Sandra DePasquale

Gabriella Gatt and Alexander Azzopardi

# Tooth Fragment Reattachment following Crown Root Fracture: A Case Report

**Abstract:** A 32-year-old man presented with a complicated crown-root fracture of a maxillary lateral incisor. The fracture extended sub-gingivally, and apical to the alveolar bone crest, invading the biologic width. Flap surgery to expose the fractured root face was performed and the coronal tooth fragment reattached with a dual-cure resin adhesive. Examination six months after treatment revealed periodontal health, good aesthetics and normal function.

**Clinical Relevance:** Tooth fragment reattachment is an alternative way of restoring a fractured anterior tooth and should always be considered in treatment planning when the tooth fragment has been recovered.

**Dent Update 2008; 35: 696-699**

Crown/tooth fragment reattachment represents a useful alternative to conventional restorative techniques (eg composite resin restorations, post and core full crown restorations), offering good short-term and medium-term results.[1] It is appropriate in relatively simple and in more complex situations, particularly where the pulp and biological width are involved.[2,3,4] The advantages of this technique include the following:[2,5]

- Good aesthetic results, since the patient's own enamel appears more natural than any restoration, maintaining the original colour, shape and translucency of the tooth;
- Uniform wear of incisal edge with the adjacent teeth;
- Improved function, as the original palatal tooth contours are maintained (anterior guidance);
- Patient acceptance, as patients prefer to keep their own natural tooth tissue when possible;
- Reduction in treatment time and cost.

Gargulio *et al* [6] studied the dimensions of the tissues of gingival attachment in humans. Their findings showed the following mean values: gingival sulcus depth, 0.69 mm; epithelial attachment, 0.97 mm; connective tissue attachment, 1.07 mm. From this study, the concept of biologic width, referring to the space between the base of the gingival sulcus and the alveolar bone crest, was established. The latter was found to have a mean length of 2.04 mm. Invasion of the biologic width by a crown root fracture significantly complicates treatment. Baratieri *et al*[2] described the following difficulties encountered when treating such an injury:

- Gaining access to the margins of the tooth remnant (tooth root face);
- Obtaining adequate isolation for the operative field;
- The need to restore biologic width before proceeding with the restoration;
- The possibility of creating a gingival depression favouring plaque retention and accumulation.

This paper describes a clinical case of crown tooth fragment reattachment in an adult, in the presence of invasion of the biologic width, resulting in satisfactory periodontal health, function and good aesthetics.

## Case report

A 32-year-old man presented at the dental department, complaining of pain and mobility of the maxillary left lateral incisor, /2, following a fall. The patient was referred from the hospital casualty department, where his lacerated lower lip was cleaned and sutured. On examination, the lateral incisor was found to be mobile and tender to percussion. A periapical radiograph of this tooth (Figure 1a) and a dental panoramic tomogram (DPT) revealed no root fracture, however, clinical examination revealed a fracture line buccally at the cervical margin.

**Sandra DePasquale**, BChD, **Gabriella Gatt,** BChD, MSc(Lond) and **Alexander Azzopardi**, BChD(Hons), MPhil(Malta), PhD(Lond), Chairman, Department of Dental Surgery, Mater Dei Hospital, Tal-Qroqq, Malta.

**Figure 1. (a)** Radiograph taken on first examination showed no root fractures. **(b)** Radiograph taken the following day clearly showed horizontal crown root fracture.

The following day a further periapical radiograph of the incisor clearly showed a horizontal fracture involving the pulp (Figure 1b). The coronal tooth fragment was removed following administration of local anaesthetic. Clinical examination of the extent of the fracture at this time revealed an oblique crown-root fracture. The fracture line was at the level of the gingivae buccally, however, distopalatally it extended subgingivally and apical to the bone crest, invading the biologic width in this area.

Since the tooth pulp was exposed by the fracture, endodontic treatment was performed that same day. Pulp extirpation was carried out and the root canal filed and shaped to receive a root canal filling eventually. The root canal was then temporarily dressed with non-setting calcium hydroxide paste (Calasept, Nordiska Dental), and the access to the canal was closed with a cotton wool pledget followed by a glass ionomer cement (GIC Voco) temporary filling. The coronal tooth fragment was meanwhile stored in sterile saline, after an access cavity had been cut on its palatal aspect.

