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Multidisciplinary approach to traumatized teeth: a case report

CASE REPORT

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Abstract – Treatment of crown fractures often requires a multidisciplinary approach. In the anterior teeth, reestablishment of proper esthetics and function is quite important for the patient. However, crown-root fractures with fracture line below the gingival attachment or alveolar bone crest presents restorative difficulties. This case report presents a cervical tooth fracture that had been treated with minimal invasive approach with different disciplines. The tooth had endodontic treatment and a glass-fiber post, and a composite core was accomplished. Then, the tooth was extruded to the desired level with orthodontic forced eruption before definitive restoration.

Tooth fracture below the gingival attachment or alveolar bone crest presents restorative difficulties (1). Failure to place the crown margins on sound tooth material may violate the biologic width, and should be considered a restorative failure. Orthodontic root extrusion or forced eruption is a well-documented clinical method for altering the relation between a non-restorable tooth and its attachment apparatus, elevating sound tooth material within the alveolar socket. It has some advantages over surgical crown lengthening, which is less conservative considering the sacrifice of supporting bone and the negative change in the length of the clinical crowns of both the tooth and its neighbors (2). Orthodontic extrusion is usually achieved with fixed appliances. During orthodontic treatment, 20–30 ***g*** of force is required for extrusion. However, some clinicians prefer using higher forces of 50–60 ***g*** for the rapid extrusion of traumatized teeth. This rapid extrusion involves stretching and readjustment of the periodontal fibers without any marked bone remodeling. Rapid extrusion causes little or no coronal shift of marginal bone, which may complicate tooth preparation. That is why fiberotomy of the stretched supracrestal periodontal fibers has to be performed to avoid any relapse (3).

For orthodontic extrusion, usually prefabricated cast metal posts or metal buttons attached to the coronal portion of the tooth are used. Due to the reflection of metal shade through the remaining tooth structure, these posts present some esthetic concerns (4). The introduction of fiber posts by Duret et al. in 1990 (5) offered an esthetic solution for the restoration of traumatized teeth. Moreover, laboratory-based studies have shown that these posts yielded high tensile strength (6) and modulus of elasticity (7–9) similar to dentine. Previously, rigid metal posts were found to be resistible to lateral forces without distortion. However, they transferred the stresses to less rigid dentine, causing potential root cracking and fracture (10, 11). It was thought that fiber posts flex under load distributing stresses between the post and the dentine (5). Apart from this approach, failure caused by root fracture may be the possible outcome of excessive amount of tooth structure removed during the placement of metallic posts (12).

The objective of this case report is to present the reconstruction of a traumatized and fractured left maxillary incisor by building a composite resin core with a glass-fiber post to perform orthodontic extrusion before placing porcelain fused to metal crown as the final restoration.

Case report

The left maxillary incisor tooth of a 20-year-old male patient was fractured by trauma. Intraoral examination revealed that the upper left central incisor sustained a crown-root fracture with a pulp exposure. The fracture line extended below the gingival level at the palatal surface of the tooth. The cementoenamel junction could be felt with an explorer below the gingival margin. The adjacent teeth showed no sign of mobility, and electric pulp responses gave positive readings.

The tooth had been first endodontically treated by conventional methods. Orthodontic extrusion of the tooth was required as the fracture level was below the gingival margin at the palatal surface (Fig. 1). Before the orthodontic extrusion was initiated, a glass-fiber post

