Case Report

Multidisciplinary approach for the treatment of an oblique root fracture: a case report

Demiralp B, Keçeli HG, Kökat AM, Muhtarogullari M, Tuncel B, Eratalay K. Multidisciplinary approach for the treatment of an oblique root fracture: a case report.

Abstract – This clinical case study describes a multidisciplinary modified technique for the treatment of an oblique root fracture. A-38-year old woman with a history of trauma and a broken tooth was referred to our clinic. There was an oblique crown fracture extending the coronal third of the root just underneath the cingulum of the crown. The patient was willing to keep her tooth in function by any means. Two weeks after root canal therapy the flap was raised. The coronal two third of the root canal was enlarged. An impression of the enlarged root canal and tooth surface with surrounding bone was taken. The flap was sutured and the impression was sent to the laboratory for the post-casting preparation. After 7 days, the flap was opened again and casting was cemented. The flap was sutured. Ten days after the second surgery, three anterior teeth were prepared and a final impression was taken for the preparation of porcelain crowns. Restoration was finished 15 days after the second operation. The patient is still under maintenance therapy and the 12 month results are presented in this report. Extraction may not be the only alternative for the root fractures. Even for fractures under the alveolar margin, alternative multidisciplinary approaches can be used to restore and allow the tooth to survive.

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Sudden impact involving the face or head may result in trauma to the teeth and supporting structures. The most frequent causes are falling while running, traffic accidents, sports and acts of violence (1). Traumatic dental injuries are typically classified as avulsion, luxation and root fracture injuries (2). Crown fractures have been documented to account for 92% of all traumatic injuries to the permanent dentition (3). Some fractures are minor, others are severe enough to result in the untimely loss of the tooth involved. Root fractures frequently occur in endodontically treated teeth (4, 5). The prognosis of root fracture is usually poor and extraction is often undertaken. Horizontal root fractures in the permanent dentition have been reported to comprise from 0.2 to 7% of all traumatic injuries to teeth (6–9). As with most dental traumatic injuries, horizontal root fractures occur more often in the maxillary incisors (6, 10) and most of these fractures happen in the middle third of the root followed by apical third fractures (11, 12).

Treatment options for extensively damaged teeth may involve root canal therapy, periodontal therapy if needed and finally prosthetic restoration. The restoration type for an endodontically treated tooth is dictated by the extent of the coronal destruction and the tooth involved in general, such teeth receive a dowel for reinforcement and a crown protection. Due to the location and the extent of the fracture, a prosthetic conventional restoration may not be possible and the extraction of the tooth becomes essential. As a treatment option Tulunoğlu and

Görduysus (13) have reported that the fractured part can be placed into its original position by adhesive bonding. This approach is useful in the case of moderate defects however, the fractured part must be intact.

The potential adverse sequelae and proper treatment after a horizontal root fracture are all based on the complex interrelationship between bone, tooth, pulp and the periodontium (14). Its management needs a multi-disciplinary approach, requiring endodontic, prosthetic and periodontal collaboration (15, 16).

In this case report, a modified, multidisciplinary approach for the treatment of an oblique root fracture in the middle third of a lateral incisor tooth is described. Clinical and radiographic results of 12 months have also been presented.

Case presentation

A 38-year-old woman with no medical contraindication to dental treatment presented with a fractured tooth and need of a restoration for the comprimising functional activity and esthetics. The patient said that she fell down from the stairs in her apartment 3 days ago and she was seen at the emergency clinic. She also had a tear on her upper lip and had a broken nose. Dental examination revealed that the maxillary right lateral incisor tooth was fractured and only 1 mm of a root section without a crown could be seen clinically (Figs 1 and 2). The right central incisor tooth was also damaged and there was a fracture line on the palatal site of the crown which caused the exposure of the pulp. Due to the exposed pulp, root canal treatment was also carried out on the right central tooth. There was an oblique crown fracture extending the coronal third of the root just underneath the cingulum of the crown of the right lateral incisor tooth (Fig. 3). Upon radiographic evaluation, the length of the root was shown to be 12 mm (Fig. 4). Periapical radiolucency, periodontal disease, external or internal root resorptions or any other pathological conditions were not

Fig. 1. Buccal view of the fractured tooth. Only 1 mm of the root section was visible.

Fig. 2. Palatal view of the fractured tooth.

Fig. 3. The fractured part of the tooth.

Fig. 4. Periapical radiograph of the tooth before treatment.

observed. Different treatment alternatives were described and discussed with the patient.
These were:

1. Extrusion of the root by orthodontic approach and restoration of the tooth by a fixed porcelain crown.
2. Extraction of the root and compensation of the missing tooth by a bridge or a single-tooth implant.
3. Two stage periodontal surgery and the restoration of the tooth with a custom made post (Fig. 5).

