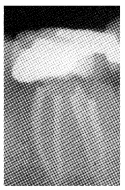
doi:10.1111/j.1365-2591.2008.01380.x



CASE REPORT

Different clinical outcomes following root fractures of adjacent incisors: a case report

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Abstract

Schmitz MS, Montagner F, Montagner H, Escobar CAB, dos Santos RA, Gomes BPFA. Different clinical outcomes following root fractures of adjacent incisors: a case report. *International Endodontic Journal*, **41**, 532–537, 2008.

Aim To report different patterns of root fracture healing in adjacent maxillary central incisors with distinct post-treatment outcomes.

Summary To describe the case of a 12-year-old girl who presented with an avulsed coronal fragment of tooth 11 and root fractures in the middle thirds of teeth 11 and 21. Four months after initial treatment, she was referred for specialized endodontic care. Tooth 11 presented no clinical or radiographic signs of pulp breakdown. However a sinus tract was found related to the middle root third of tooth 21, indicating pulp necrosis in the coronal fragment. The coronal fragment was root filled and periapical surgery was performed to remove the apical fragment. Twelve months after the clinical procedures and 16 months after trauma, hard tissue healing was evident in tooth 11 region. Bone healing was also satisfactory in the periapical region of tooth 21.

Key learning points

- Even adjacent teeth may display different reaction patterns after trauma.
- The prognosis of root fractures is variable and different clinical approach may be required to preserve teeth with fractured roots.

Keywords: dental trauma, endodontics, healing, intra-alveolar root fracture.

Received 16 May 2007; accepted 23 November 2007

Introduction

Trauma is responsible for 1% of all dental losses in the permanent dentition of the Brazilian population (Caldas 2000). It normally affects individuals aged 11–20 years

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(da Silva *et al.* 2004), and the occurrence in males is higher than or equal to that in females (Nicolau *et al.* 2003, Grimm *et al.* 2004). Falls, car accidents and sports injuries are the most frequent causes of dental trauma (da Silva *et al.* 2004, Kececi *et al.* 2005, Sandalli *et al.* 2005). Transverse root fractures account for 2–7% of all traumatic lesions and may be associated with trauma to other teeth, alveolar bone fractures or soft tissue lacerations (Majorana *et al.* 2002). Transverse root fractures require radiographic confirmation, but are often clinically associated with dental extrusion and dislocation (Andreasen & Andreasen 1994).

The mechanism of root fracture healing depends on the interaction of pulp and periodontal responses in the fracture area, which are modulated by the presence or absence of bacterial contamination (Andreasen & Andreasen 1994). The healing of root fractures can be divided into four categories: (i) healing with calcifying tissue; (ii) healing with interproximal connective tissue; (iii) healing with interproximal connective tissue and bone and (iv) interproximal inflammatory tissue without healing (Andreasen & Hjørting-Hansen 1967).

The sequelae of root fractures can be complex because of the combined damage to the pulp, dentine, cementum, bone and periodontal ligament. Andreasen *et al.* (2004) suggested that pre-injury and per-injury factors such as patient age, degree of root development, fragment mobility, dislocation and separation between fragments appeared to have a significant influence upon the pattern of healing. Some changes that may affect the tooth fragments such as pulp calcification, ankylosis, external and internal resorptions may be found in follow-up examinations (Andreasen & Andreasen 1994, Davidovich *et al.* 2005).

Report

A 12-year-old girl was referred to the Emergency Service of the School of Dentistry of the Federal University of Santa Maria, RS, Brazil. Radiographic examination was performed for the maxillary anterior teeth and revealed horizontal root fractures in the middle thirds of teeth 11 and 21. The patient reported a bicycle accident 4 months before. After the accident, the patient was referred to a dentist for postincident care. According to the dentist's notes, the first examination revealed avulsion of the coronal fragment of the right maxillary central incisor and root fractures in the middle third of both right and left maxillary central incisors. The dentist immediately replanted the avulsed fragment, repositioned the displaced fragment, and fitted a rigid splint from the left to the right maxillary canines with a 0.9 stainless steel orthodontic wire and composite resin, which was kept in place for 45 days. Four months after the initial care, a sinus tract was found in the middle third of the maxillary left central incisor and the patient was referred for specialized treatment.

The first examination at the Emergency Service of the Dental School showed no radiographic alteration in the maxillary right central incisor and confirmed the presence of a sinus tract in the soft tissue adjacent to tooth 21. This tooth did not respond to pulp sensibility tests and was mobile, tender to percussion and was painful on palpation. The patient reported mild spontaneous pain. A gutta-percha cone was used to trace the origin of the sinus tract to the middle third of the root in tooth 21 (Fig 1b). Radiographs also showed evidence of a fracture in tooth 11, which was responsive to sensibility tests, but had no discolouration, tenderness to percussion or pain on palpation.

