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Case Report

Transverse fracture of a tooth root as a consequence of long-term traumatic occlusion—A case report

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Received 18 August 2010; accepted 4 October 2010

Available online 16 November 2010

KEYWORDS

tooth fracture;
traumatic occlusion;
adults

Abstract The purpose of this paper is to present treatment results of transverse root fracture in an adult patient caused by long-term traumatic occlusion resulting from use of a wrongly fitted upper-frame denture. A 44-year-old male patient had a transverse displaced fracture at one-third of the crown–root boundary area of tooth 42. The tooth was treated endodontically after prior positioning of fragments in 1 plane. The canal was filled, and a “Splint It” splint was applied for the period of 1 year. The patient returned for check-ups after 2 and 2.5 years, at which time X-rays were taken. Our goal was achieved through preservation of the patient’s own completely recovered and fully functional tooth.

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Introduction

Fracture of tooth roots usually occurs in children. However, such accidents may also affect adults as a result of an impact, a traffic accident or, less frequently, as a consequence of a traumatic occlusion.

Fractures caused by macro- and micro-injuries mostly affect the roots of the upper and lower anterior teeth.¹ Depending on the profile of the fissure, fractures may be transverse, longitudinal, or oblique. Depending on the location of the fissure, fractures may be located at the upper one-third of the crown section of a tooth, at half of its length, or the lower one-third of the root section. Horizontal/oblique root fractures most frequently occur in the apical area. Fractured fragments may or may not be displaced. Fractured fragments of the crown may be dislocated or protruding from the tooth socket. If dislocation of a crown fragment occurs, repositioning and splinting should be conducted as promptly as possible. A fracture in the middle portion of the root

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doi:10.1016/j.jds.2010.11.008

requires splinting for a period of 2–3 months. It is important to assure that the fixation time is not too long as it may cause complications, namely pathological resorption and ankylosis. These pathological lesions most frequently occur if teeth are rigidly fixed and their physiological mobility is suppressed. Moreover, a splint should allow access to the root canal as endodontic treatment is necessary in this type of trauma. Three types of restoration processes are used in the fracture region: reconstruction with mineralized tissue, connective tissue, and bone and connective tissue.¹ In adults, the situation is more complex as far as the treatment and prognosis are concerned. In many cases, alveolar arches are not complete and alveolar process resorption occurs, which is connected with aging (passive eruption of teeth after the age of 25 years). Also, the volume of the pulp and, as a consequence, its defensive abilities are much less than in children.

Therefore, treatment to be undertaken in adult patients depends on the patient's age, the type of fracture, the degree of mutual dislocation of the tooth fragments, and the height of the fracture fissure (at the upper one-third of the crown section of the tooth, at half of its length, or at the lower one-third of the root section). In cases with a fracture, using the original tooth fragments is the most economical, fastest, and least traumatic treatment.^{2–6} Many authors confirmed that in most cases, trauma affects only 1 tooth, and there are many more cases in which 2 teeth are traumatized than with 3 or more traumatized teeth. Maxillary teeth are also more prone to damage than mandibular teeth. The most frequently encountered cases are an uncomplicated crown fracture, complicated crown fracture, subluxation, and crown–root fracture. Other traumatic dental injuries are less common, and their frequencies are presented in Fig. 1 prepared based on results described by Flores et al.⁷

The purpose of this paper was to present treatment results of a transverse root fracture in an adult patient caused by traumatic occlusion resulting from the use of a wrongly fitted upper denture.

Case presentation

A 44-year-old male patient applied to the outpatient clinic of the Department of Conservative Dentistry, Medical University of Silesia. He complained of an idiopathic toothache of tooth 42 that had lasted for 5 days. The tooth had undergone no preventive treatment. The patient denied that any strong trauma had occurred in the area of the tooth. Four days previous, he had visited a dentist who tried unsuccessfully to open the pulp chamber. After taking a contact radiogram (Fig. 2) of one-third the length of the crown section, the dentist proposed tooth extraction to which the patient did not consent. Therefore, he was directed to the outpatient clinic of the Department of Conservative Dentistry, Medical University of Silesia. During the initial visit, an intraoral examination showed edema of the mucosa of the alveolar process in the area of tooth 42 and its increased mobility (class II according to the Entin scale).¹ Pus content escaped from the gingival sulcus during the mobility test and periodontal examination. The patient had a full alveolar arch of the mandible, while in the maxilla, there was a prosthetic filling in the form of a frame denture which he had used for 1 year. That denture

