long axis of tooth. True extrusion also has been proposed earlier using a J-Hook or Microimplant in the root canal or Begg bracket on the occlusal surface of fractured tooth. All of which achieved true extrusion but the disadvantage with these techniques was that the appliance was replaced after extrusion by post for restoration of tooth. All of these needed extra-chair side time, extra-armamentarium and also increased the risk of damage to the tooth during their removal and placement of post.

In this case a simple custom-made appliance was fabricated for rapid extrusion of root fragment. Brackets were bonded on 5 adjacent teeth and a stainless steel 0.017" × 0.025" wire was engaged passively. As the brackets on the adjacent anchor teeth and the wire used were buccal to the root being extruded, there was a possibility of displacement of the root buccally during orthodontic movement. Therefore a horizontal bend was incorporated in the wire with respect to the tooth to be extruded. This enabled the force to be exerted along the long axis of tooth resulting in true extrusion. As most of the cases of subgingival fractures require root canal treatment followed by post, this is simple and effective technique where we utilized the same post for carrying out true extrusion.

Prior to final restoration, it is advisable to retain the root in its new position to prevent relapse. Rapid extrusion is carried out at higher forces hence, needs longer retention time to stabilize the tooth. Supracrestal fiberotomy is known to shorten the retention period following the movement, as the tension potential in the supracrestal fibres is reduced significantly. Rapid orthodontic extrusion with supracrestal fiberotomy needs retention period of at least 3-4 weeks, which adequately reduces the risk of potential relapse. Therefore; in this case we had given a lingual bonded retainer for 5 weeks. The technique used in this case was cost effective and beneficial for achieving true extrusion along with reducing chair side time.

Conclusion

In many cases, forced orthodontic eruption provides a useful alternative to extraction or extensive periodontal surgery. Adjacent teeth need not be prepared for fixed crown and bridge prosthesis and alveolar bone is conserved because the root is retained. The results are both biologically and esthetically acceptable. Application of force along the long axis of tooth results in true extrusion and using the same post for orthodontic extrusion as well as for restoration of fractured tooth reduces chair side time and makes it more economical.

Declaration of conflict of Interest

The Authors declares that there is no conflict of interest.

References

- Bach N, Baylard JF, Voyer R (2004) Orthodontic extrusion: Periodontal considerations and applications. *J Can Dent Assoc* 70: 775- 80.
- Andreasen JO, Lauridsen E, Gerds TA, Ahrensburg SS (2012) Dental trauma guide: A source of evidence-based treatment guidelines for dental trauma. *Dent Traumatol* 28: 345-50.
- Andreasen JO, Ravn JJ (1972) Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. *Int J Oral Surg* 1: 235-9.
- Malhotra N, Kundabala M, Acharaya S (2011) A review of root fractures: Diagnosis, treatment and prognosis. *Dent Update* 38: 615-6: 619-20, 623-4 passim.
- Bach N, Baylard JF, Voyer R (2004) Orthodontic extrusion: periodontal considerations and applications. *J Can Dent Assoc* 70: 775- 80.
- Patil SS, Panicker AS, Hindlekar A, Srinidhi SR, Dhupal A, et al. (2014) Forced orthodontic extrusion for anterior traumatized teeth by a simplistic approach. *J Dent Allied Sci* 3: 111-3.
- Mittal R, Gupta S, Singla A, Gupta A (2013) Managing sub-gingival fracture by multi-disciplinary approach: Endodontics forced orthodontic extrusion and prosthetic rehabilitation. *Saudi Endod J* 3: 82-6.
- Johnson RH (1990) Lengthening clinical crowns. *J Am Dent Assoc* 121: 473-6.
- Liam D Addy, Peter Durning, Matthew BM Thomas, William S McLaughlin (2009) Orthodontic Extrusion: An Interdisciplinary Approach to Patient Management. *Dent Update* 36: 212-8.
- Sandra Rivera (2011) Clinical Management of a Complicated Crown-Root Fracture: A Case Report. *Braz Dent J* 22: 258-62.
- Ortolan SM, Strujic M, Aurer A, Viskic J, Bergman L, et al. (2012) Esthetic Rehabilitation of Complicated Crown Fracture Utilizing Rapid Orthodontic Extrusion and Two Different Restoration Modalities. *Int J Clin Pediatr Dent* 5: 64-7.
- Heithersay GS (1973) Combined endodontic/orthodontic treatment of transverse root fractures in the region of the alveolar crest. *Oral Surg* 36: 404-15.
- Tariq ajaz Ansari, Akhter Husain, Rohan Mascarenhas (2008) Extrusion of fractured teeth. *JCO* 42.
- Nisha Acharya, Praveen Singh Samant, Vanita Gautam (2014) Multidisciplinary Approach in the Rehabilitation of Complicated Crown-root Fracture: A Case Report. *Orthod J Nepal* 4.
- Ahmed Hashim, Ahmed Shaz, Nandish Shetty, Akhtar Hussain (2016) Management of Subgingivally Fractured Tooth with Miniscrew- Anchored Extrusion. *JCO* 50: 570.
- Guedes AO, Alencar AHG, Lopes LG, Pecora JD, Estrela C, et al. (2010) A retrospective study of traumatic dental injuries in a Brazilian dental urgency service. *Braz Dent J* 21:153-7.
- Smidt A, Lachish-Tandlich M, Venezia E (2005) Orthodontic extrusion of an extensively broken down anterior tooth: A clinical report. *Quintessence Int.* 36: 89-95.
- Sorensen JA, Engelman MJ (1990) Ferrule design and fracture resistance of endodontically treated teeth. *J Prosthet Dent* 63: 529-36.
- Ingber JS (1976) Forced eruption.II. A method of treating non restorable teeth-Periodontal and restorative considerations. *J Periodontol* 47: 203-16.
- Ortolan SM, Strujic M, Aurer A, Viskic J, Bergman L, et al. (2012) Esthetic Rehabilitation of Complicated Crown Fracture Utilizing Rapid Orthodontic Extrusion and Two Different Restoration Modalities. *Int J Clin Pediatr Dent* 5: 64-7.
- Weissman J (1983) Orthodontic extrusion of endodontically treated anterior teeth. *Can Dent Assoc J* 11: 21-4.
- Pontoriero R, Celenza F, Ricci G, Carnevale GP (1987) Rapid extrusion with fibre resection: A combined orthodontic -periodontic treatment modality. *Int J Period Rest Dent* 7: 31-43.
- Simon JHS, Kelly WH, Gordan DG, Ericksen GW (1978) Extrusion of endodontically treated teeth. *JADA* 97: 17-23.
- Reitan K (1959) Tissue re-arrangement during retention of orthodontically rotated teeth. *Angle Orthod* 29:105-13.
- Malmgren O, Malmgren B, Frykholm A (1991) Rapid orthodontic extrusion of crown root and cervical root fractured teeth. *Endod Dent Traumatol* 7: 49-54.