Root canal treatment of the coronal fragment of tooth 21 was performed with 1% sodium hypochlorite irrigation. Calcium hydroxide paste was inserted to full working length and left in place for 15 days. The tooth was restored with temporary cement (Cavit; ESPE, Seefeld/Oberbay, Germany). As the canal had constant exudation, the intra-canal medicament was replaced monthly over a period of 6 months. During this period, the

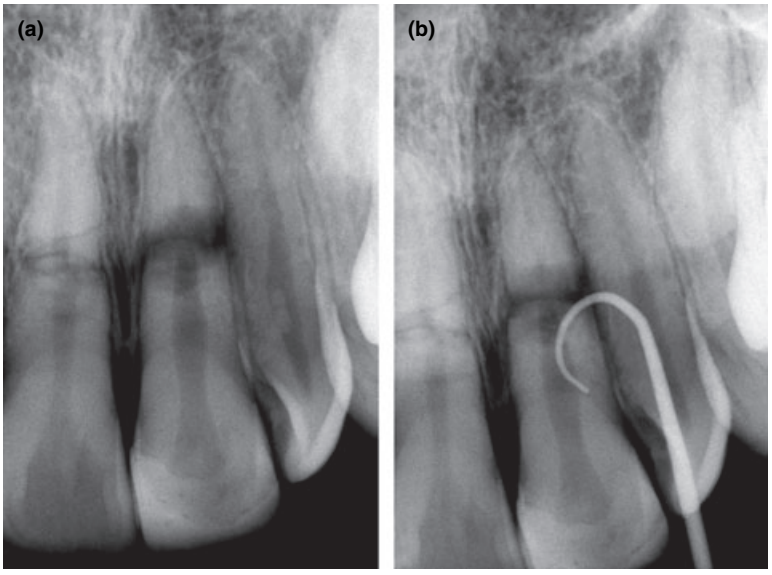

Figure 1 (a) Preoperative periapical radiography 4 months after the trauma, showing horizontal root fracture in both maxillary incisors. (b) Gutta-percha cone tracing the sinus tract to the middle third of tooth 21.

sinus tract was present and the patient complained of tenderness to percussion and mild spontaneous pain. Despite these signs, the canal was filled with gutta-percha and Sealer 26 (Dentsply, Rio de Janeiro, Brazil) by cold lateral compaction.

After root filling, the fistula continued to drain and endodontic surgery was conducted in order to remove granulation tissues around the fractured area. Examination during the surgery revealed that there was a fracture running from a more incisal position buccally to a more apical position palatally, with multiple fragments in the area. The fragments were removed and the granulation tissue was curetted. The apical fragment was mobile and was displaced; it was also removed.

After surgery, the coronal fragment of tooth 21 was rigidly splinted for support. Five days later, the sutures were removed, and soft tissues started healing properly. Clinical and radiographic control experiments were periodically performed. To reduce mobility and ensure patient comfort, rigid immobilization was maintained for 30 days postsurgery.

Clinical follow up was performed and periapical radiographs were obtained 1, 3, 6 months and 1 year postsurgery. Clinically, the sinus tract disappeared. Radiographs revealed that bone healing was satisfactory in the periapical region of tooth 21. At the 1-year follow up, pulp sensitivity tests were positive and radiographs showed no signs of pathology related to tooth 11. However, the coronal and radicular pulp spaces were reduced (Fig. 2).

Discussion

Traumatic root fractures are seen frequently, and maxillary central incisors are the most vulnerable to injury, followed by maxillary lateral and mandibular incisors (Çaliskan & Pehlivan 1996). According to Andreasen & Hjørting-Hansen (1967) there are four healing patterns, and pre-injury and injury factors can affect the prognosis and tissue response to dental trauma (Andreasen *et al.* 2004).

The most desirable type of healing occurs when a calcified tissue callus forms around the fracture and the root is reunited (Andreasen & Hjørting-Hansen 1967). This was

