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Case Report

The fate of a mid-root fracture: a case report

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Abstract – The present report describes a case of a mid-root fracture in a maxillary central incisor of a 19-year-old patient. The fractured tooth was splinted with composite that was removed only 3 years later, as the patient did not appear for follow-up examinations. At this time, the radiographs revealed a normal periodontal ligament, rounding of the borders of the fragments and pulp obliteration of both fragments. Eight years later, the tooth was clinically normal and blurred calcification of the root canal was disclosed radiographically. After 13.5 years the patient complained of tooth mobility and radiographic examination revealed an advanced cervical root resorption. As no conservative approach was possible at this stage, the patient was referred to a prosthodontist for esthetic rehabilitation.

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Root fractures are relatively uncommon among dental trauma, comprising between 0.5 and 7% of the injuries affecting the permanent dentition (1). Although the diagnosis of root fracture depends entirely upon the radiographic examination, clinically the fractured tooth is often extruded and displaced palatally (1). Healing events following root fracture initiate both at the pulp and at the periodontal ligament (PDL). These processes apparently occur independently and are sometimes even competitive in their attempt to close the injured site with either pulpal or periodontally derived tissue (1). On the pulpal site of the fracture, two healing events may occur, depending upon the integrity of the pulp. If the pulp is intact, it will react similar to a coronal pulp exposure under optimal conditions: odontoblast progenitor cells will be recruited and a hard tissue bridge will form within 2–3 months, uniting the apical and coronal fragments (1). This bridge forms the initial callus, which will stabilize the fracture. Callus formation is followed by deposition of cementum, derived from a tissue ingrowth, from the PDL, that gradually obliterates the fracture site. Hard tissue union of the fractured root fragments cannot be diagnosed radiographically earlier than 3 months after the injury, and may take even several years to be completed (1). In the event that the pulp is damaged or severely stretched at the level of the fracture, a revascularization process in the coronal aspect of the pulp is initiated. In the absence of bacteria, this process may result in obliteration of the coronal pulp. While this revascularization process is under way, periodontally derived cells generate the root fracture healing process by apposition of connective tissue uniting the coronal and apical root fragments (1). Successful outcome of mid-root fractures are frequently observed. However, complications in pulp and periodontal healing such as pulp canal obliteration, external and internal resorptions may be disclosed in follow-up examinations. The healing of mid-root fractures was described by Cvek et al. (2) in a retrospective study of 208 root-fractured incisors in individuals aged 7–17 years. They found that 33% of the teeth had developed hard tissue healing of the fragments. Interposition of PDL and bone between the fragments was seen in 8% of the teeth, while interposition of PDL alone was observed in 36% of the teeth. Healing could not be confirmed in 23% of the teeth, and pulp necrosis with inflammatory changes between fragments was evident.

A delayed complication after dental trauma may be root resorption below the epithelial attachment. It probably has an inflammatory origin in which the unprotected or altered root surface becomes susceptible to resorbing clastic cells maintained by infection (3).

The present report describes the late development of cervical resorption in a 'healed' mid-root fracture of a maxillary permanent incisor.

Case report

A 19-year-old male was referred by his dentist to the Hadassah School of Dental Medicine Emergency Clinic, 3 days after one of his maxillary central incisors was injured. The patient, a soldier in active military service, informed that he had been hit on his mouth during a dispute with one of his colleagues. He reported that his mouth bled extensively and the tooth was sore and felt loose. Clinically, the coronal fragment of the left central incisor was extruded and the radiograph revealed a mid-root fracture (Fig. 1). Under local anesthesia, the tooth was repositioned with finger pressure and splinted to the adjacent tooth with composite resin. The splint was removed after 5 months, but was replaced again 1 month later, as the tooth was still slightly mobile. The splint was finally removed after 3 years, as the patient, a dental phobic, did not present to the clinic during this period. At that appointment, 3.5 year after the initial injury, radiographic examination revealed normal PDL, rounding of the borders of the fragment and pulp obliteration of both fragments (Fig. 2). Eight years later, the tooth had normal clinical appearance with no mobility, and the radiograph revealed a blurred calcification at the fracture site (Fig. 3). The patient presented again 2 years later complaining of acute pain in a maxillary molar. At this time the periapical radiograph of the injured tooth confirmed the suspicion of cervical resorption (Fig. 4). The patient returned 13.5 years after the trauma complaining of excessive tooth mobility. The radiographic examination revealed extensive progression of the cervical resorption

Fig. 1. Initial radiograph after the trauma of a maxillary left central incisor, demonstrating mid-root fracture.

