Case Report

# Adhesive fragment reattachment after orthodontic extrusion: a case report

Cengiz SB, Kocadereli I, Gungor HC, Altay N. Adhesive fragment reattachment after orthodontic extrusion: a case report. Dent Traumatol 2005; 21: 60–64. © Blackwell Munksgaard, 2005.

Abstract – In the treatment of crown fractures, adhesive fragment reattachment provides a good alternative to other restorative techniques, offering several advantages. The present paper reports a case in which the treatment of a cervical crown fracture was accomplished by reattaching the tooth fragment with a flowable resin composite. Orthodontic root extrusion was performed with a modified Hawley appliance prior to fragment reattachment. The clinical and radiographic results after 2.5 years were successful.

The dynamics of developing dentition and continuing growth of the jaws complicate prosthodontic approaches in children (1). Clinicians must, therefore, make every effort to save the teeth, function and the natural occlusion when treating young patients who confront traumatic dental injuries. In general, the preferred treatment plan for a child is the most conservative one, as the earlier the restorative cycle is initiated, the greater the number of times a restoration will need to be replaced through the years (2). Replacement of restorations usually involves the loss of sound tooth structure and possible complications capable of weakening and/or causing the loss of the tooth.

Presently, with the ever-improving composite formulations and adhesive systems, reattachment of fractured tooth fragments to a vital or non-vital tooth seem to offer an ultraconservative treatment alternative (3, 4). This technique is exceptionally advantageous for the child patient, as it does not complicate any possible future restorative approach (2). Although durability of a reattached fragment is not predictable, the literature supports successful short-term (5) and medium-term (6) results with good esthetic and functional outcome. On the contrary, fractures that extend subgingivally may complicate adhesive reSevi Burcak Cengiz<sup>1</sup>, Ilken Kocadereli<sup>2</sup>, H. Cem Gungor<sup>3</sup>, Nil Altay<sup>3</sup>

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Key words: tooth fracture; fragment reattachment; orthodontic extrusion; flowable composite; reimplantation

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Accepted 20 January, 2004

attachment. In such cases, other treatment options including tooth extrusion or crown lengthening may need to be performed prior to final reattachment (5).

The present paper reports combined treatment of orthodontic extrusion and adhesive fragment reattachment to restore the fractured crown of a previously traumatized and endodontically treated tooth.

# **Case report**

A 10-year-old boy was referred to the pediatric dentistry clinic 2 h after he fell in the schoolyard. He was in good physical condition with a noncontributory medical history. Intraoral examination revealed subluxation injury in teeth 11, 12, 21, and the absence of tooth 22 that was avulsed. There was no apparent trauma to the soft tissues. Further clinical and radiographic examinations showed that the roots, the alveolar process and the socket were free from any fracture. As the parents kept the avulsed tooth under dry conditions for 120 min, endodontic treatment was performed before reimplantation. Accordingly, the tooth was first removed of necrotic periodontal ligament. Following extirpation of the pulp, the tooth was placed in a 2.4% sodium fluoride solution (acidulated to pH 5.5) for 15 min. The root was then obturated with gutta-percha and selaer after which the tooth was rinsed with saline for 2 min. During the rinsing procedure, the clot in the socket was gently washed out by sterile saline irrigation. Following replantation with gentle pressure, the teeth were splinted with a semi-rigid 0.9 mm fisherman spring, bonded between the upper maxillary primary molars. On the first week recall, the thermal test revealed loss of vitality in teeth 12, 11, and 21, which called for extirpation of the pulps followed by application of calcium hydroxide into the root canals (Fig. 1). On the postoperative sixth week, the splint was removed. As there were early signs of inflammatory root resorption in teeth 12, 11, and 21, calcium hydroxide was reapplied, changing the dressing every 8 weeks. After 4 months, inflammatory resorption had ceased and root canals were filled permanently with gutta-percha points and sealer. The unmanageable replacement resorption in tooth 22 resulted in the loss of the tooth 18 months following replantation.

In the second year recall, the patient came up with a cervical crown fracture on tooth 11 with the fragment in place, attached to the gingiva (Fig. 2). Due the favorable clinical root length and morphology, orthodontic extrusion of the root was initiated. The coronal fragment was gently removed and placed in saline immediately. After removal of gutta-percha to halfway down the root, a screw post was inserted and cemented into the root canal (Fig. 3). At the same appointment, impressions were taken and casts were prepared. A removable appliance comprising two Adams clasps and a labial



*Fig. 1.* Radiographic view of the luxated teeth after splinting and application of calcium hydroxide. Tooth 22 was root filled extraorally before reimplantation.



Fig. 2. Cervical crown fracture in tooth 11.



Fig. 3. Screw post cemented in the root canal. A narrowdiameter post was selected to avoid stress accumulation in the radicular dentin.