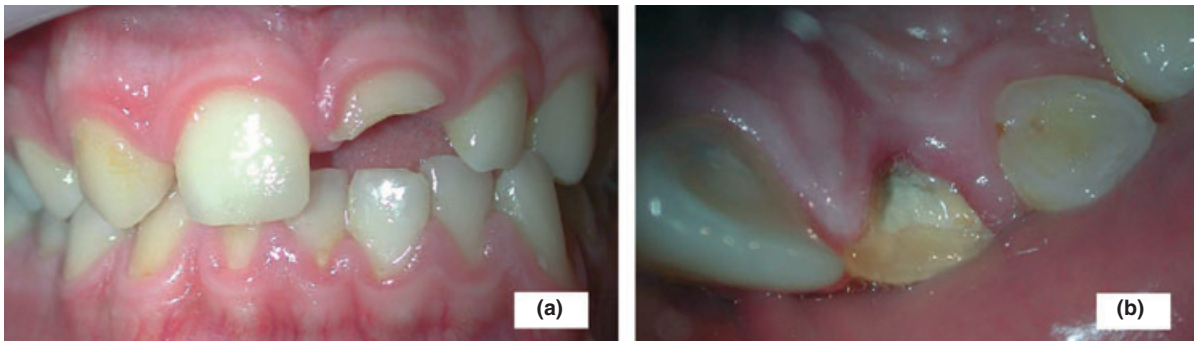

Fig. 1. (a, b) Intraoral views before treatment.

was inserted to the root canal, and composite resin core was built up instead of constructing a conventional post core system for anchorage (Fig. 2). Later, the orthodontic bracket was bonded on the tooth that was formed by the resin composite core. For the orthodontic extrusion of the fractured left maxillary incisor tooth, 0.18 slot straight wire brackets were attached on right maxillary incisor, left maxillary lateral, and left maxillary canine teeth. For the leveling, 0.016 nitinol archwires were placed at the first appointment (Fig. 3). At the second appointment, a 0.016 stainless steel arch wire with a step-down bend at the left incisor area was placed. At the third appointment, this arch wire was replaced with 0.016×0.022 rectangular, rigid stainless steel arch wire. The step-down bends were increased at each appointment until the desired extrusion level was attained (Figs 4 and 5). The total extrusion time was 4 months. The extruded tooth was retained with the same arch wire for 12 weeks to prevent any relapse. At the end of a 12-week retention period, gingivectomy and fiberotomy

Fig. 2. Periapical radiograph after glass-fiber postplacement.

Fig. 3. Composite resin crown prepared for orthodontic bracket attachment.

Fig. 4. Intraoral view at the beginning of orthodontic therapy with the horizontal lines showing the insizal edges before extrusion.

were performed for lingual margin exposure and better esthetics. Afterwards, the resin core build-up was reduced in size and prepared for permanent restoration. Porcelain fused to metal crown was constructed over the fractured tooth with crown margins on sound tooth structure (Fig. 6).

Discussion

Horizontal tooth fractures are observed quite frequently in maxillary anterior region and in young male patients (13). Fractures at the cervical region occasionally result in loss of coronal part of the tooth, which creates esthetic problems for the patient. Therefore, traumatized anterior teeth require quick repair for both functional and esthetic needs. The possibility of saving and reconstructing teeth with cervical crown-root fractures is the preferred method of treatment to extraction of the remaining tooth structure (14). However, the presence of

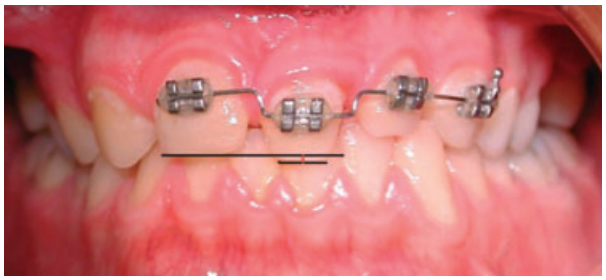

Fig. 5. Intraoral view at the end of orthodontic therapy with the horizontal lines showing the extrusion level.

Fig. 6. Final restoration with porcelain fused to metal crown.

fracture line below the gingival attachment or alveolar bone crest presents restorative difficulties for the clinician. The possible treatment alternatives include surgical or orthodontic extrusion of the root, osteotomy, and gingivectomy (15). Surgical extrusion is rather an invasive technique that may cause complications related to surgical procedure or postoperative marginal bone loss. In this case, osteotomy and gingivectomy would affect the esthetics in the anterior region due to retraction of the gingival tissues.

