Case Report

Multiple complicated crown-root fracture of a permanent incisor

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Abstract – The treatment of a transverse complicated and a vertical uncomplicated crown-root fractures with a horizontal root fracture of a maxillary right central incisor is presented. Coronal fragments were extracted atraumatically and gingivectomy was performed with electrosurgery to expose the subgingival fragment. The root canal was treated with calcium hydroxide to perform the healing at the fracture site. After the root fracture healing, a post was cemented into the canal and the coronal fragment was attached with a composite resin. Examination 18 months after treatment revealed good aesthetics and normal function.

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A crown-root fracture is defined as a fracture involving enamel, dentin and cementum and may be classified as either complicated or uncomplicated according to the pulpal involvement (1). While crown fractures occur most frequently in the permanent dentition, crown-root fractures account for 5% of all traumatic injuries (1-7).

In anterior teeth, these fractures are usually caused by direct trauma and often complicated in fully erupted teeth, whereas occur as cusp fractures extending variably down the root in posterior teeth (8-10). The treatment modalities can be changed depending on the level of fracture line and the amount of remaining root. In cases where the fracture line extends down along the long axis of the root, extraction of the tooth is indicated (8). However, an alternative approach to the extraction of the tooth is the vital tooth submergence in which the root fragment is retained in situ in order to preserve alveolar bone until the root can be replaced by an implant (11, 12). If the fracture involves maximum 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 (8). In the latter case, gingivectomy, 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 the original fragment or composite resins (8, 12-17).

Using the original fragment to restore crown and crown–root fractures presents some advantages over composite restorations:

- **1** The technique is generally faster, economical and less complicated;
- **2** More aesthetic restoration could be attained particularly by conserving the original translucency and contours;
- **3** The restored tooth is more resistant to stain and abrasion than a resin restoration (18–24).

This type of treatment could be successfully performed when there is a single fragment which is bigger enough to manuplate and the adaptation of the fragment and the tooth is accurate. Cause of fragment loss was reported to be due to new trauma, non-physiological use and horizontal traction (12).



Fig. 1. Intraoral view of uncomplicated crown fractures of maxillary left central and lateral incisors, and the fracture line beginning at the marginal gingiva and extending to the mesial corner of the maxillary right central incisor.

The fracture line of crown-root fractures is usually single and multiple fractures are rarely associated with a crown-root fractured tooth (8). However, in the following case a rare combination of uncomplicated and complicated crown-root fractures along with a root fracture in maxillary permanent central incisor of a boy is presented.

Case report

An 11-year-old boy was referred to the Department of Pediatric Dentistry from the Emergency Department of a University Hospital after he had fallen from the second floor and injured his anterior teeth. A medical history revealed that he had been under psychotherapy and taking sedation agents for 6 months.

A clinical examination revealed uncomplicated crown fractures of maxillary left central and lateral incisors. A fracture line beginning at the marginal gingiva of maxillary right central incisor and following a vertical course to the mesial corner of the tooth associated with pulp exposure was observed at maxillary right incisor (Fig. 1). When the tooth was gently pushed backwards, the excessive mobility of the crown and a separate vertical fracture extending down the root was observed clinically (Fig. 2, arrow). The radiographic examination clearly revealed the vertical uncomplicated crown-root fracture, a transverse complicated crown-root fracture and a horizontal root fracture (Fig. 3, arrows). The roots of maxillary central and lateral incisors were fully developed and there was no apparent periapical pathosis. The patient's parents were informed about the risk of tooth loss.



Fig. 2. Intraoral view of excessively mobile crown-root portion and a separate vertical fracture line (arrow).



Fig. 3. Periapical radiograph of the transverse complicated crown-root fracture, vertical uncomplicated crown-root fracture and a horizontal root fracture (arrows).

After performing local anaesthesia, the transversely fractured crown-root portion was separated from the remaining tooth at the palatal region by means of a high-speed handpiece with air and water spray and a tapering bur. The vertically fractured crown-root portion was removed by means of a



Fig. 4. Periapical radiograph of the definitive root canal treatment.

forceps. The pulp chamber in the transversely fractured portion was cleaned and fractured portion was stored in saline, which was changed once a week to avoid dehydration.

Following preparation and cleaning of the root canal, calcium hydroxide paste was applied. To evaluate the possibility of performing crown attachment procedure electrosurgery was used to reestablish the gingival margin and to convert the subgingival fracture site to supragingival one. The exposed root cavity was filled with zinc phosphate cement (Adhesor, Dental a.s., Prague) to prevent the new gingival margin.

