



Horizontal Root Fracture Treated with Calcium Hydroxide and Triethanolamine: Case Report with a 10-Year Follow-Up

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Abstract

Dental fractures affect mainly the upper central incisors, due to their anatomical location, targets of automobile accidents, sports, aggressions, and several other types of trauma. Children and adolescents are more affected than adults. Several procedures and techniques may be necessary, among them endodontic treatment. Ideally, one should proceed with biomaterials that can favor the repair of damaged tissue. The purpose of this article is to present the case of a 12-year-old patient who presented a horizontal fracture in the middle third root of the upper right central incisor. Endodontic treatment was performed and repair was achieved through the therapeutic association between calcium hydroxide and triethanolamine. The patient has been followed up for 10 years, presenting healing of the fracture line.

Keywords: Dental Trauma; Fracture Healing; Calcium Hydroxide; Horizontal Fracture

Introduction

Dental fractures affect mainly the upper central incisors, due to their anatomical location, targets of automobile accidents, sports, aggressions, and several other types of trauma. Children and adolescents are more affected than adults. Traumatic injuries are the cause of emergency care in dental practice. Horizontal root fractures are most commonly seen in the maxilla, anterior teeth, and in young males. The most common type of radicular fracture is in the middle third, followed by the apical and coronal part [1-3].

Traumatic dental injuries can result in pulpal sequelae, including pulpal necrosis with infection, pulpal canal obliteration, and root resorption [4].

Horizontal root fractures comprise between 0.5 to 7% of injured permanent teeth, including the dental pulp, dentin, cementum, and tissue support (periodontal ligament and the alveolar bone) [3,5-8].

With fracture, there may be formation of hard, connective or granulomatous tissues interposed at the fracture line. From this perspective, fractured teeth can be classified into four groups: healing with hard tissue; healing with interposition of hard and soft tissue; healing with interposition of soft tissue; and no healing [2,5,9-12].

Frequently, temporary immobilization maneuvers of fractured teeth are necessary, such as ferulizations or splints [2,13-16]. Several biomaterials have been used, including mineral trioxide aggregate associated with antibiotics [3,8,12,13,17-19]. Calcium hydroxide has been widely used, associated with the most diverse vehicles, thanks to its biocompatibility. Among the vehicles used, triethanolamine has shown promise as an intracanal medication. The calcium hydroxide paste conveyed by triethanolamine was resorbed and replaced by newly formed bone tissue, observed by histological and pHmetric evaluation [11,20,21].

Clinical, radiographic and tomographic follow-up should be performed in cases of fractured teeth, since in 25% of cases, pulp necrosis occurs in the coronary fragment, requiring endodontic treatment [6,11,13,16,18,19,22-25]. It is usually indicated only for the coronary fragment [22]. Additionally, in some cases, paraendodontic surgery may still be necessary and recommended [11,19].

The survival percentage of the teeth with horizontal root fracture is relatively high (83 to 91%) for up to 10 years of observation [23,26,27]. Fracture healing is possible, with restoration of pulpal activity and tooth staining, and scarred hard tissue, without professional management [14-16,28,29].

The purpose of this article is to present the case of a 12-year-old patient who presented a horizontal fracture in the middle third root of the upper right central incisor. Endodontic treatment was performed and repair was achieved through the therapeutic association between calcium hydroxide and triethanolamine. The patient has been followed up for 10 years, presenting healing of the fracture line.

Case Report

A Caucasian female patient, 12-years-old, presented to the dental clinic of the University of Taubaté complaining of spontaneous pain in tooth 11.

Clinically, tooth 11 presented normal staining. The periodontal tissues and mucosa adjacent to the tooth were normal. No bleeding or tooth mobility were observed. However, tooth 11 showed sensitivity to vertical and horizontal percussion and palpation at the apical level when compared to tooth 21. The pulp vitality test on tooth 11 with refrigerant gas spray revealed intense and long lasting pain response.

The patient reported trauma 6 months ago, with pain on cold and heat, during brushing and in the decubitus position when sleeping.