Vertical forced eruption by orthodontic attachments has been used by many clinicians for the elevation of the fracture line above the epithelial attachment so that proper finishing margins can be prepared. Orthodontic extrusion was the least invasive choice of treatment despite its requirement of a certain treatment time and a long retention period. Some clinicians prefer using rapid orthodontic extrusion for the treatment of traumatized teeth. However, rapid extrusion involves stretching of the periodontal fibers without any marked bone remodeling. Rapid tooth movement may cause a relapse before apical fiber reorganization. Thus, fiberotomy to the stretched supracrestal periodontal fibers has to be performed. On the other hand, it has been shown that new bone formation can be seen after 4–5 weeks of orthodontic extrusion (16). Reitan (17) has shown that the marginal and apical periodontal fibers remain in a stretched mode 3–5 months after orthodontic tooth movements. Therefore, it is advisable to perform fiberotomy of the supracrestal periodontal fibers to minimize the risk of relapse and to reduce the retention period. For the treatment of the present case, a slower extrusion rate was preferred together with a retention period of 12 weeks, and combined gingivectomy and fiberotomy was performed to prevent any possible relapse. However, long-term follow-up is needed to evaluate the stability of the case.

During the extrusion of the left maxillary central incisor, some intrusion was observed in the neighboring teeth because orthodontic tooth movement is a reciprocal type of movement in which anchorage teeth also react to the applied force. Anchorage reinforcement is needed in cases where no movement of the neighboring teeth is desired. However, reciprocal intrusion of the right maxillary incisor was favorable for this Trauma to the anterior teeth may result in loss of gross coronal material, and even loss of the whole crown in some instances. The remaining tooth material often needs endodontic treatment. Restoration with a post after endodontics provides retention of a core to support coronal restoration especially with extensive tooth loss. Traditionally, these posts have been cast or machined from metals, and can be grouped as active or passive posts (18). Active posts derive their primary retention directly from the root dentine by the use of threads. Passive posts rely primarily on luting cement for their retention. It is acknowledged that the placement of traditional metal posts weakens the roots and leads to root fracture, or may lead to caries that may cause irreversible failure and extraction of tooth in some cases (5). 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 (9). Lanza et al. stated that glass-fiber posts are compatible with Bis-GMA resin used in bonding procedures, and so they can be bonded to the root canal with adhesive resin cement and new generation adhesive systems. These adhesive systems transmit the stresses between the post and the root structure, reducing stress concentration and preventing fracture (9). In a retrospective study of the clinical performance of 1314 placed fiber posts, the survival rate was 96.8% (11). In a 2-year prospective study on 225 patients treated with fiber posts, Monticelli et al. (12) have reported a survival rate of 96%. No root or abutment fracture was observed, and no postdislodgement or crown debonding was recorded (12). Five-year results of clinical comparison of endodontically treated teeth restored with amalgam or fiber posts and resin composite on 219 patients showed comparable results, with other clinical studies being 90% durability. Adhesive restorations were found to be more effective than amalgam in preventing root fractures (10).

For the treatment of the present case, a composite core was built up over the fiber post to provide esthetically pleasing temporary restoration to the patient and to attach brackets for controlled tooth movements. Orthodontic extrusion of the fractured teeth can be managed by different methods like elastic chain or threads; however, the control of tooth movements in all

directions cannot often be possible with elastic attachments fixed to the post only. The composite core build-up used in this case enabled the placement of a bracket to the tooth, which provided a three-dimensional control in tooth movements.

Conclusions

The construction of a resin core for orthodontic anchorage has an esthetic advantage over conventional post-core systems, especially for young patients. The placement of the final restoration after orthodontic extrusion resulted in good esthetics and periodontal health postoperatively.

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