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CASE REPORT

Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor – The sling shot method

A. Sumathi Felicita *

Department of Orthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, 162, Poonamallee High Road, Chennai, Tamil Nadu, India

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KEYWORDS

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Abstract The aim of this paper is to evaluate the efficacy of forced extrusion using the sling shot elastic. A 21 year adult patient reported with an Ellis Class VIII fracture of the maxillary right lateral incisor. Root canal treatment followed by a fiber reinforced composite post was placed and core build up was done. A metal button was bonded to the tooth. Begg brackets were placed from the second premolar on one side to the second premolar on the opposite side. 0.016″ × 0.025″ stainless steel was placed in ribbon mode. The ligature wire was placed as a sling shot from the button on the fractured tooth to the two adjacent teeth. 4 mm of extrusion was achieved and there was no evidence of root resorption. Forced extrusion was achieved in four months. The sling shot method is a very effective method of ligation. Light forces are delivered over a long duration with definitive results as compared to the inconsistent force delivery with conventional extrusion mechanics.

1. Introduction

An Ellis Class VIII tooth fracture involves loss of the crown en-masse and its replacement. There is fracture of the crown of the tooth below the gingival attachment. Restoration of such a tooth will violate its biologic width resulting in chronic pain, chronic inflammation of the gingiva and unpredictable loss of alveolar bone (Koyuturk et al., 2005). Hence, sufficient tooth structure is required above the attached gingiva. This can be achieved by orthodontic extrusion of the fractured tooth. Forced orthodontic eruption of the tooth will result in sound tooth structure occlusal to the gingival margin and help preserve the junctional epithelium. Orthodontic extrusion of the tooth can be done by several ways with several advantages and disadvantages. The aim of this paper is to evaluate the efficacy of the sling shot method of ligation for forced extrusion of fractured maxillary lateral incisor.

2. Case report

A 21-year-old male patient reported to the hospital with fracture of the right maxillary central and lateral incisor due to trauma. Intraoral examination revealed crown-root fracture with pulp exposure in 12 (Fig. 1). There was an Ellis Class VIII

* Address: Department of Orthodontics, Saveetha Dental College, Saveetha University, 162, Poonamallee High Road, Chennai 600077, Tamil Nadu, India.
E-mail address: sumifeli@hotmail.com.
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fracture of 12 with loss of the crown en-masse with the fracture margin extending sub-gingivally (Fig. 1). The root could be felt with an explorer below the gingival margin. 11 showed an Ellis Class III fracture involving the enamel and dentine with pulp exposure (Fig. 2).

2.1. Treatment objectives

- Root canal treatment in 11, 12
- to rebuild the fractured and traumatized 12 with fiber reinforced post and composite resin core
- Orthodontic extrusion of 12
- Restore the tooth with porcelain fused to metal crown

2.2. Endodontic treatment

Endodontic treatment was done in both 11 and 12 (Fig. 3). The morphology of the crown of 11 was restored with composite restoration. Root canal preparation was done (Fig. 4) and a glass fiber post was inserted into the root canal of 12 (Fig. 5), luted with adhesive resin and composite resin core was built up.

2.3. Orthodontic extrusion, follow up, retention protocol and restoration of coronal structure

Orthodontic Begg brackets were bonded on the teeth from 15 to 25 (Fig. 6). 0.016 Niti arch wires were placed for initial levelling and aligning. This was followed by a $0.016'' \times 0.022''$ stainless steel arch wire placed in ribbon mode (Fig. 6). Orthodontic extrusion of the tooth was done by bonding a button on the labial aspect of the composite core using a sling shot elastic (Fig. 6). A sling shot elastic is an elastic thread placed from the button placed on the lateral incisor to the base arch wire on the two adjacent teeth (Fig. 6). The elastic thread was tied around the Begg bracket placed in 13 to the button placed on 12 around the Begg bracket in 11. This method of ligation was contemplated compared to the conventional method of vertical ligation (Fig. 7).