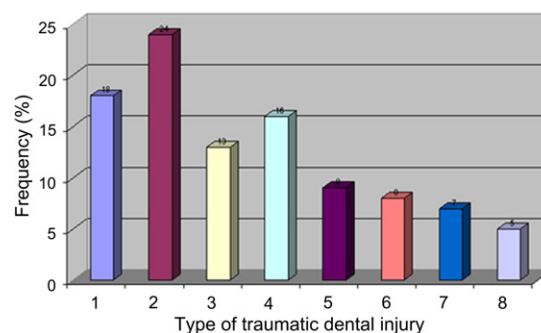


Figure 1 Frequency of traumatic dental injuries (Scheme prepared based on results described by Flores et al.⁷). 1. Uncomplicated crown fracture (the fracture involves the enamel or dentin and enamel, but the pulp is not exposed); 2. Complicated crown fracture (the fracture involves the enamel and dentin and the pulp is exposed); 3. Crown–root fracture (the fracture involves the enamel, dentin, and root structure, and the pulp may or may not be exposed); 4. Root fracture (the coronal segment may be mobile and may be displaced); 5. Subluxation (the tooth is tender to the touch or tapping and has increased mobility, but it has not been displaced); 6. Extrusive luxation (the tooth appears elongated and is excessively mobile); 7. Lateral luxation (the tooth is displaced usually in a palatal/lingual or labial direction); 8. Intrusive luxation (the tooth is displaced axially into the alveolar bone).

restored the filling defects of teeth 16, 12, 24, and 26. During occlusion, the denture had dislocated and caused a trauma node in the area of tooth 42. In the area of teeth 31–43, there were large deposits of dental plaque. The patient had abandoned normal hygiene practices in that region due to strong pain during the procedure. He was ready to undergo preventive treatment even though he was informed that the risk of tooth loss was high.

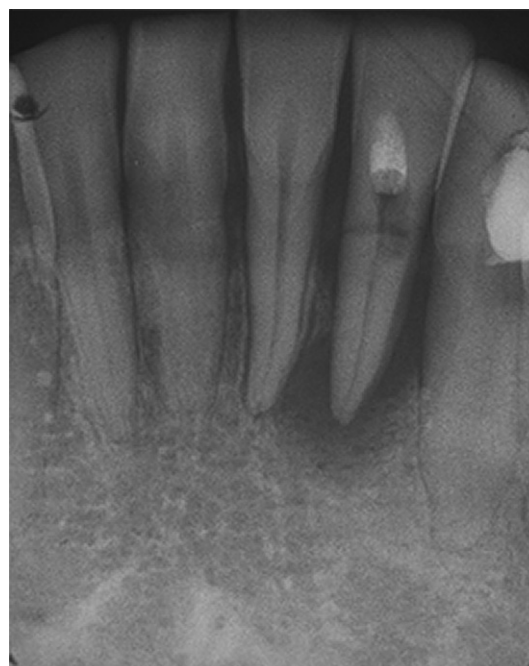


Figure 2 Tooth 42 with a transverse root fracture.

During the first session, trepanation of the pulp chamber was performed. An abundant volume of pus content flowed out. The tooth was excluded from occlusion and left "open" with no further procedures that day, due to the presence of pain despite infiltrative anesthesia. Due to significant effusion, a decision was made to leave the tooth chamber open for the period of the antibiotic treatment. An oral antibiotic was prescribed (300 mg clindamycine, 3 times per day, for 8 days), and a semiliquid diet and chlorhexidine-based rinse were suggested because of the bad in-house hygiene in the area of the tooth. Significantly increased pain during palpation and abundant pus from both the canal and pocket meant that any manipulation, such as setting up a rubber dam and braces, was impossible.

