

Management of Horizontal Root Fracture: A Four-Year Follow-up Case Report

Case Report

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Abstract

Tooth fracture is the most common traumatic event in permanent dentition, representing one of the most common causes of tooth loss. Maxillary central incisors have the highest risk of horizontal root fracture (80% incidence). The aim of this work is to analyze the clinical approach and the prognosis of a permanent maxillary central incisor with a horizontal root fracture of the middle third. A seven-year-old patient was referred for evaluation of the maxillary teeth after an accidental trauma. On clinical and radiological examination, the maxillary central incisor (element 2.1) was palatally luxated, the mobility was increased and shows a horizontal fracture in the middle third of its root. Moreover, the maxillary central incisor (element 1.1) showed a coronal enamel-dentine fracture, not exposing the pulp. The teeth had a positive response to the pulp sensibility test and were normochromic. After clinical and radiographical evaluation, the root fracture was reduced, and a splint was made. The patient had follow-ups at 6 weeks, 3, 6, 12, 24, 32 and 48 months after the trauma: all the teeth involved preserved vitality and chroma during the checks. The periapical radiographs demonstrated the reduction of the fracture line and suggested the repair of the maxillary central incisors with deposition of mineralized tissue upon the fracture line. The splint was removed 6 months after the trauma: the dental mobility of tooth 2.1 was increased. At 12 months follow-up the mobility was physiological. 48 months after the trauma, 2.1 and 1.1 teeth were positive to the vitality test.

Keywords: Fracture; Dental injuries; Pediatric dentistry; Horizontal root fracture

Introduction

One-fifth of traumatic injuries involve the maxilla and, in this case, the dento - alveolar district. In Glendor's review it is estimated that 33% of adults have experienced at least a trauma of permanent elements during their lifetime [1]. The most common trauma in the deciduous dentition is dislocation; in the permanent dentition, is fracture [1-4]. Due to their position, the permanent teeth with the highest risk of root fracture are the upper central incisors, which account for 80% of the cases [5]. The prevalence rate of root fractures in permanent teeth following trauma is between 0.5 and 7%; in deciduous teeth, this rate drops to 3.8%. The age groups with the highest reported incidence of root fracture are reported to be for permanent elements 11-20 years and 3-4 years for deciduous teeth [2,6,7]. Root fracture can be classified according to the orientation of the rhyme into vertical or horizontal fractures. In horizontal fractures, the outcome of the trauma can be classified more precisely according to the number of fracture rims, the location (cervical, middle, or apical third), extension (partial

or total), and based on the presence or absence of dislocation of the coronal fragment. In horizontal fractures, the middle third of the root is more often involved, rather than the cervical and apical thirds [8]. The coronal-radicular or radicular fracture represents the third most common cause of tooth loss [2]. A case report and its management is described here concerning the treatment of a horizontal fracture of the upper incisor following trauma.

Case Report

A 7-year-old patient came to our attention following trauma due to an accidental fall that occurred about 3 hours before the visit as confirmed by her parents. The patient did not report any spontaneous allergic symptoms; An initial extra-oral objective examination showed excoriations on chin skin and laceration of the lower lip (Figure 1).

The intra-oral clinical examination showed a coronal fracture of tooth 1.1 without pulp involvement, the element 2.1 was dislocated in palatal direction and the tooth was painful to percussion, showing



mobility in vestibulo-palatal direction. Elements 1.1 and 2.1 gave positive responses in thermal pulpal vitality tests and were normochromic (Figure 2). A periapical X-ray showed a horizontal fracture of the middle third of the 2.1 tooth's root. Furthermore, the same x-ray highlights the not completely formed root apex of 2.1 tooth (Figure 3).



Figure 1: Extra-oral photo taken during the first visit after trauma.



Figure 2: Intra-oral photo taken during first visit after trauma.

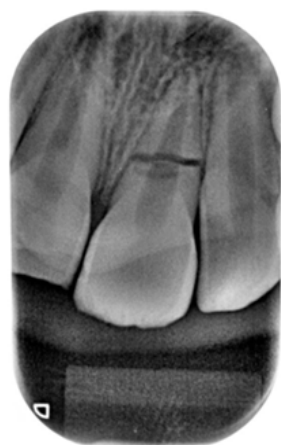


Figure 3: Periapical intraoral x-ray performed during the first visit, which highlights the presence of a horizontal fracture gap at the level of the middle third of the root of element 2.1.

After clinical and radiographical evaluation the diagnosis was: fracture of the middle third root of 2.1 with dislocation in the palatal direction associated with comminuted fracture of the vestibular wall of the alveolar process. The reduction of the fracture was performed under local anesthesia (articaine 40 mg/ml with vasoconstrictor 1:100,000): the crown fragment was repositioned and splinted to the adjacent elements with soft wire (Figure 4 & 5). It was then prescribed antiseptic therapy (chlorhexidine mouthwash 0.2%) and pain relief (paracetamol pediatric suspension) as needed.



Figure 4: Intraoral photo taken following element 1.1 composite reconstruction, reduction and soft splinting of element 2.1.