The patient was reviewed once a month. Elastic thread was changed each appointment. Loosening of the tie was not observed. The treatment duration was 4 months. The extruded tooth was retained on the same arch wire for two months to minimize relapse. This was followed by gingivoplasty to improve esthetics and fiberotomy to improve stability. Crown preparation was done on the resin core (Fig. 8) and porcelain fused to metal crown was cemented (Fig. 9).

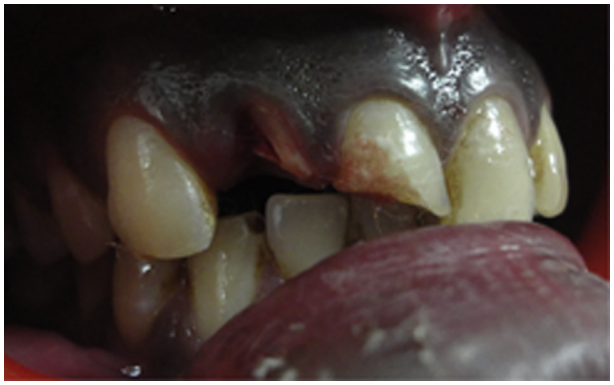

Fig. 1 Intraoral pre-treatment photograph with an Ellis Class VIII fracture of 12 and Ellis Class III fracture of 11.

Fig. 2 Radiograph showing a Ellis Class III fracture of 11 involving the enamel and dentine with pulp exposure and part of 12 with fracture at the gingival margin.

Fig. 3 Completion of root canal treatment in 11 and 12.

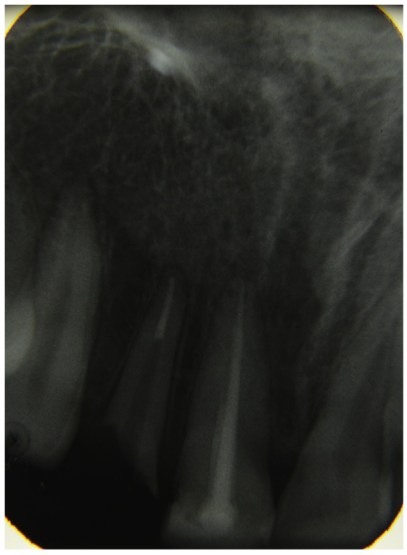

Fig. 4 Preparation of root canal for cementation of a fiber reinforced composite post.

Fig. 5 Fiber reinforced composite post placed in the root canal.

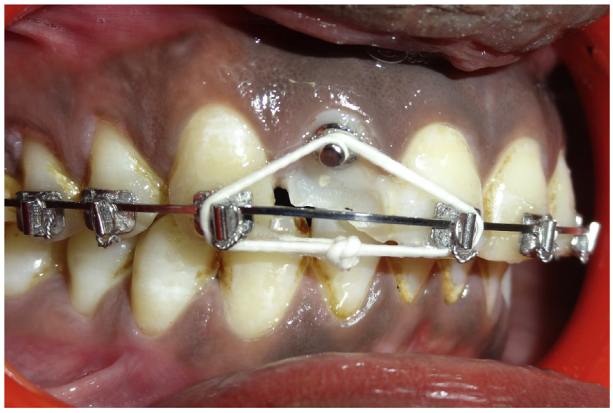

Fig. 6 Begg bracket placed from 15 to 25. 0.016″ × 0.025″ stainless steel arch wire placed in ribbon mode. Sling shot elastic placed for extrusion of 12.

