Case Report

Orthodontic extrusion of subgingivally fractured incisor before restoration. A case report: 3-years follow-up

Koyuturk AE, Malkoc S. Orthodontic extrusion of subgingivally fractured incisor before restoration. A case report: 3-years follow-up. Dent Traumatol 2005; 21: 174–178. © Blackwell Munksgaard, 2005.

Abstract – Orthodontic forced eruption may be a suitable approach without risking the esthetic appearance in tooth fracture below the gingival attachment or alveolar bone crest. Extrusion of such teeth allows elevating the fracture line above the epithelial attachment and so the proper finishing margins can be prepared. Restoration after orthodontic eruption may present a more conservative treatment choice in young patients compared with the prosthetic restoration after extraction. This case describes a multidisciplinary approach using the orthodontic forced eruption facilitating the composite restoration of a fractured upper permanent central incisor.

Tooth fracture below the gingival attachment or alveolar bone crest presents restorative difficulties. Subgingivally fractured incisors pose a true therapeutic dilemma to the dental team. Because, statistically, most dental injuries occur before adult life, it is usually the pediatric dentist who is confronted with the decision as to what treatment option to choose. As in all cases involving pediatric patients, the decision is not only based on the technical possibilities available, but also on behavior management, including the continual guidance and remotivation of the patient throughout a comprehensive and multidisciplinary treatment plan (1-4). Loss of the coronal part of permanent incisor in a young patient may create esthetic needs and severe emotional problems (4). Extraction must not be the first choice of treatment for the fractured and extremely broken down young permanent teeth in the anterior region and alternative treatment modalities must be considered. Orthodontic extrusion and surgical extrusion to save such teeth has been recommended (3, 5, 6). Heithersay in 1973 (7)

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Key words: apexogenesis; dental trauma; esthetic treatment; orthodontic extrusion

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discussed orthodontic forced eruption, the treatment chosen for the case presented here. Vertical forced eruption may be a suitable approach without risking the esthetic appearance. Extrusion of such teeth allows the fracture line to be elevated above the epithelial attachment and so the proper finishing margins can be prepared.

Teeth that sustain severe trauma in a relatively early developmental root stage always present a guarded prognosis. The degree of root immaturity makes any apexification attempt difficult. Furthermore, even if the apexification procedure is successful, the tooth has weak root dentinal walls that may be subject to a future fracture (8, 2). In an immature tooth, root development will continue if the radicular pulp remains healthy. But if it dies, the root apex will stay open and this will present a problem in endodontic treatment (9).

The rapid extrusion involves stretching and readjustment of periodontal fibers, without marked bone remodeling because of the fast movement. It can thus be achieved without a coronal shift of marginal bone, thereby facilitating the coronal restoration because there is no need reshape bone (5, 10).

This case describes a multidisciplinary approach using the orthodontic forced eruption facilitating the composite restoration and calcium hydroxide pulpotomy for apexogenesis of a fractured upper permanent central incisor.

Case report

In May 2000, a 9-year-old child had applied to our clinic with complaint of tooth fracture and bad esthetic appearance of his upper right central incisor 1 day after dental trauma (Fig. 1). Intra-oral and radiographic examinations revealed cervical root fracture and pulp exposure of the immature central incisor (Fig. 2). Calcium hydroxide (Sultan, Englewood, NS, USA) pulpotomy for apexogenesis, orthodontic forced eruption and composite resin restoration were planned as the treatment approach.

For the first step, calcium hydroxide (Sultan) pulpotomy was performed for apexogenesis and a button was bonded to the coronal portion of the tooth by using a hybrid composite resin system (Quadrant Universal LC, Cavex, the Netherlands) (Fig. 3).

Maxillary left central incisor and right lateral incisor were bonded with 0.022-inch standard brackets. A heavy stabilizing arch wire that bypass fractured root was bent between the left central incisors and right lateral incisor. The fractured root bypass was stepped out to the buccal in order to avoid any interference with the erupting root. Superelastic wire was overlaid on the main arc wire and tied directly on the button (Fig. 4). The force along the long axis of the root of the tooth was performed by a simple extrusion mechanism and an extrusion of 2–3 mm was obtained within



Fig. 1. Preoperative view.



Fig. 2. Preoperative radiograph.



Fig. 3. Button attaching in the coronal portion.

6–8 weeks. After extrusion was completed (Fig. 5), the tooth was restored by using a hybrid composite resin system (Fig. 6). The patient was examined every 3 months during the follow-up period of 18 months.

The patient was periodontally healthy during the follow-up period. No relapse occurred by the end of the 18th month. The tooth did not show any signs of the root resorption during the treatment and follow-up periods. The periapical radiograph at 18 month showed that the root formation was complete (Fig. 7). A root canal was performed on the tooth to allow for the placement of a post. After a 3-year follow-up period, the gingival sulcus depth was normal. No relapse was present during the follow-up period, nor did the tooth show any signs of the root resorption during follow-up periods (Fig. 8).

Koyuturk & Malkoc



Fig. 4. Buccal view after superelastic wire on the button tying.



Fig. 5. Buccal view of tooth after the tooth extrusion completing.