Periapical radiographic examination showed horizontal transverse root fracture in the middle third. Complete apex without visible periapical change, intact lamina dura and absence of root resorption were observed (Figure 1).

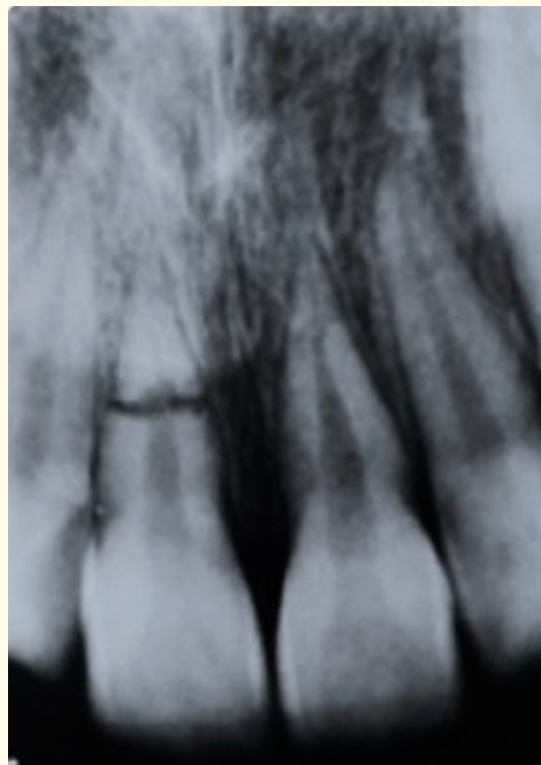


Figure 1: Periapical radiographic showing horizontal transverse root fracture in the middle third of the tooth 11.

The probable clinical diagnosis established was symptomatic irreversible pulpitis and the treatment instituted was endodontic treatment of tooth 11.

Access surgery, preparation of the pulp chamber, and pulpectomy were performed on both the coronal and apical root portions (Figure 2). The chemical-surgical preparation of the canal was performed with Endo-PTC neutralized with sodium hypochlorite with the last instrument the 40-gauge K file. Odontometry was then performed (Figure 3). Plentiful irrigation with EDTA-T, followed by aspiration and insertion of intra-canal medication with NDP (association among dexamethasone phosphate, paramonochlorophenol, polyethylene glycol and saline), occluded with glass ionomer cement were performed.

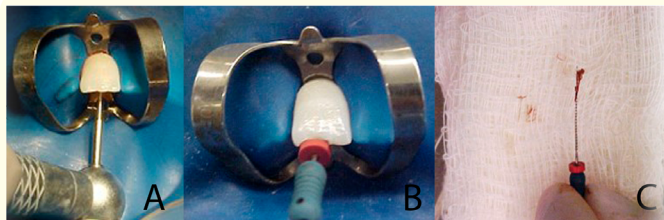


Figure 2: Access surgery (A); preparation of the pulp chamber (B); and pulpectomy (C).



Figure 3: Odontometry.

After 30 days of the procedure, the patient returned for an evaluation visit. No painful symptoms were reported. New irrigation with Dakin’s solution and aspiration were performed. After drying with absorbent paper cones, the therapeutic association of calcium hydroxide powder (1.0011g) and triethanolamine (2.4829g) was used as intra-canal medication [21]. The canal was completely filled using a K file (Figure 4). Glass ionomer cement was again used as occlusive dressing in the pulp chamber.



Figure 4: Irrigation and aspiration (A); insertion of the therapeutic association of calcium hydroxide powder and triethanolamine (B; C).

After 6 months, clinical-radiographic follow-up was performed. No changes or painful symptoms (spontaneous or sensitivity to percussion and palpation) were observed. Radiographically, no changes were observed in the apical third of the root (Figure 5).