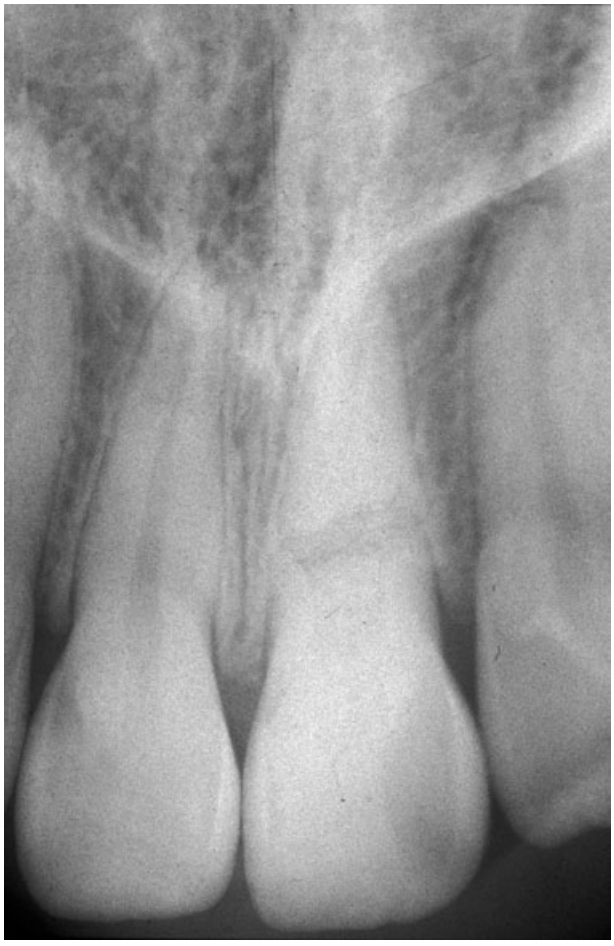

Fig. 2. The periodontal ligament within normal limits 3.5 years after the trauma. The borders of the fragments are rounded, with pulp canal obliteration.

Fig. 3. Eight years after the trauma revealing a blurred calcification at the fracture site.

Fig. 4. Ten years after the trauma, confirming the suspicion of cervical resorption.

(Fig. 5). As no conservative approach was possible, the patient was referred to a prosthodontist for esthetic rehabilitation.

Discussion

Andreasen and Andreasen (1) recommended splinting of teeth with horizontal root fracture for 2–3 months to ensure sufficient hard tissue consolidation. Cvek et al. (2) questioned the efficacy of long-term splinting upon root fracture healing. In the guidelines of the International Association of Dental Traumatology for the treatment of traumatic dental injuries the recommend splinting duration for root-fractured teeth is only for 3–4 weeks (4). In the present case the total fixation period was much longer (1). Prolonged splinting time is associated in laboratory animals (monkeys) with the development of replacement resorption in cases of avulsion and subsequent replantation (5). Conversely, splinting with rigid fixation showed no significant effect on pulp vitality and on the type of root tissue union in humans (6).

At the 8 years follow-up examination early signs of cervical resorption could have been disclosed in the radiograph (Fig. 4). Notwithstanding, these radiolucencies were initially missed, and were disclosed only after the progress of the resorptive process. Invasive cervical resorption is an insidious and often aggressively destructive form of external root resorption characterized by subepithelial invasion of clastic cells derived from the PDL (3). This pathologic process progressively resorbs the cementum and the dentin to eventually involve the pulp space late in the process (7). Its exact etiology is unknown and several potential predisposing factors have been suggested. Among these are intracoronal bleaching, trauma, orthodontic treatment, dentoalveolar surgery, and periodontal treatment (3). Cervical resorption is relatively uncommon and cannot be diagnosed clinically in its early stages; it is often only detected upon careful radiographic examination. The condition is usually painless, unless pulpal or periodontal infection supervenes (7). The treatment possibility for early stages suggested in the literature (7, 8) follows a protocol

Fig. 5. Extensive cervical resorption observed 13.5 years after the original trauma.

including: (i) careful case selection, (ii) topical application of trichloroacetic acid, (iii) thorough curettage, (iv) non-surgical root canal treatment, where necessary, and (v) restoration of the resorptive defect with glass inomer cement and follow-up. This protocol is not indicated in cases in which resorption has extended beyond one-third of root length (8). In the present case, we assume that trauma and additional infection in the PDL due to poor oral hygiene and vigorous scaling of accumulated calculus could have been the cause of the resorptive process.

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