Since the patient was a primary school teacher she was not willing to wear brackets and due to financial problems she did not want to be treated with an implant. She wanted to keep her root by any means as long as it has a chance to be treated. The co-operation of the patient was one of the most important criteria when the conservation of the tooth had been decided.

Surgical procedure

After obtaining local anesthesia, buccal and lingual flaps were raised and the fracture line and coronal aspect of the root were seen clearly (Fig. 6). Sharp bony structures over the fracture line were removed by using burs with a low speed handpiece under saline dispersion. Then, undercuts on the root surface were removed and smoothened by ultrafine diamond burs. Root canal enlargement was undertaken step by step with peezo-reamers to sixth grade. One third of root filling was left to secure the length of the cast and to prevent possible apical leakage. An impression of the enlarged root canal and tooth surface with surrounding bone was made by monophase technique. An ebonyte rod was reshaped as a tapered form to fit the canal. A sterilized commercial tray was filled with putty and light body siloxane impression material (Coltene Speedex, Coltene, WhaleDent, NY, USA) at the same time, while operating this process a small amount of light body was injected through the canal and the prepared rod was put into the root. After 3 min of setting the impression tray was removed gently in one move and sent to the laboratory to be poured. The root canal was filled with some cotton roll, the orifice of the canal was sealed with temporary composite filling material (Voco Clip, Voco, Cuxhaven, Germany) and the flap was sutured. The post was cast with type-

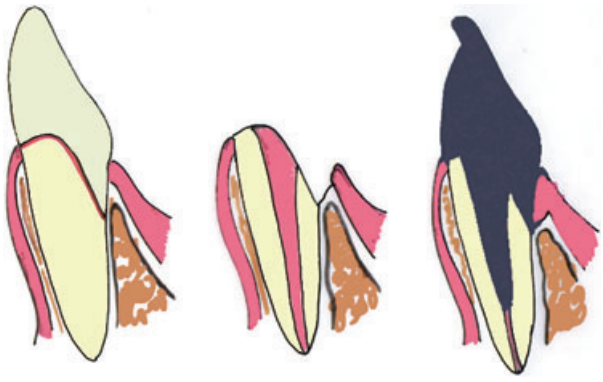

Fig. 5. Drawing of the treatment plan showing the details of the cast.

Fig. 7. Coronal portion of the casting was designed as a lateral tooth form for emergence profile and esthetic demands during the tissue healing after periodontal surgery.

Fig. 6. The fracture line and the coronal aspect of the root after opening the flap.

Fig. 8. The casting was cemented after adapting in the mouth 1 week after the first surgery.

IV dental gold alloy (Degudent, Degussa, Frankfurt, Germany). The coronal portion of the casting was designed as a lateral tooth form for emergence profile and esthetic demands during the tissue healing after periodontal surgery (Fig. 7). The flap was opened again and the casting was cemented by resin based cement (Panavia, J Morita, Tustin, CA, USA) after adapting in the mouth one week after the first surgery (Fig. 8). The flap was sutured and the buccal part of the post was covered with composite filling material. In order to obtain at least a little retention, the buccal portion was sandblasted and treated with alloy primer of the resin cement. After finishing and polishing, the patient was warned about hygiene before leaving the clinic. She was also prescribed chlorhexidine gluconate 0.2% once a day. Ten days after the second surgery surrounding soft tissue healing was uneventful. At this session right lateral, central and left central incisor teeth were prepared with chamfer finish lines (Fig. 9). The left central incisor tooth was also prepared in order to achieve the patients esthetics demands. Before preperation an alginate impression was taken to use for application of provisional restorative material directly in the mouth (Dentalon, Dentalon Plus, Heraeus Kulzer GmbH, Wehrheim, Germany). After finishing and polishing, the provisional crowns were cemented with temporary luting material (TempBond, Kerr Europe AG, Basel, Switzerland). Two days after the preparation session the final impression was made by double mixing putty wash technique with polysiloxane impression material (Coltene Speedex, Coltene, WhaleDent, NY, USA). The cast was poured immediately and sent to the laboratory. Two days after the metal cast try-in (Fig. 10) the porcelain fused to metal splinted crowns were delivered to the patient following occlusal corrections (Fig. 11). Final restorations were made according to the existing class-III occlusal relation. There were no occlusal and centric interferences after corrections and the patient had mutually protected occlusion on both sides. The permanent cementation was made with zinc phosphate luting cement (DeTrey Div, Dentsply, England).

Fig. 9. Ten days after the surgery, surrounding soft tissue healing was uneventful. Right lateral, central and left central incisor teeth were prepared at that session.

