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Integrated treatment to resolve a horizontal root fracture

CASE REPORT

Daniela Atili Brandini, Wilson Roberto Poi, Sônia Regina Panzarini, Celso Koogi Sonoda, José Carlos Monteiro de Castro, Eloá Rodrigues Luvizuto, Cláudia Resende Leal

UNESP, Araçatuba Dental School, Department of Surgery and Integrated Clinic, São Paulo State University, Araçatuba, SP, Brazil

Correspondence to: Daniela Atili Brandini, Rua José Bonifácio, 1193 Vila Mendonça, 16015-050 Araçatuba, SP, Brazil
Tel.: +55 18 3636 3240
Fax: +55 18 3636 3200
e-mail: brandini@foa.unesp.br

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Abstract – Root fractures are defined as those that involve cement, dentin and pulp, comprising from 0.5 to 7% of injuries in permanent dentition. Diagnosis is made through clinical and radiographic exams, the latter frequently being limited by the position of the fracture. Treatment varies according to the displacement and vitality of the fragments. The authors present a clinical case of recurrent trauma of tooth 21 causing a horizontal root fracture in the middle third. After several attempts at endodontic treatment, the option was to remove the apical fragment by surgery. The postoperative period of 4 years shows very satisfactory results with regard to wound repair and tooth mobility, or implantation of the coronal segment.

Root fractures are a relatively rare trauma entity, with about 1% frequency being reported in traumatized permanent teeth. They are defined as fractures that involve cement, dentin, and pulp (1–3). The teeth most affected by horizontal fracture are the central maxillary incisors. The age group with the highest incidence ranges from 9 to 20 years, a time when the individual is more prone to traumatic lesions resulting from sporting practices, falls, automobile accidents and fights (4–6). Men are the major victims (6). Prata et al. (6) also added individual predisposing factors such as accentuated horizontal overlap, childhood obesity, insufficient lip closing, and maxillary central incisor protrusion.

Çaliskan and Pehlivan (7), in an assessment of 56 root fractures, showed that fracture of the middle third was the commonest, equivalent to 57% of the cases, followed by fracture of the apical (34%) and cervical (9%) thirds.

The different types of repair depend on the distance between the fragments and the integrity of the pulp and periodontal ligament at the fracture level, because cells from both go into activity in order to repair this fracture. Andreasen et al. (8) related that after the occurrence of horizontal root fracture, four specific modalities of repair could appear: repair with calcified tissue; repair by means of conjunctive tissue interposition; or by means of bone and conjunctive interposition between the fragments; and by granulation tissue interposition.

In order to diagnose horizontal root fracture, detailed clinical and radiographic exams are required. When performing the clinical exam, the tooth color must be inspected, and vitality, percussion and mobility tests performed. Clinical signs such as extrusion and linguoversion are also mentioned in the literature, as well as edema and localized pain symptoms in the fractured root area (4).

Frequently radiographs are shown to be limited for diagnosing root fracture, and various radiographs need to be taken, with changes mainly in the vertical angulation (9). Radiographic inspection must be carried out with the purpose of observing the fracture lines in the root region, as well as the alterations in the periradicular area (4).

After a horizontal root fracture has occurred, the immediate treatment consists of reducing it by aligning and juxtaposing the segments intimately, and placing splinting, in order to form a bridge of calcified tissue between the fragments (10). Premature occlusal contacts must be eliminated. Clinical–radiographic control to assess loss of vitality must continue for 1 month to 1 year, because in this period, there is greater possibility for the occurrence of pulp necrosis (6).

Factors such as lateral luxation and/or extrusion of the coronal fragments, splinting with the application of excessive force, absence of splinting and teeth with extensive restorations and/or periodontal problems (8) contribute to the occurrence of pulp necrosis. In these cases, endodontic treatment is instituted. Infected, necrotic pulp is removed to avoid the occurrence of external inflammatory reabsorption.

Treatment of both fragments is complicated and difficult, and prognosis is poor, because the accumulated debris is not completely cleaned out from the space

between the fragments in order to decontaminate them (1, 11).

The aim of this study was to relate a clinical case of recurrent trauma in tooth 21 causing a horizontal root fracture in the middle third.