The patient returned after 4 days for the second session. The edema had regressed; but the toothache was still present during palpation, and reddening of the marginal gingiva was evident. Infiltrative anesthesia was applied and was successful; therefore, chemical and mechanical debridement of the canal was performed. During the procedure, it was found that fractured root fragments were mutually dislocated in the fibular plane which had not been visible on the contact radiogram. These fragments were positioned with the root canal tool still present. A palpation examination of the process mucosa resulted in discovery of the canal in the apical part of the fracture. After mutual fixation of the fractured fragments (a control radiogram was taken with the root canal tool still present) (Fig. 3), a splint "Splint It" (Pentron Clinical Technologies, Wallingford, USA) was applied to fix the position of tooth 42. After chemical and mechanical processing of the tooth using a step-back method, it was decided not to fill the canal due to the presence of exudate which still flowed from it. Grinazole Ung. (Septodont, Paris, France) was introduced into the canal for a period of 3 days, and the defect was covered with a temporary dressing.



Figure 3 Positioning of the fracture fragments with the root canal tool still present.



Figure 4 After mutual fixation of fractured fragments, a splint (Splint It) was applied to fix the position of tooth 42.

During the third session, the canal was chemo-mechanically prepared and Cresophene (Septodont, Paris, France) was introduced with the use of sterile cotton wool and left for 10 days (Fig. 4).

In the fourth session which occurred 10 days later, the canal was finally filled using a classic Endomethazone



Figure 5 Radiogram taken after treatment.

N (Septodont, Paris, France) method and a gutta-percha cone. A decision to seal the root canal with this kind of material was made due to its antibacterial features and the fact that it is commonly used in Polish dental practice and reimbursed by the National Health Insurance scheme. A control radiogram taken after filling the canal showed slight displacement of the material beyond the apex hole and outflow of the material through a lateral canal on the mesial side (Fig. 5).

After this complex endodontic treatment, the patient was informed of the situation. Further observation of the tooth was advised, as well as radiological follow-up and replacement of the prosthetic filling as the cause of all of the problems. In a follow-up visit 1.5 years after the treatment was performed, the patient applied to the clinic for removal of the fixing splint. A radiological assessment was performed 1 (Fig. 6) and 2.5 years (Fig. 7) after the fracture, which showed that the root fragments had grown together, first at the distal and then on the mesial side. In the area where the filling material had pushed beyond the apex hole and lateral canal, no aberrations were observed. Since completion of the treatment, the patient reported no subjective complaints, and the tooth was not painful to palpation and was fully functional.

Discussion

There are 4 types of calcification reactions that can occur as a consequence of a root fracture, provided the fragments are properly protected. These are interproximal tooth tissue growth, interproximal junction of the bone and tooth tissue, and interproximal tissue inflammation.⁸ Due to the above-mentioned types of reaction of the body, the patient should be under continuous medical surveillance.



Figure 6 Radiogram taken 12 months after the fracture.



Figure 7 Radiogram taken 30 months after the fracture.

Despite an unfavorable prognosis in this case resulting from difficulties arising from processing of tooth 42's canal and mutual displacement of fractured fragments in the fibular plane, the tooth was successfully endodontically treated. Fragments grew together first on the distal side of the root and then after 2.5 years, on the mesial side. The patient reported no idiopathic complaints; the tooth was not painful to palpation; and no excessive mobility was noted. Radiograms showed neither pathological resorption nor ankylosis, despite long-lasting splinting (1.5 years), which is much longer than advised in the literature.^{6,9} The prognosis for teeth with horizontal root fractures is usually good.¹⁰ It is very important to differentiate between vertical and horizontal fractures. Vertical fractures which split roots along their long axes have a poor prognosis. Fortunately, they rarely occur as a result of acute trauma. Horizontal infrabony fractures involve the cementum, dentin, and pulp. As long as the fracture is infrabony with no communication to the gingival sulcus and the patient uses meticulous oral hygiene, appropriate treatment can result in a high degree of successful outcomes. Treatment comprises reduction of the fracture and firm stabilization of the tooth to the adjacent teeth during a period of at least 3 months.^{10,11}

Conclusions

To declare success of the treatment presented above, it must be stated that the goal we assumed before treatment, i.e., preservation of the tooth with no pathological signs, was achieved. Results of treatment are affected by many factors. One of the most important among them is age of the patient. Dentist's access to the intra-root chamber in endodontic treatment of young patients is much easier than in adults and seniors, in which stricture or obliteration may be present.

That may pose a great problem in case of dislocated fragments and attempts at treatment. The healing process is also much slower in older patients. Despite all those difficulties that occurred during this treatment, it is always better than extracting a tooth and the subsequent prosthetic or implant-prosthetic reconstruction. Therefore such treatment as described above should be undertaken in similar cases.

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