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Reattachment of endodontically treated lateral incisor with supragingivally complicated crown fracture using fiber-reinforced post

CASE REPORT

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Abstract – Re-restoring endodontically treated teeth with complicated crown or crown root fractures is a major challenge for dental practitioners, because they can present difficulties for successful treatment. This report describes the management of supragingivally complicated crown fracture of an endodontically treated maxillary lateral incisor. The involved tooth was restored with the reattachment procedure using light transmitting fiber post. After 11 months, the reattached tooth had a satisfying function, favorable physiological and esthetic outcomes and healthy surrounding periodontal structures.

The long-term functional survival of initial endodontically treated permanent teeth was reported as 97.1% after 8 years in a large epidemiologic survey (1); however, coronal and/or radicular tooth fractures continue to remain important reasons for postendodontic tooth repairs and extractions (2, 3).

Re-restoring endodontically treated teeth with complicated crown or crown root fracture is a major challenge for dental practitioners because it requires profound knowledge in endodontics, periodontics and operative dentistry. The treatment modalities can be changed depending on the level of the fracture line and the amount of the remaining root. In cases where the fracture line extends down along the long axis of the root, extraction of the root is indicated. If the fracture involves at maximum, which means the coronal third of the root and the remaining root structure is long enough to support the subsequently applied restoration, only the fractured portion is extracted and root canal therapy is performed. If the fracture extends further subgingivally, flap surgery combined with osteoplasty/osteotomy procedures, and surgical or orthodontic extrusion of the apical fragment is necessary to convert the subgingival fracture to a supragingival one in order to restore the fracture either with a post–core covered by a porcelain or metal crown (4–6). Using the original tooth fragment to restore a fractured tooth, makes it possible to achieve good esthetics with original tooth contours, texture and radiolucency and function. Furthermore this technique is simple, faster, cost-effective and less complicated compared with other invasive prosthetic procedures (7, 8).

Nowadays a number of successful reattachment cases and studies of the crown fragment with or without using intra-canal metal anchorage are reported in the literature (9–13); however, there are only two published case reports of complicated crown root fractures that were successfully treated by the reattachment of the original tooth fragment using an intra-canal fiber post (14, 15).

The following case report describes a conservative approach for the treatment of the supragingivally complicated crown fracture of an endodontically treated maxillary lateral incisor.

Case report

A 25-year-old female patient with a non-contributory medical history was referred to our clinic immediately after she was involved in a crown fracture of right maxillary lateral incisor while biting into hard bread (Fig. 1a,b). The patient had stated that the tooth had received a conventional root canal treatment with a non-vital bleaching procedure 5 years earlier. A radiograph taken immediately after the accident showed no evidence of a periapical lesion, root or alveolar fracture and a well condensed root filling that appeared to reach a reasonable radiographic standard (Fig. 2). The tooth was asymptomatic and not tender to percussion or palpation tests. The adjacent teeth responded within normal limits to vitality testing. The patient was very apprehensive about her fractured teeth. She was assured and the condition was explained to her. Of the various treatment options explained to the patient, she preferred to retain the fractured fragment. Upon direct inspection, we determined that the fracture line of the maxillary right lateral incisor was horizontal, not extending in apical direction, from labial to palatinal surface with no visible

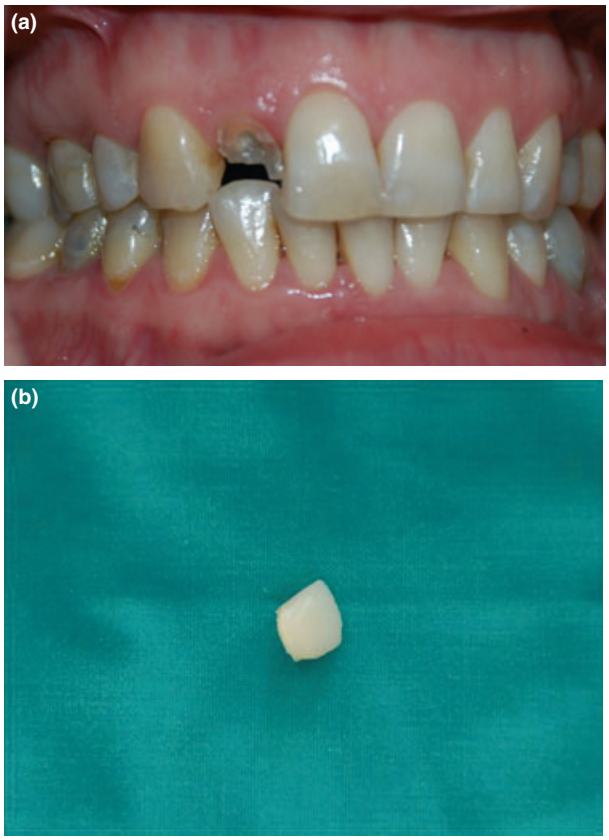

Fig. 1. (a) Preoperative frontal extra-oral view of supragingivally complicated crown fracture of maxillary right lateral incisor. (b) Fractured crown fragment.