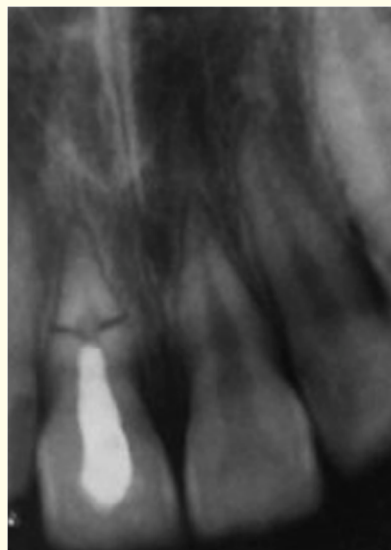


Figure 5: Periapical radiographic showing no changes in the apical third of the root after 6 months.

After the cone test (Figure 6), obturation of the root canal was performed (main cone diameter 40 and N. Rickert cement) by lateral condensation technique and subsequently vertical condensation. The pulp chamber was provisionally sealed with glass ionomer (Figure 7). The final restoration occurred 30 days after obturation of the canal.



Figure 6: Cone test.



Figure 7: Final obturation of the root canal.

After 2 years, the patient was evaluated again, with no clinical or radiographic signs of changes (Figure 8).



Figure 8: Periapical radiographic with no changes after 2 years.

The patient has been under clinical follow-up for 10 years with no complaints or changes (Figure 9). Radiographic control showed normal width periodontal root space, integrity of the lamina dura and probable healing with hard tissue of the fracture line (Figure 10).



Figure 9: Clinical aspects after 10 years.



Figure 10: Periapical radiographic showing no changes, after 10 years.

Discussion

Accidents resulting in root fracture, separating the root into two fragments may subsequently cause pulp mortification of both root segments and occurrence of inflammatory process in the tissues adjacent to the fracture [1-3,7-14,16-19,23,28-30]. From this perspective, endodontic therapy aims to promote local conditions in the fracture area enabling repair. When possible, therapy should be performed only on the fractured cervical portion of the canal, attached to the crown of the tooth. In view of the size and involvement of the inflammatory process, with the possibility of causing future pulpal complications and hard tissue lesions, therapy should also be performed in the apical third of the root canal [4], as was done in the present case.

The extent of the fracture can directly alter the prognosis of the fractured tooth. The greater the trauma to the supporting tissues and the distance between the fragments (diastasis), the lower the possibility of repair through the formation of mineralized tissue

[2,18]. In diastasis of root fractures, formation of hard, connective or granulomatous tissue may occur at the fracture line [2,5]. The procedures include repositioning of the fractured tooth, immobilization with splints, and endodontic treatment. The correct execution of the techniques, immediately after the dental trauma has occurred, should improve the short and long term prognosis, that is, adequately treated teeth with root fractures have a good prognosis [18]. Although the management in the case presented only occurred 6 months after the trauma - thanks to the painful symptomatology - the therapeutic conducts culminated in the maintenance of the tooth and preservation after 10 years of endodontic treatment.

The therapeutic association between calcium hydroxide and triethanolamine was favorable as an intracanal medication. The paste of calcium hydroxide and triethanolamine suffered resorption being replaced by newly formed bone tissue [20]. Additionally, it showed advantages of not needing periodic changes acting as an obturation, remaining inside the canal for a longer time, reducing clinical care steps. Besides the significant improvement in pain symptoms, the disappearance of possible pigmentation, stains and unwanted coloration was also observed.

Triethanolamine is biocompatible, even after 90 days. Triethanolamine is water-soluble and is easily removed from the canal during irrigation. These characteristics, associated with calcium hydroxide, make it an excellent vehicle for intra-canal medication [20].

Spontaneous healing of horizontal root fractures in the apical third can usually occur [2,14-16,25,28]. This phenomenon depends, among other factors, on pulp vitality. Spontaneous healing of the fracture line occurred by interposition of connective tissue or bone tissue has been reported, by diagnosis using computed tomography [14,15,28].

Conclusion

Root fractures require adequate diagnosis and treatment plan, as well as long preservation. Preferably, biomaterials that can favor the repair of damaged tissue should be used. In this perspective, intracanal medication based on calcium hydroxide and triethanolamine resulted in satisfactory response, evaluated clinically and radiographically after 10 years of treatment.

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