The calcium hydroxide dressing was changed at 2-month intervals and maintained for 11 months. At the end of this period, healing was observed radiographically and root canal therapy was performed in a conventional manner (Fig. 4). A screw post was cemented to the root canal after 3 weeks and a retention box was prepared into the fragment. A hole was prepared with a round bur to the palatal side of the crown to facilitate the light curing of the subsequently applied composite resin. Both the fractured crown and the root fragment were etched with 37% phosphoric acid for 15 s. Dentin adhesive (Prime & Bond 2.1 Dentsply, Konstanz, Germany) was applied to both



Fig. 5. Periapical radiograph of the final restoration.

surfaces according to the manufacturer's instructions. The crown was filled with a light cured hybrid composite resin (TPH, Dentsply Caulk, Milford, DE, USA) and placed firmly against the root. Excess resin was removed with an explorer and the resin was light cured for 60 s from both facial and lingual directions (Fig. 5).

The fractured maxillary left central and lateral incisors were restored with a light cured hybrid composite resin (TPH, Dentsply Caulk).

Clinical examination was conducted at 1-month intervals. After 18 months, the restorations were functionally acceptable and aesthetically pleasing (Fig. 6).

Discussion

The alternative treatment modalities of crown-root fractures are fragment reattachment, composite resin restoration and full crown coverage (8). Up to date a number of case reports with the follow-up periods ranging from 1 month to 6 years have been documented about the reattachment of subgingivally fractured teeth (16, 25–29). These reports considered the fragment reattachment as an alternative to composite build-up and full crown coverage in children.

Complicated crown-root fractures of an incisor



Fig. 6. Intraoral view of the patient 18 months after the treatment.

Besides being a less time consuming procedure and more aesthetic restoration than a composite build-up, fragment reattachment offers an advantage over a full crown coverage in cases where the preparation of a fractured tooth is impossible or undesirable when the dentition has not reached full maturity. Thus, prosthetic restorations could be delayed for young patients (25, 26, 30). The reattached teeth serve as semi-permanent or longterm provisional restorations for children until the tooth and the pulp have developed to a stage allowing a permanent restoration (31). Moreover, as the reattached tooth is restored with its original contours and margins, the gingival problems tend to be occur less frequently than they do around crown margins (18, 26).

In this case, while the maxillary right central incisor was restored with its own portion, maxillary left central and lateral incisors were restored with composite resins as the fractured portions were lost.

In the subgingivally fractured teeth gingivectomy with or without electrosurgery and sometimes with ostectomy, surgical or orthodontic extrusion of the apical fragment and elevation of a tissue flap are the methods of choice to expose the fracture site and facilitate further treatment (8, 12, 14, 15, 25, 27-29, 32). Gingivectomy is a simple method and allows the restorations to be completed soon after injury (8). In the present case, the horizontal root fracture contraindicated any extrusion of the affected tooth. Besides, there was no need to extrude the tooth any more as the subgingivally involved fracture sites were only at the mesial and distal aspects of the tooth. Hence, gingivectomy was achieved easily only at these sites without affecting the patient's aesthetic view. The main advantage of utilizing electrosurgery for gingivectomy is the haemorrhage control, which can be established easily (27).

In this case, as the fragments in the horizontal root fracture were not dislocated, endodontic therapy could be established to the whole root. Michanowicz et al. (33) in examining histological studies of fractured roots, revealed that not the pulp but the integrity of the periodontal membrane is necessary for root repair.

In conclusion, in the present case fragment reattachment of a subgingivally fractured tooth was found to be successful clinically 18 months after treatment. With the improvement in bonding agents and restorative resins better and long lasting results may be obtained in reattachment technique. Hence, both parents and patients must be informed about reattachment procedure and should be advised to keep the fragments after any kind of trauma.