Fig. 2. The periapical radiograph showing previously completed adequate root canal treatment and absence of periapical pathosis.

damage on the marginal periodontal tissue. The margin on the labial surface was just located above the free gingival margin while 3 mm of sound tooth structure above the palatinal margin was observed. When the coronal fragment was positioned to verify fit, it was concluded that flap surgery was not needed.

Based on the clinical and radiographic findings, a diagnosis of the supragingivally complicated horizontal crown fracture was achieved. Once the fragment was properly cleaned from any remaining old resin composite, it was stored in distilled water to be used at a later stage. Isolation was achieved using cheek retractor, cotton rolls, and saliva enjector placed in position. The postspace of previously adequately completed root canal treatment was prepared with a Unicor #3 drill (Ultradent Products Inc., South Jordan, UT, USA) and was then irrigated with EDTA, 5.25% NaOCl and distilled water respectively. After drying the postspace with sterile paper points, a light-transmitting fiber post (Ultradent Products Inc.) was tried in the canal and cut at the desired length. The fractured fragment was tried on the cut end of the fiber post. A groove was made on the fractured fragment until it fitted comfortably on the post and the fractured tooth. Once the desired fit was confirmed, it was again stored in distilled water. After acid etching of the postspace with 37% phosphoric acid (Total Etch; Ivoclar Vivadent, Liechtenstein), Syntac primer and adhesive (Ivoclar Vivadent) was applied to the root canal walls, and Heliobond (Ivoclar Vivadent) was applied to both root canal walls and the fiber post, following this the post was cemented with the help of a dual-cure resin cement (Variolink II; Ivoclar Vivadent). Any excess resin cement oozing out of canal was removed with an explorer compromising the fit of the coronal fragment. The post was then light-cured for 40 s (Elipar Freelight 2; 3M Espe, St Paul, MN, USA). After cleaning the coronal fragment with pumice and a brush, the internal aspect of the fragment was etched, rinsed, coated with Syntac primer and adhesive, lightly dried to evaporate the solvent, and light-cured. Then a resin composite (Filtex Z350 Universal Restorative; 3M Espe) was inserted on the inner lingual surface groove of the fragment and on the cervical portion of the remaining tooth. The crown fragment was carefully repositioned to the fractured tooth with firm finger pressure. After removing the excess composite, the reattached crown was light-cured for 60 s from both labial and palatal surfaces. Composite material was incrementally added to the lingual surface to reestablish natural anatomy and contour. Flame-shaped carbide burs and BP blades were used to remove excess of material and finish the restoration. The occlusion was carefully checked and adjusted. Polishing was done using Soft-Lex polishing system (Soft-Lex; 3M Espe). Routine post-treatment instructions were given in writing and patient was recalled periodically.

Clinical and radiographic examinations after 11 months revealed a stable reattachment of the fragment, excellent esthetics, satisfying function and periodontal health with no bleeding on probing (Fig. 3a–c).

Discussion

Endodontically treated teeth have traditionally been considered to be weaker. In fact, when being extracted they have greater tendency to break during extraction