Figure 5: intraoral x-ray following reconstruction of element 1.1, reduction and soft splinting of element 2.1.

At 2-week-postoperative control, element 2.1 was thermally positive and free of inflammatory signs and symptoms. At the 6-month follow-up, the splint was removed: dental mobility of 2.1 appeared slightly increased at this stage. The clinical evaluation also showed that all the elements involved in the trauma were viable and normochromic. The periapical x-ray showed a less marked and clear fracture rhyme, compatible with the creation of a dentinal callus (Figure 6). The radiographic examination at 48 months showed a further reduction in the extent of the fracture rhyme, with a narrowing of the root canal at the fracture site (Figure 7).



Figure 6: Periapical intraoral x-ray 6 months after trauma.



Figure 7: Periapical intraoral x-ray 24 months after trauma.

Discussion

The survival rate of an element with a horizontal root fracture is relatively high (approximately 83% at 10 years) [9]. The treatment of horizontal fractures involves reduction of the root fracture, stabilization of the adjacent teeth and preservation of pulp vitality [7]. Several factors can influence the long-term prognosis of the tooth affected by this type of trauma such as:

- Presence or absence of dislocation at the time of injury concussion: the prognosis is better than for a dislocated element [8].
- Position of the fracture line: horizontal fractures of the middle third have a more favorable prognosis in 86% of cases, viability is preserved [10]. On the contrary, the prognosis of a cervical third fracture element is worse: only 30% of cases maintain pulpal viability [11].
- Age: young patients with elements with open apex have a better prognosis because of easier revascularization [8].
- Distance between the stumps: the closer they are, the better the prognosis is [8].
- Exposure of the fracture rhyme to the oral environment: if there is direct communication between the two sites, as it often occurs in fractures of the cervical third, healing may be influenced by bacterial contamination [6,8,12].
- Conservative, endodontic and periodontal conditions before trauma: the more the elements are compromised before the trauma, the worse their prognosis is [8].

The treatment of a horizontal fracture involves its reduction and splinting of the coronal stump to the adjacent elements through the use of a rigid or semi-rigid wire. The retention time of the splinting varies from one author to another: the guidelines recommend removal of the splint from 4 weeks to 4 months depending on the type of fracture [3]. In case of fracture of the cervical third of the root, it is recommended to keep the splint in place for up to 4 months. Although there are several articles in the literature, there is no unequivocal evidence on the timing of splint removal [3,7]. The use of soft splints and their removal in the indicated time frame is intended to prevent ankylosis of the tooth. In the presented case it was decided to prolong the maintenance of splinting until the sixth month as the mobility of the fragment and the width of the fracture rhyme can be considered unfavorable prognostic factors. The possibility of obtaining the same results with splint removal at 4 weeks cannot be excluded.

The outcome of this type of trauma can be represented by three main scenarios: pulp necrosis due to bacterial colonization, sterile necrosis

associate a pupal obliteration or revascularization and pulpal repair/regeneration. A consequence of pulpal necrosis is represented by the arrest of the development of the tooth if still maturing. The development of bacterial necrosis will depend on who colonizes the pulp tissue first: bacteria or vascularizing and regenerating cells. The bacterial necrosis, which is observed in about 25% of cases, develops most frequently two months after trauma; in these cases, “healing” occurs by the interposition of granulation tissue between the two stumps. The therapy for bacterial necrosis is endodontic treatment: the crown fragment is treated up to the fracture line.

In the case of sterile necrosis, the development of pulpal obliteration is observed. A consequence of pulpal necrosis is represented by the arrest of the development of the tooth if still maturing. The healing of the fracture rhyme can take place by the interposition of hard tissue, connective tissue or granulation tissue. Radiographically it is possible to evaluate the results of healing: if there has been no change in the anatomy of the canal, there has been healing through the interposition of hard tissue; if not, there has been interposition of connective tissue. In a study by Andreasen et. Al. it was observed that in a pediatric population 25% of the fractures heal through the interposition of hard tissue, 50% by connective tissue interposition and 25% by granulation tissue interposition [7].

Following the trauma, the patient must be monitored by follow-up from one month to one year. The choice of this time frame is due to the fact that during period there is a greater probability of pulpal necrosis [7,13]. During this period, it is good practice to assess the viability of the affected element by thermal testing: data obtained up to three months after trauma are not indicative of the long-term prognosis of the element due to the incidence of false positives and false negatives as a result of possible pulp shock [3].

If the traumatized tooth fails the vitality test after these three months, endodontic treatment is necessary. It is estimated that in approximately 20-44% of cases of root fracture the pulp is necrotic. The definitive diagnosis of pulp viability or necrosis cannot be defined before three months of follow-up [14-18].

Conclusion

In agreement with the most recent literature, it can be stated that early post-traumatic intervention, fracture reduction and splinting of the mobile coronal segment improves the long-term prognosis and the chances of maintaining the pulpal viability of the tooth.

Conflict of Interests

The authors declare that they have no conflict of interests.

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Informed Consent

The authors declare that informed consent has been obtained from the patient for publication of the case, including photographs.

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