References

- Andreasen JO, Andreasen FM. Classification, etiology and epidemiology. In: Andreasen JO, Andreasen FM, editors. Textbook and Color Atlas of Traumatic Injuries to the Teeth. Copenhagen: Munksgaard; 1994. p. 151–80.
- Zerman N, Cavalleri G. Traumatic injuries to permanent incisors. Endod Dent Traumatol 1993;9:61–4.
- Häyrinen-Immonen R, Sane J, Perkki K, Malmstrom M. A six year follow-up study of sports related dental injuries in children and adolescents. Endod Dent Traumatol 1990;6:208–12.
- Onetto JE, Flores MT, Garbarino ML. Dental trauma in children and adolescents in Valparaiso, Chile. Endod Dent Traumatol 1994;10:223–7.
- 5. Nysether S. Dental injuries among Norwegian soccer players. Community Dent Oral Epidemiol 1987;15:141-3.
- Liew VP, Daly CG. Anterior dental trauma treated afterhours in Newcastle, Australia. Community Dent Oral Epidemiol 1986;14:362–6.
- Altay N, Güngör HC. A retrospective study of dentoalveolar injuries of children in Ankara, Turkey. Dent Traumatol 2001;17:201–4.
- Andreasen JO, Andreasen FM. Crown-root fractures. In: Andreasen JO, Andreasen FM, editors. Textbook and Color Atlas of Traumatic Injuries to the Teeth. Copenhagen: Munksgaard; 1994. p. 257–77.
- Howe CA, McKendry DJ. Effect of endodontic access preparation on resistance to crown-root fracture. JADA 1990;121:712–5.
- Theodossopoulou JN. Crown-root fracture of lower molarrestorative procedures. Endod Dent Traumatol 1997;13:193–5.
- Mackie IC, Quayle AA. Alternative management of a crown root fractured tooth in a child. Br Dent J 1992;173:60–2.
- Olsburg S, Jacoby T, Krejci I. Crown fractures in the permanent dentition: pulpal and restorative considerations. Dent Traumatol 2002;18:103–15.
- O'Donnell D, Wei SHY. Management of dental trauma in children. In: Wei SHY, editor. Pediatric Dentistry Total Patient Care. Philadelphia: Lea & Febiger; 1988. p. 275–98.
- Çalışkan MK, Türkün M, Gomel M. Surgical extrusion of crown-root-fractured teeth: a clinical review. Int Endod J 1999;32:146–51.
- Kocadereli İ, Taşman F, Güner SB. Combined endodonticorthodontic and prosthodontic treatment of fractured teeth. Case report. Aust Dent J 1998;43:28–31.

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- Koparal E, Ilgenli T. Reattachment of a subgingivally fractured central incisor tooth fragment: report of a case. J Clin Pediatr Dent 1999;23:113–5.
- Bondemark L, Kurol J, Hallonsten AL, Andreasen JO. Attractive magnets for orthodontic extrusion of crown-root fractured teeth. Am J Orthod Dentofacial Orthop 1997;112:187–93.
- Mader C. Restoration of a fractured anterior tooth. JADA 1978;96:113–5.
- Ehrmann EH. Restoration of a fractured incisor with exposed pulp using original tooth fragment: report of case. JADA 1989;118:183–5.
- Liew VP. Re-attachment of original tooth fragment to a fractured crown. Case report. Aust Dent J 1988;33:47– 50.
- 21. Amir E, Bar-Gil B, Sarnat H. Restoration of fractured immature maxillary central incisors using the crown fragments. Pediatr Dent 1986;8:285–8.
- 22. Burke FJT. Reattachment of a fractured central incisor tooth fragment. Br Dent J 1991;170:223-5.
- Simonsen RJ. Traumatic fracture restoration: an alternative use of the acid etch technique. Quint Int 1979;10:15–22.
- Chu FCS, Yim TM, Wei SHY. Clinical considerations for reattachment of tooth fragments. Quint Int 2000;31: 385–91.

- Spasser HF. Repair and restoration of a fractured pulpally involved anterior tooth: report of case. JADA 1994;94:519– 20.
- Martens LC, Beyls HMF, De Craene LG. Reattachment of the original fragment after vertical crown fracture of a permanent central incisor. J Pedod 1988;13:53–62.
- DiAngelis AJ, Jungbluth MA. Restoration of an amputed crown by the acid-etch technique. Quint Int 1987;18:829– 33.
- Baratieri LN, Monteiro S, Cardoso AC, de Melo Filho JC. Coronal fracture with invasion of the biologic width: a case report. Quint Int 1993;24:85–91.
- 29. Ludlow JB, LaTurno SAL. Traumatic fracture-one-visit endodontic treatment and dentinal bonding reattachment of coronal fragment: report of case. JADA 1985;110:341–3.
- Worthington RB, Murchison DF, Vandewalle KS. Incisal edge reattachment: the effect of preparation utilization and design. Quint Int 1999;30:637–43.
- Farik B, Munksgaard EC, Kreiborg S, Andreasen JO. Adhesive bonding of fragmented anterior teeth. Endod Dent Traumatol 1998;14:119–23.
- 32. Roeters J, Bressers JP. The combination of a surgical and adhesive restorative approach to treat a deep crown-root fracture: a case report. Quint Int 2002;33:174–9.
- Michanowicz AE, Michanowicz JP, Abou-Rass M. Cementogenic repair of root fractures. JADA 1971;82:569–79.

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