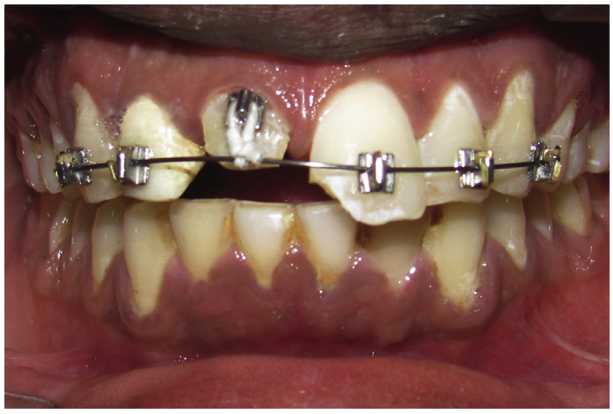

Fig. 7 Showing conventional method of elastic ligation for forced extrusion.

Fig. 8 Crown preparation done in 12 after forced extrusion.

Fig. 9 Porcelain fused metal crown cemented 12.

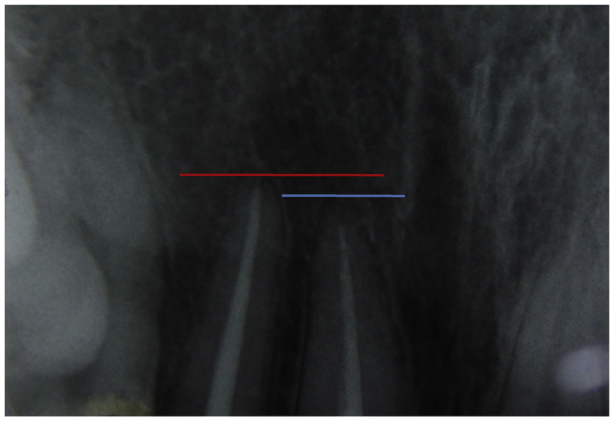

Fig. 10a Pre-treatment intraoral periapical radiograph showing root of 12 apical to the root of 11.

2.4. Comparison of pre-treatment vs post-treatment change

Comparison of pre-treatment and post-treatment intraoral findings showed no evidence of discrepancy in the height of gingival margin of 12. Comparison of radiographs taken prior to treatment (Fig. 10a) and at the end of treatment (Fig. 10b) showed that root apex of 12 had moved coronally by 4 mm when compared with the root apex of 11. No evidence of root resorption was noted.

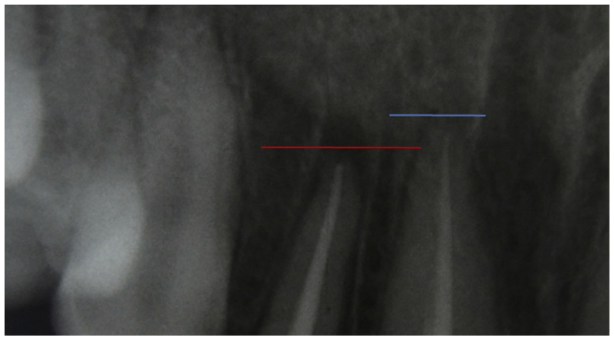

Fig. 10b Post-treatment intraoral periapical radiograph showing root of 12 coronal to the root of 11 following orthodontic extrusion of 12.

3. Discussion

Fracture of the maxillary anterior teeth occurs frequently in young patients (Andreasen, 1981). Restoration of the fractured tooth is a better option compared to extraction of teeth (Goldson et al., 1981). Preservation of a tooth with fracture and loss of the crown en-masse is a challenging task.

3.1. Different treatment modalities for treatment of fractured anterior teeth (Calıskan et al., 1996)

These include crown lengthening with osteotomy and gingivectomy, orthodontic extrusion and surgical extrusion. Crown lengthening with osteotomy and gingivectomy may result in varied gingival heights between adjacent teeth compromising esthetics. It also results in loss of supporting bone with variation in the length of the clinical crowns between adjacent teeth (Smidt et al., 2005). Surgical extrusion is invasive. It is associated with infection, mobility of the tooth, marginal bone loss sometimes with failure of the procedure with subsequent extraction of the tooth. Orthodontic extrusion on the other hand has several advantages. It is an effective method to move the fractured tooth occlusal to the gingival margin, maintains the biologic width and enables proper finishing of margins of the restoration. The disadvantage is that it is time-consuming. Orthodontic extrusion can be done in several ways.