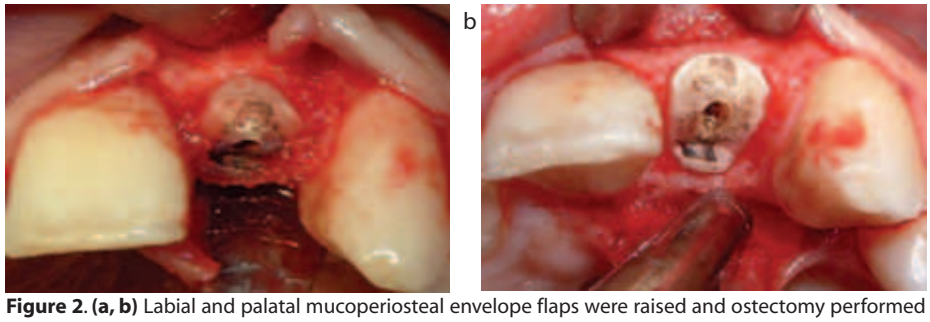

**Figure 2. (a, b)** Labial and palatal mucoperiosteal envelope flaps were raised and ostectomy performed distopalatally to render the fracture line supracrestal.

One week later, the patient attended for surgical exposure of the root face, in order to gain access to the fracture line. The temporary restoration was removed following administration of local anaesthetic. A periradicular intrasulcular incision, extending into the gingival sulcus of the adjacent teeth, was performed and labial and palatal mucoperiosteal envelope flaps were raised. An ostectomy was performed distopalatally in order to render the fracture line supracrestal (Figure 2). The amount of bone removed was dictated by the minimal amount of tooth root exposure necessary to achieve adequate isolation and allow cementation of the coronal tooth fragment.

Prior to cementation of the fragment, a gutta-percha point was placed in the root canal in order to avoid cement flowing into the canal, so as to maintain patency. The fragment was removed from the saline and tried on the exposed root face to ensure accuracy of fit. Before reattachment, the root face and the opposing surface on the coronal fragment were etched for 30 seconds with phosphoric acid, washed with an air-water spray and then dried (Figure 3). The fragment was reattached with dual cure resin-based cement (Panavia F, Kuraray Medical Inc.) following the manufacturer's instructions. Excess resin, together with the gutta-percha point, were removed before polymerization. When completely set, the resin at the margins was finished and polished with fine diamond burs. The mucoperiosteal flaps were then re-apposed and sutured (Figure 4 a–c). The root canal was thoroughly irrigated with saline through the coronal palatal access cavity and again dressed with Calasept. A cotton pledget and a GIC temporary restoration were used to close the access cavity.

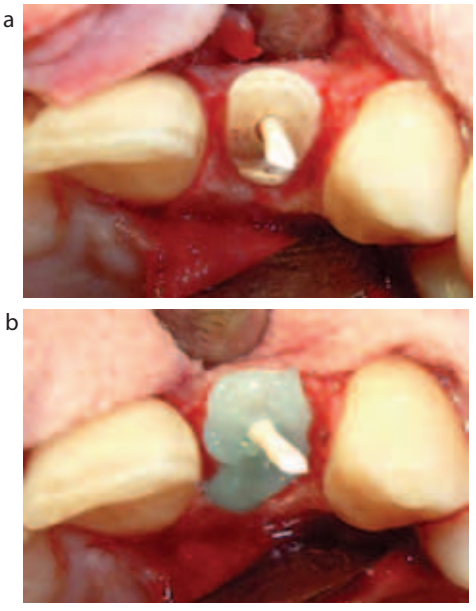

**Figure 3. (a, b)** Gutta-percha point placed in root canal to maintain patency of canal. The root face and the opposing coronal tooth surface was etched for 30 seconds with phosphoric acid.

Endodontic treatment was then completed through the access cavity in the cemented coronal tooth fragment at a subsequent appointment. The GIC temporary restoration was removed and the canal was obturated with gutta-percha and sealapex (Kerr). A GIC temporary restoration was placed in the access cavity and a post-operative radiograph was taken.