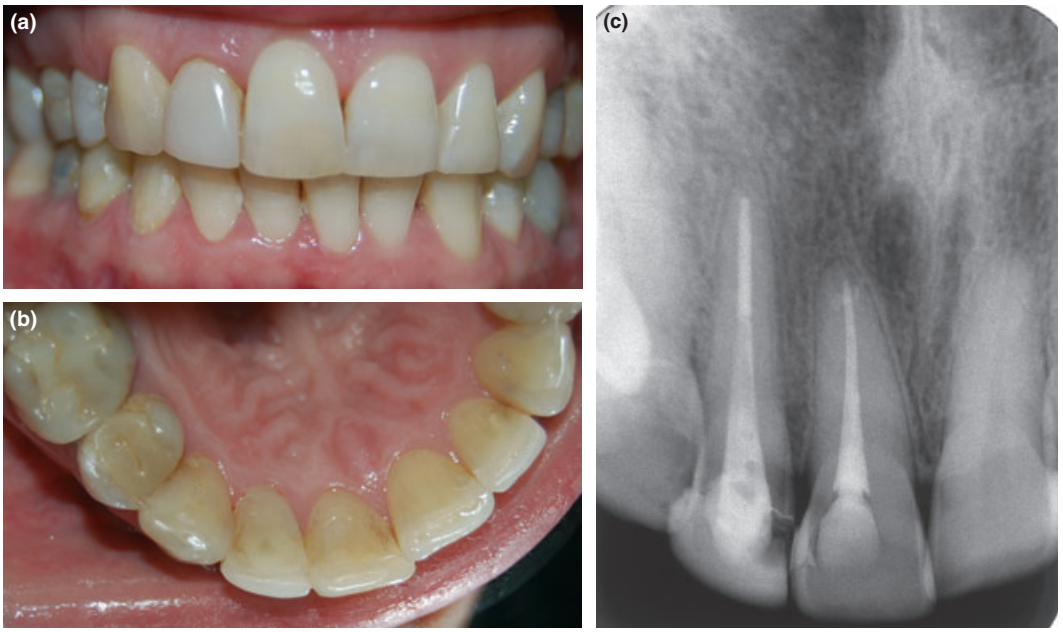

Fig. 3. (a) Frontal intra-oral view of reattached tooth 11 months after the reattachment. Note the excellent adaptation between the crown fragment and involved tooth at the cervical aspect. (b) Palatal view of restoration. (c) Periapical radiograph showing no pathological alteration in the periapical region.

maneuvers (16). Although endodontic treatment might contribute in the compromising biomechanical properties of the teeth (17), Sedgly & Messer (18) demonstrated that the physical properties such as hardness, shear resistance and breaking strength of endodontically treated teeth are similar to those of vital teeth. The solidity and breaking strength of the endodontically treated teeth weaken due to the loss of the tooth structure and this has greater importance than any possible changes affecting the proportion of collagen or the moisture content (18–20).

Maximal removal of remaining sound tooth structure during the endodontic access cavity preparation, over instrumentation of the root canal and postspace preparation might lead to higher occurrence of fractures in endodontically treated teeth. Furthermore, prolonged use of high concentrations of different root canal irrigants, bleaching agent and type of coronal restoration might increase the risk for root fracture (21, 22). In the present case, the supragingivally complicated crown fracture occurred during biting of a hard bread. The cause of this fracture might be the extensive loss of coronal hard tissue structure and non-vital bleaching.

The goal of endodontic and restorative dentistry is to retain natural teeth with maximum function and pleasing esthetics. Traditionally, custom-cast post and cores, covered by metal or porcelain fused to metal crowns, were the restoration choices of this type of complicated crown fractures. Recently, there has been a clearly observable transition from the use of metal alloy posts toward the use of fiber-reinforced resin-based composite posts with resin composite build-ups especially with teeth in the esthetic zone such as maxillary anterior incisors. Fiber-reinforced resin-based composite posts have a dentin-like modulus that allows a more even distribution of occlusal stresses in the root dentin (23), which usually have lead to fewer and less severe *in vitro* root fracture failures (24–26).

When compared to alternative treatment options such as direct or indirect composite restorations with full coverage crown, tooth fragment reattachment is a more conservative, affordable, less time-consuming treatment option with favorable psychological and esthetic outcomes. It is difficult to determine how long the restoration presented in this case report will provide a reasonable degree of esthetics and function. Various case reports of even subgingivally crown-root fractures were treated successfully by fragment reattachment without using intra-canal anchorage with different follow-up periods ranging from 1 month to 6 years (7, 11–13). The present case report shows that coronal fragment without visible damage can be used with a fiber post even if the fracture is complicated but the margins are accessible. This provided a good adaptation of the fragment, associated with the sealing effect of the restorative material used, and also a proper fit and contour of the margins as recently demonstrated in case reports (14, 15). By using a prefabricated fiber post used in conjunction with a resin based composite in endodontically treated tooth may reinforce the weakened root-canal walls, increase the fracture resistance and may also support the retention of the crown fragment.

Although a well-controlled, long-term, multicenter clinical study showed less optimistic outlook (7); it is expected that, with the improvements in composites and adhesives, these retention rates of reattached teeth would be higher today.

Conclusion

Complicated crown fractures also occur in endodontically treated teeth. Reattachment of the coronal frag-

ment to an endodontically treated tooth requires a slightly different technique which focuses on maintaining the tooth's structural integrity, while ensuring that there is enough retention form for the fragment reattachment. In the present case, fragment reattachment using intracanal fiber postsystem of supragingivally complicated crown fracture of an endodontically treated tooth was found to be successful clinically 11 months after the treatment.

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