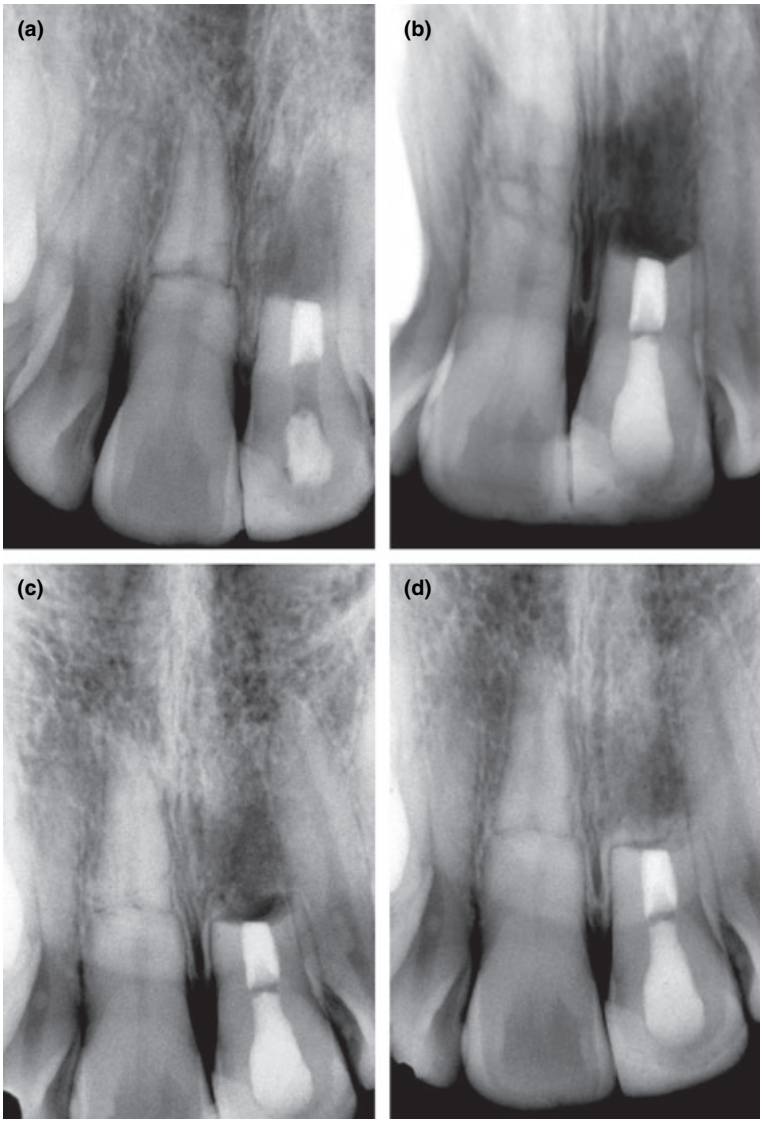

Figure 2 Radiographs taken at different periods after root canal and surgical treatment of tooth 21: (a) 1 month; (b) 3 months; (c) 6 months, and (d) 1 year.

probably observed in tooth 11 which was responsive to pulp tests, had physiological mobility and had no bony pathosis on radiographic examination. Even though the fragments were separated by a narrow radiolucent line and the fracture edges were rounded, the periodontal space had no alterations. The strong relationship between pulp vitality and healing events could possibly be related to the revascularization of the avulsed coronal fragment. In the present case, the narrow distance between the fragments probably led to a favourable healing pattern, a pattern in agreement with the findings of Andreasen *et al.* (2004).

Dislocation of the coronal fragment was more pronounced in tooth 21, and the prognosis was poor when pulp necrosis and infection were present in the coronal fragment. The wide root canal opening at the fracture site and the separation of the fragments made it difficult to achieve proper mechanical cleansing and adequate filling of the root canal (Cvek *et al.* 2004). This fact could explain the persistence of a sinus tract,

the increase of the space between fragments and the clinical symptoms in this tooth. Therefore, periapical surgery was performed in order to remove granulomatous and contaminated tissues around the fracture site. Surgery is a potentially arduous procedure, especially in children and adolescents, but the prognosis was considered favourable (Cvek *et al.* 2004).

Andreasen & Hjørting-Hansen (1967) reported that even though necrosis may occur in the coronal fragment, the pulp of the apical fragment usually remains vital. However, the clinical observations during the surgery suggested that it would be best removed as a potential nidus of infection. Even though the crown:root ratio was unfavourable, a decision was made to retain the coronal fragment. The presence of roots in alveolar process maintains bone volume and avoids atrophy (Andersson *et al.* 2003). Replacing lost teeth after trauma presents particular problems as many of the patients are young and growing. Immediate placement of an osseointegrated implant was not indicated on this basis.

The absence of signs (i.e. mobility) and symptoms during the postoperative period suggested a favourable outcome. On the other hand, the maintenance of an infected area could contribute to rapid bone resorption (Andersson *et al.* 2003).

Procedures for the management of dental trauma should follow a logical sequence to promote healing and preserve teeth along with their supporting tissues. The prognosis for root fractures can only be confirmed by follow up, as late complications may often but not always arise (Davidovich *et al.* 2005). This report has demonstrated very different patterns of progress in adjacent teeth after impact trauma.

Conclusions

This case report supports the published literature that healing in root-fractured teeth may follow different patterns, even in adjacent teeth. Therefore, a multidisciplinary approach should be taken in order to monitor problems in periodontal and pulp healing and intervention should be on the basis of emergent issues.

Disclaimer

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