The patient was reviewed a week later to assess the success of the root canal treatment. There were no signs of infection and/or tooth mobility and the

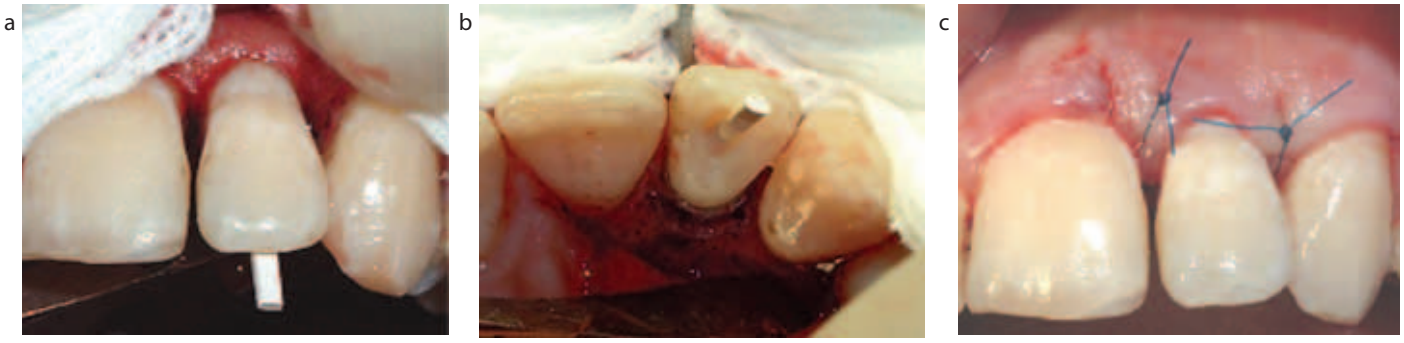

**Figure 4**. **(a–c)** Coronal tooth fragment reattached with dual cure resin-based cement (Panavia F, Kuraray Medical Inc). When completely set, the resin at the margins was finished and polished. The mucoperiosteal flaps were then re-apposed and sutured.

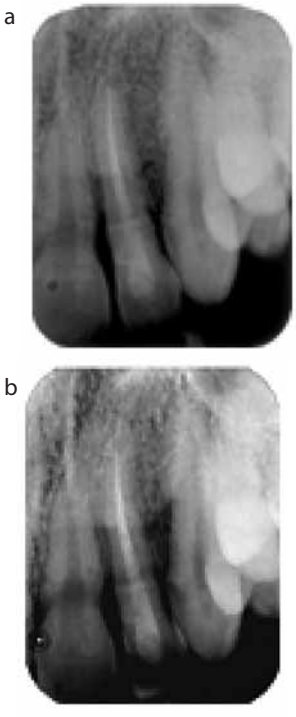

**Figure 5**. Periapical radiograph **(a)** taken at insertion of post and **(b)** periapical taken 6 months after treatment.

gingival tissue had healed well. Treatment could therefore be completed by the placement of an intra-radicular fibre-glass post. The GIC restoration in the access cavity was removed, together with enough of the gutta-percha to allow seating of a suitable diameter fibre-glass post (Parapost Whaledent) of adequate length. The root canal was prepared to receive the post and the latter was cemented using Panavia F. The access cavity was filled with a composite restoration. Finishing and polishing of the restoration were carried out, and the occlusion was checked and adjusted. A post-operative radiograph was taken (Figure 5a).

**Figure 6**. Clinical examination after six months showed good coronal aesthetics and periodontal health.

Clinical and radiographic examination after six months, and again after one year, revealed a fully functional and stable reattachment of the coronal tooth fragment to the tooth root, good coronal aesthetics and periodontal health, and no discomfort (Figures 5b and 6).

## Discussion

With modern resin adhesive systems offering better and longer-lasting results, reattachment of tooth fragments, even in cases involving pulp exposure or fractures encroaching on the biologic width, has become more feasible. Treatment options when a tooth fracture infringes the biologic width include:[5,7]

- Crown lengthening, followed by restoration with a post-crown;
- Orthodontic tooth extrusion, followed by fragment reattachment or restoration with a post-crown;
- Flap surgery without ostectomy to gain access to the subgingival margin, followed by tooth fragment reattachment;
- Ostectomy/osteoplasty, followed by tooth fragment reattachment;
- Tooth extraction, followed by the fabrication of a removable tooth and/or implant-supported fixed prosthesis.