Fig. 6. Buccal view of tooth after composite resin system.

Discussion

Pulpotomy implies removal of all coronal pulp. The aims of pulpotomy of a vital tooth are to remove inflamed pulp tissue and to preserve healthy radi-



Fig. 7. Radiographic view after the root formation completing.



Fig. 8. Radiographic view after the permanent sealing.

cular pulp. In an immature tooth, root development will continue if the radicular pulp remains healthy (9). Vital pulpotomy has long been established as the treatment for an immature tooth that has sustained a fracture involving pulp, and has been shown to be highly effective (11). In this case, the calcium hydroxide pulpotomy was used for vital pulpotomy. Thus, the root development was sustained after trauma. The tooth remained asymptomatic and showed no periapical pathologic changes. After a periapical radiograph showed that the root formation was complete, a root canal treatment was performed to facilitate the fabrication of a post. The decision to choose orthodontic forced eruption as the final treatment modality was influenced by several considerations. If extraction were performed, a removable appliance is uncomfortable and must be worn until the patient is 18-years old. The associated potential for plaque retention increased the caries risk of adjacent teeth. In addition, the need to wear a removable prosthesis in place of a tooth may cause psychological stress (12).

The changing gingival marginal height and the enlarged pulp chambers of the adjacent teeth contraindicate preparation of a fixed prosthesis in a patient at this age (12). Crown lengthening procedures through orthodontic extrusion for subgingivally fractured teeth are modern treatment alternatives to be considered.

Treatment options with preservation of the root; crown lengthening procedure - to prevent inconsistent bone levels and the resulting periodontal complication, the surgical procedure must be included to the adjacent teeth (7, 13). This results in a severe esthetic problem in the anterior area. Therefore this treatment option should be reserved for the posterior region, for shallower fractures, or for patients needing only palatal gingivectomy and ostectomy. Surgical repositioning: Tegsjo et al. (14) described a surgical one step procedure, intraalveolar transplantation, to extrude a deep fractured root in a position accessible for restoration. The values of this method on a long-term basis are not yet clear (1). Orthodontic forced eruption: because of increased plaque retention, oral hygiene plays a key role in the decision whether to perform orthodontic treatment (12). In this reported case, we felt that despite previous neglect, the patient was motivated to improve oral hygiene and to undergo comprehensive dental care.

Eruption of a fractured root has been achieved by many techniques. Chain elastics or elastic threads are used to deliver a single erupting force to the root and are attached directly to the main arch wire. These techniques have significant effects, such as tipping of the adjacent teeth if the main arch wire is deflected, and providing only poor control of the fractured root. This appliance design also has a high load deflection rate because of the rapid decay of the force delivered by the elastics and necessity of using very rigid arch wire to avoid deflection. Superelastic wires are able to withstand great deflection without significant deformation and can be placed directly into the attachment of the fractured root. By using a root bypass arch wire, it is possible to distribute the undesired forces and moments to a larger number of teeth and therefore minimize the clinical side effects (15).

In general the clinical crowns of the maxillary central incisors are longer than those of the lateral incisors but shorter than the canines. The free gingival margin of the anterior teeth has a certain natural contour, which we accept as esthetic. If a central incisor is fractured and allowed to erupt, the free gingival margin will follow the erupting tooth and the tooth will appear shorter. If the difference in crown length and gingival contour is substantial, the esthetic appearance of the anterior teeth can be unsatisfactory. The discrepancy in crown length is accentuated when lateral incisors are substituted for central incisors or when maxillary canines are substituted for lateral incisors (16). Through the extrusion of the remaining root of tooth, the clinical crown heights and gingival contours can be made more esthetic.

The normal overbite and over-jet, as well as the skeletal-dental class I morphology represented no contraindication for the planned procedure. The amount of extrusion estimated to necessity, considering the 'biologic width' (17, 18) was approximately 4 mm. The root length of the fractured incisor allowed the tooth to undergo the necessary amount of extrusion and still retain a crown-root ratio of approximately 1:1. This ratio is favorable for maintaining periodontal support (1). In this case, the root length of fractured incisor was enough for orthodontic extrusion.

The retention period after orthodontic extrusion has been estimated to be approximately 6 months (19), in the present patient, the radiograph showed a normal trabecular bone pattern at the apical area, a normal periodontal ligament, and a dense lamina dura. No relapse from the achieved tooth position was noted, as described with shorter retention periods.

Extraction must not be the first choice of treatment for the fractured and badly broken down young permanent teeth in the anterior region and alternative treatment modalities must be considered. It is possible to achieve a good functional and esthetic result if orthodontic movement is carried out in such cases. Orthodontic eruption plus restoration may be a more conservative treatment choice in young patients compared with the extraction plus prosthetic restoration.

Conclusion

We report a case of a multidisciplinary approach between the orthodontisst and restorative dentist to extrude and esthetically restore a tooth that had been root fractured below the attachment level. Apexogenesis was performed to ensure completed root development. The root was extruded and the tooth temporary restored with a composite resin.

Koyuturk & Malkoc

Finally when root development was complete and the root was stabilized in its correct position, it was permanently restored with a post and coronal restoration.

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