Clinical case report

The patient JPP, a 14-year-old boy, sought attendance at the Integrated Clinic Course of the Dentistry Faculty of Araçatuba – UNESP after having suffered dento-alveolar traumatism in the region of the maxillary anterior teeth. In anamnesis, he related that at the age of 12 years, after a fall from his own height, he fractured the crowns of teeth 11, 12, and 21. At that time, he received attendance at a public health clinic, where the crowns of these teeth were restored. He also related that after some time, an abscess formed in the traumatized area, and he was again submitted to treatment that consisted of opening the crown of tooth 11 to drain the purulent collection via the canal. After the pain ceased, he did not seek the dental service again to have the endodontic treatment performed. On clinical examination, after the second traumatism in the region, there was no mobility or sensitivity in teeth 11 and 21. By radiographic exam, biomechanical preparation and the presence of the remainder of a dressing was found in tooth 11, as well as a periapical radiolucent area in tooth 21 (Fig. 1). Because of this, the option was to successively change the calcium hydroxide dressing and perform radiographic follow up of the lesion. Afterwards, the root canal of tooth 11 was filled with gutta-percha and Sealapex (Sybron Kerr Indústria e Comércio Ltda, Petrópolis, RJ, Brazil), using the lateral condensation technique. The patient did not appear at the next consultation to have tooth 21 filled, but returned 12 months later. On examination, a horizontal root fracture in the middle third, with appearance of a radiolucent area adjacent to the fracture line was observed. Further changes of the $Ca(OH)_2$ dressing were made, and then the canal was filled with gutta-percha and Sealapex (Sybron Kerr Indústria e Comércio Ltda), using the lateral condensation technique, and the crown was restored with resin composite TPH (Dentsply Indústria e Comércio Ltda, Petrópolis, RJ, Brazil). During follow up, greater displacement of the apical fragment and increase in the radiolucent area adjacent to the fracture line was observed radiographically (Fig. 2). For this reason, surgery was performed to remove the apical segment and curettage of the lesion (Figs 3–5). Two years later, in a control radiograph, the patient presented with a periapical lesion in tooth 11 and satisfactory bone regeneration in the apical region of tooth 21. The option was to retreat the canal of tooth 11 (Fig. 6). Next, the lesion was surgically removed by curettage and apexectomy.

Two years later, taking the patient's aesthetic demands into consideration, he was given the choice between two treatment options: rehabilitating tooth 21 with an implant, and tooth 11 with a single fixed denture; or rehabilitating both teeth with fixed dentures. All the advantages and disadvantages of performing a prosthetic restoration in tooth 21 were explained to the patient, because tooth presented a certain degree of compromise, and considering its crown/root ratio of a little less than 1/1. The patient, however, did not accept losing tooth 21, and chose the second option. Therefore, a single fixed dental prosthesis was made for each of the two teeth, 11 and 21, using In ceram (Vita in ceram, Wilcos do Brasil Indústria e Comércio LTDA, Petrópolis, RJ, Brazil). After 4 years of follow up, the coronal segment presented no mobility and the treatment has shown to be satisfactory (Figs 7 and 8).

Fig. 1. Initial periapical radiograph. Presence of the remainder of a dressing was found in tooth 11, as well as a periapical radiolucent area in tooth 21.

Discussion

In the radiographic exam performed immediately after the accident, Zachrisson and Jacobsen (12) perceived that depending on the intensity of the trauma, the fracture could go unnoticed. In the course of time, however, there would be separation of the fragments or reabsorption located at the fracture line, which would make diagnosis easier. Nevertheless, early correct diagnosis is essential.

Indeed, in the case related above, the fracture was not diagnosed immediately, probably because of the

Fig. 2. Periapical radiograph. Observe displacement of the coronal fragment and increase in the radiolucent area adjacent to the fracture line.

angulation of the main X-ray beam, which did not allow the root fracture line to be visualized and therefore, treatment was directed towards the pulp necrosis and periapical lesion only.

As the root fracture of the patient in this case report was not diagnosed immediately, and the fragments were well positioned, it was possible to treat the canals of both fragments. However, cleaning and decontamination had

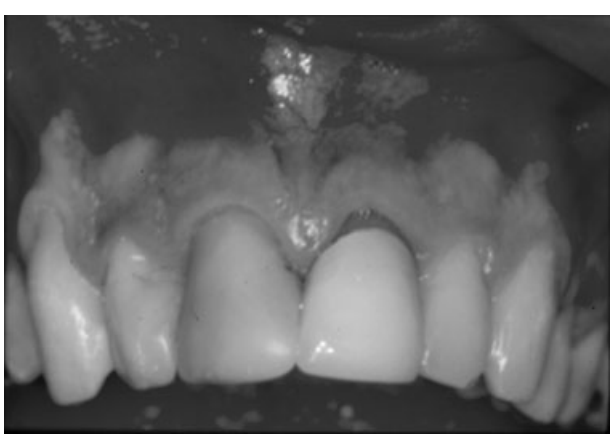

Fig. 3. Initial photograph of the clinical case.