3.2. Different methods of force application for orthodontic extrusion

Orthodontic extrusion can be performed on a stiff arch wire with elastic thread, stainless steel ligature on a light arch wire, flexible arch wire and an elastic thread and piggyback Niti on stiff base arch wire.

Use of a stiff arch wire and elastic thread can be divided into vertical elastic tie and sling shot elastic. A stiff arch wire and elastic thread with vertical tie results in the elastic tie being close to the line of the arch. A shorter piece of stretched elastic will have a very short range with risk of applying excessive pressure initially. The traction applied directly from the attachment to the arch wire is inefficient, requires frequent changes with very slow response.

Use of a stiff arch wire and sling shot elastic thread results in a greater length of elastic thread thereby increasing the range of traction force. The lateral displacement of an elongated elastic thread produces a potentially greater range of movement within optimum limits. It also increases the effectiveness of the force with controlled and measurable forces delivered over a longer duration of time.

Disadvantages of vertical elastic thread are that the knot tends to loosen and much of the original force of the tie will be lost in this loosening. Elastic thread has a rapid and high degree of force decay, the force levels decay below that required for tooth movement in one to three weeks, depending upon the amount of tension initially applied (Lu et al., 1993; Storie, 1994).

Other methods of orthodontic extrusion like the stainless steel ligature on a flexible arch wire produces an extrusive force due to displacement of the arch wire. But, distortion of a flexible arch wire will bring about an alteration in the horizontal and vertical planes with unwanted change in the form of the dental arch and an uneven occlusal plane.

A flexible arch wire and an elastic thread can be counterproductive (Shapira, 1981). The elasticity of the thread will be neutralized by the deflection of the flexible wire and tooth movement will not be satisfactory and will offer no physical advantage over a steel ligature. A piggyback Niti on a stiff base arch wire is expensive and time consuming. Therefore, use of a stiff arch wire with a sling shot elastic thread appears to be more effective.

3.3. Magnitude of force application and prevention of relapse

20–30 gms of force is the optimum force required for extrusion (Bulem et al., 2008). Remodelling of bone at the end of orthodontic extrusion causes new bone formation which occurs at about 4–5 weeks after orthodontic extrusion (Andreasen et al., 1994). Fiberotomy of the supracrestal periodontal fibers was performed to prevent relapse due to the stretching of the marginal and apical periodontal fibers. Sometimes remodelling continues for about 3–5 months after the completion of orthodontic treatment (Reitan, 1969).

3.4. Highlights of the present case

- Extrusion of 12 did not produce any undesirable movement of the adjacent teeth as a stiff $0.016'' \times 0.022''$ stainless steel arch wire was placed.
- $0.016'' \times 0.022''$ stainless steel wire placed in ribbon mode in the Begg bracket offered greater labial lingual control of the tooth.
- Offset bend in the arch wire is not required.
- No additional anchorage was needed.
- Begg brackets were used. Hence, was cost effective compared to the standard edgewise brackets.
- Comparison of intraoral periapical radiograph showed about 4 mm extrusion of 12 with no evidence of root resorption.
- The gingival heights were at the appropriate level between the lateral incisor, the canine and the central incisor.

4. Conclusion

- Extrusion of 12 did not produce any undesirable tooth movement.
- No additional anchorage or offset bends were required.
- 4 mm of extrusion was achieved with no evidence of root resorption.
- The metal ceramic crown was esthetically pleasing with proper gingival heights between adjacent teeth.
- Therefore, the sling shot elastic proves to be a better method of ligation for orthodontic extrusion.

Conflict of interest

The authors declare that there are no conflict of interest.

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