Fig. 10. Metal cast try-in.

Fig. 11. Porcelain crowns at the end of the treatment.

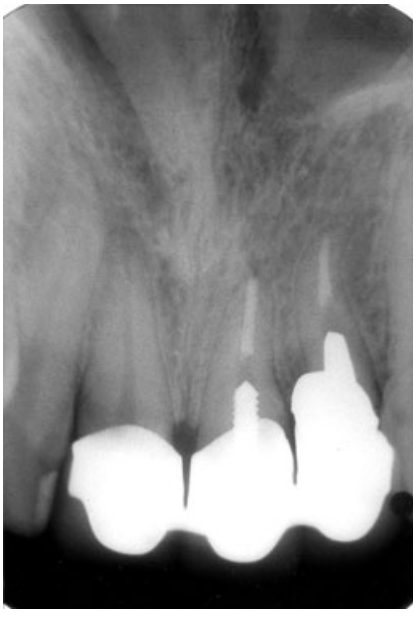

Fig. 12. Periapical radiograph of the tooth at the 12 months recall visit.

Post-operative care

The patient was seen every 2 months for the first year. These follow-up visits included routine intra-oral examination and professional plaque removal. Pathological conditions like bone and/or root resorption or periapical problems were not observed at the post-operative radiographic examination (Fig. 12). After 12 months she was able to use her tooth as normal. The patient was completely satisfied with the results of the treatment.

Discussion

This case presents the treatment of an oblique crown-root fracture with a multidisciplinary approach after a dental trauma.

In the treatment of root fractures with oral communication there are five treatment options available:

1. Repositioning the coronal fragment of the fractured tooth (17).
2. Vital root submergence (18).
3. Orthodontic or surgical extrusion of the root (14).
4. Crown lengthening for building an optimal crown.
5. Endodontic, periodontal and prosthetic procedures or the combinations of these (14).

An important aspect of restoring damaged teeth is the protection of remaining tooth structure. Tooth which has lost large amounts of its structure is usually very weak to withstand occlusal forces. Therefore, especially when restoring the anterior teeth, the teeth must be protected from any functional and non-functional contacts. Such contacts may be harmful to the extremely damaged teeth. Another important point for restoring a fractured tooth is splinting the restoration to the adjacent tooth. Since traumas to the anterior region generally affect more than one tooth, designing a restoration which will also work as a splint may increase the strength and longevity of the restoration (19). Esthetics is another important point in the anterior region. In order to copy the contralateral tooth and achieve a better esthetic, both central teeth were treated with crowns.

In order to choose the first treatment option listed above, the clinician should have the original fractured fragment of the tooth. In our case, this approach was tried but it was not succesful probably due to the patient's class-III occlusion. Vital root submergence is not a usual therapy for obtaining the functional and aesthetic demands. In these kinds of fractures, extrusion of the root is a common approach leading to the coronal movement of the marginal gingiva and the alveolar bone (20, 21). This 'gingival movement' appears to be an increase in the amount of attached gingiva not a movement of the mucogingival junction (22). Therefore, a gingivectomy and occlusal bone recontouring may be necessary to expose the fractured root after the root extrusion. In 1988, Kahnberg (23) reported the use of surgical techniques to extrude and save a root after a cervical crown-root fracture. Apical resorption was present in 30% and periapical radiolucencies were identified in about 25% of these teeth. Besides, the amount of remaining clinical exposed root required for a crown restoration consists of the necessary biologic width and adequate tooth structure for an ideal crown retention. The biologic width is the area from the crest of alveolar bone to the base of the gingival sulcus. This biologic width consists of 1 mm of tooth structure for connective tissue attachment and 1 mm for junctional epithelium (24). Adequate retention of a crown requires at least 2 mm of tooth. The amount of sound tooth structure necessary for the fabrication of a crown is 4 mm above the alveolar bone (25). So, following a root fracture, sufficient tooth structure may be exposed using periodontal surgery and osseous recontouring.

The position of the fracture line and its relationship to the base of the gingival crevice are the most important factors in determining the long-term prognosis for the tooth (26). For this reason in such a case two main factors must be addressed: the access to the fracture margin and the possibility of performing a tight seal restoration. In this case a tight seal restoration was performed under the alveolar margin level of the tooth by opening the flap. The major limitations of the osseous reduction is compromising the functional support and retention of the final restoration. But in this report, with minimal bone reshaping, a satisfied functional alveolar bone level and also a retentive restoration has been achieved. Restoration of fractured teeth due to a trauma may be treated by a close colloboration between different dental specialities. We believe that a well planned and designed multidisciplinary approach may help a lot of teeth to survive. It is better to think twice before extraction.

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