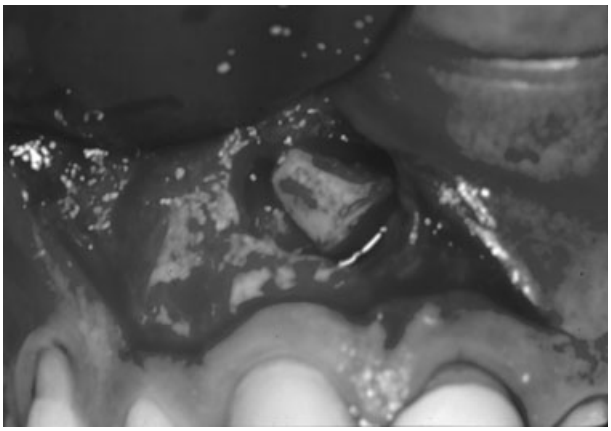

Fig. 4. Exposure of the apical segment during the surgical procedure for its removal and curettage of the lesion.

not been achieved, probably as a result of residual infection or coronal leakage, which generated a lateral periapical lesion. This made it necessary to unobstruct the canal up to the fracture limit, and restart the therapy with $Ca(OH)_2$ dressings, which persisted for 1 year. After

Fig. 5. Periapical radiograph immediately after removal of the apical segment.

Fig. 6. Periapical radiograph. Root canal retreat and presence of periapical lesion in tooth 11. Satisfactory bone regeneration in the apical region of 21.

Fig. 7. Periapical radiograph at 4 years of follow up after removal of the apical segment. Satisfactory bone regeneration in the apical region of teeth 11 and 21. Presence of cast metal cores and prosthetic crowns in these teeth.

this period, the coronal portion was filled. The case was followed up, and during this period, the tooth presented absence of coronal fragment mobility, but because of the increase in the lesion, surgery was performed to remove the apical segment and perform curettage.

The persistent microbial infection in the root canal system was the biggest problem in the case report related here, and as reported by Siqueira (13), this is the major factor associated with endodontic failure. These microorganisms may have survived the biomechanical procedures (14) or invaded the canal via coronal leakage through the root filling (15, 16).

This residual infection was aggravated because the patient found it difficult to return for the control consultations, with the result that he did not appear for treatment for a prolonged period of time. Thus the damage caused by the microbial infection was exacerbated and prevented the endodontic lesions from being resolved at their onset, when treatment might have helped to attain a better prognosis.

Molander et al. (17) studying the microbiological status of root-filled teeth showed that intracanal microorganisms were also found in teeth with no signs of periapical pathosis. From a clinical point of view, the authors suggested that all root-filled teeth should be regarded as potentially infected. Also, calcium hydroxide has limited effectiveness in eliminating bacteria from human root canal when assessed by culture techniques (18).

Surgery to remove the apical segment and curettage of the lesion of tooth 21 were performed when the patient was between 15 and 16 years old; that is to say, in a growing patient, at the worst time to have prosthetic treatment, both from an esthetical point of view and the psychological impact it caused (19). However, an advantage to be considered was that alveolar ridge height was

Fig. 8. Photograph at 2 years of follow up after the installation of the In ceram crowns in teeth 11 and 21. Four years of follow up after removal of the apical segment.

maintained, thereby enhancing the future prosthetic treatment (20).

It would have been possible to replace the coronal fragment of tooth 21 by a titanium implant when the patient reached the growing stage, as demanded for aesthetic reasons, however, in spite of the facilities that implant supported rehabilitations present, the patient was dissatisfied and did not accept losing this tooth; therefore the psychological factor was allowed to prevail at the time of opting for the treatment to be performed.

In these cases, the dental surgeon must explain the actions to be performed and their risks to the patient; they must work together to obtain satisfactory results and consequently, successful treatment. The clinical case described is an example of this approach, and presents satisfactory results after 4 years of control. The coronal fragment has remained without mobility, the patient presents no symptoms and there is bone neoformation in the previously radiolucent areas.

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