Fig. 4. The extrusion appliance in mouth, depicting the level of fracture.

bow with an occlusal offset bend loop (confronting tooth 11) was fabricated. Final adjustments were performed in the mouth. After insertion of the appliance, an elastic string was placed around the screw post and tied to the loop of the labial bow (Fig. 4). The patient was instructed to wear the appliance 24 h a day. The elastic string was changed twice a week by the clinician and approximately 3 mm of extrusion was accomplished in 7 weeks (Fig. 5). The screw post was then removed from the canal and replaced with resin composite material (Z250; 3M, St Paul, MN, USA). At the same appointment, the stored fragment was reattached to the root, using a flowable composite resin (Filtek Flow; 3M), in conjunction with a totaletch adhesive system (Single Bond; 3M) (Fig. 6). Thereafter, orthodontic brackets were placed on the fractured crown and neighboring teeth and a



Fig. 5. Seven weeks after the start of extrusion. The cervical fracture site has been entirely exposed.



Fig. 6. Radiographic view of the reattached fragment immediately after application of orthodontic brackets. Note perfect marginal adaptation.



Fig. 7. 2.5-year postoperative view.

straight archwire was applied, serving both as a means to prevent relapse of the extruded tooth and to provide proper alignment of the malpositioned traumatized teeth. After 3 months, the brackets were removed and the bonded coronal fragment was rechecked for any possible mobility. The patient has been using for the tooth uneventfully for 2 years (Fig. 7).

# Discussion

Following root canal therapy, physiologic characteristics and physical properties of dentin will change due to a decrease in immature collagen levels leading to reduced hardness and resistance to shearing (7), to dehydration resulting in decreased Young's modulus (8) and to the loss of sound tooth substance (9). Endodontically treated incisor teeth are prone to fracture, particularly in the cervical region that must withstand excessive tensile and compressive stresses (10, 11). Although physiologic and physical changes in dentin are inevitable in such teeth, excessive loss of tooth substance can be avoided by the clinician. An adequate access cavity may play role in preserving tooth integrity, particularly in luxation type of injuries where the crown is intact and caries-free.

Three distinct types of cavities that have been recommended to access pulp canals of maxillary anterior teeth are: the lingual cingulum access cavity, the lingual conventional access cavity, and the incisal straight-line access cavity (12, 13). Among these, the incisal straight-line cavity is reported to allow the best mechanical planning of the root canal walls, whereas lingual cingulum cavity is reported to be the least favorable (13). The lingual conventional access cavity allows reasonably good contact of the file with the canal walls while preserving more tooth substance compared with the incisal straight-line cavity. Thus, in the present case, a lingual conventional cavity was the preferred access to the root canal. However, coronal binding of files due to the lack of a straight-line access may have predisposed the fracture by weakening the cervical area (13). It appears that a straight-line access may better preserve integrity of traumatized incisor teeth, particularly in the cervical region.

Once a crown fracture occurs, several factors need to be evaluated before consideration of adhesive fragment reattachment. These include the adaptation of fragment to the dental remnant as well as the periodontal, endodontic, and occlusal assessments (2, 3). In the present case, adaptation of the fragment was almost perfect, enhancing the esthetic outcome. No bevels, grooves, or undercuts were performed on either the fragment or the dental remnant, as previous work has shown the effect of such preparations to be non-contributory on the prognosis and fracture resistance of the reattached fragment (2, 14).

Occlusal forces generated during protrusive mandibular movement are detrimental to the fragment-tooth remnant bonding interface (2, 3). Some authors have, therefore, advocated utilization of porcelain veneers to reinforce the tooth and prevent fragment loss (2, 3). Being considered too young to wear a fixed prosthesis, this option was delayed in the present case until the cessation of growth.

A variety of materials comprising luting cements, bonding agents alone and bonding agents with different resin composite formulations have been tested for their performance in fragment reattachment (15, 16). Studies reporting similar results obtained with different materials suggest that the material used for bonding does not appear to have a definitive impact on the success of treatment. On the contrary, Andreasen et al. have shown that materials with relatively high mechanical properties, such as resins, may offer additional support against functional stresses (17). Here, reattachment was performed with a bonding agent and a flowable resin as the bonding interface was continuous with no missing parts in the fragments. In most cases, however, a perfect adaptation may not be present, calling for the use of paste resin composite systems to achieve acceptable fracture strength as well as a more pleasant esthetic result (2).

# Conclusion

In the treatment of crown fractures, fragment reattachment offers a conservative and effective alternative to other restorative techniques, since it reduces cost and chairside time and eliminates problems of otherwise applied restorative material including differential wear, unmatched shades, and difficulty of contour and texture reproduction. Although adhesive fragment reattachment cannot be considered a durable treatment, such teeth may withstand functional and orthodontic forces until prosthetic rehabilitation is performed after the cessation of growth.

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