The selected option depends on several factors, such as the site and extent of the fracture, smile line, pulpal status, degree of root formation, occlusion and the patient's aesthetic demands.[4,7]

The debate concerning treatment of a crown root fracture invading the biologic width continues, with little consensus among researchers. Flap surgery with ostectomy/osteoplasty involving adjacent teeth was thought necessary to create an adequate osseous architecture and prevent the formation of periodontal pockets.[2,6] However, this necessitates the removal of significant amounts of supporting bone from these teeth, as well as the introduction of aesthetic problems, since this will eventually inevitably result in elongation of the clinical crown.[2,3] In an attempt to minimize these shortcomings, Baratieri *et al*[2,3] suggested a modification of the conventional surgical approach in selected cases, in which ostectomy/osteoplasty is limited to the area of biologic width invasion.

It has traditionally been advocated that restoration of the biologic width becomes mandatory to ensure the restoration of periodontal health (Baratieri *et al*).[3] Maynard and Wilson[8] stated that subgingival margin placement could damage the epithelial and connective tissue attachments, encouraging

inflammation and periodontal pocket formation. Flores-de-Jocoby *et al*[9] suggested the exposure of 3 mm of healthy dental structure between the fracture line and the bone crest, to ensure maintenance of periodontal health. This technique allows 2 mm to accommodate the biologic width, and 1 mm for the restorative margin. Nevertheless, Ramfjord[10] affirmed that restoration of the biologic width does not justify the removal of this amount of bone. He stated that the amount of bone removed should be minimal, and dictated only by the need to expose the fracture line and allow adequate access for placement and finishing of the restoration. He also affirmed that the biologic width may be restored by itself, or adapt to restorations, as long as there is adequate control of dental plaque. In this case report, the treated tooth showed no signs of periodontal pocket formation after six months, in spite of the close relationship between the fracture line and the bone crest.

Post placement in an endodontically treated tooth will provide retention for the crown, if this is required. Christensen[11] stated that this was necessary when more than half the coronal tooth structure was missing on a non-vital tooth. However, post-space preparation will weaken the tooth rather than strengthen it and thus careful consideration should be given to the need for a post to retain the restoration of endodontically treated teeth.[12] It is well known that failures of post and core restorations are often dramatic, leaving few options other than extraction. Thus the need of a post in order to support the core is questionable.

Rigid posts contribute a high degree of stability, but they also increase the chances of root fracture because of the differences in flexibility of the post and root, which concentrates stresses during occlusal loading.[13] Fibre-glass posts have a similar flexibility to that of tooth tissue and, as a result, these stresses are reduced, along with the risk of root fracture. The latter also have the advantage of being tooth-coloured and do not impart a grey colour to the tooth, as could metal posts.[13]

Advances in the field of biomaterials have increased the success of tooth fragment reattachment, even when no enamel exists at the cervical margin of the tooth remnant. Thus marginal leakage, which can result in caries and subsequent failure, is minimized.[4,5,7] In this report, the fragment was cemented using Panavia F, a self-etching, dual-cure resin adhesive which produces demonstrable adhesion to both enamel and dentine. This cement also has the ability to bond to the fibre-glass post used in this report, which adds to the strength of the entire restoration. A composite band, as described in other case reports, was therefore not placed over the fracture line in this case as it was considered that adequate stiffness had been achieved and that the aesthetic result was acceptable.

The prognosis of a reattached tooth, when the fracture extends subgingivally, depends on the sealing effect of the restorative material, good adaptation of the fragment and the fit of the fracture surfaces, contour and surface finishing of the margin of the subgingival restoration. All these features will prevent plaque accumulation at the coronal tooth fragment, cement/root face interface, however, adequate plaque and diet control by the patient are essential to ensure success.[4,5]

## Conclusion

The reattachment of tooth fragments through adhesive techniques is feasible, even when the biologic width is invaded. Satisfactory aesthetics and function of fractured anterior teeth is possible, even without conventional osteotomy and osteoplasty to restore the biologic width. Care must, however, be taken in all restorative techniques, to preserve periodontal health. However, promising short-term results may appear satisfactiory, but long-term follow-up is necessary to confirm the periodontal stability of reattached teeth with fractures extending subgingivally.

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