

Horizontal Root Fracture Detected as Elliptical in Radiography: Case Report and 3-Year Follow-Up

Radyografide Eliptik Olarak Tespit Edilen Horizontal Kök Kırığı: Olgu Sunumu ve 3 Yıllık Takip

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ABSTRACT Horizontal root fractures occur in 0.5-7% of all dental injuries, and frequently are located on the middle third of the root of upper incisors. This paper reports a clinical case with a 3-year follow-up of a horizontal radicular fracture located between the middle- and apical-third of an upper left central incisor. The fractured fragments were separated by a narrow radiolucent line and detected elliptical in radiography and were splinted using a 1x3 twisted wire and a composite resin for four months. After 3 years, in clinical and radiographic examination, it was determined that the tooth was asymptomatic and vital, and the fractured fragments had healed with fibrous tissue developing between the fractured segments, which is classified as the second type of root-fracture healing.

Key Words: Tooth fractures; splints; dental pulp calcification; fracture healing

ÖZET Horizontal kök kırıkları, tüm diş yaralanmalarının %0,5-7'sini oluşturur ve sıklıkla üst keser dişlerin kök orta üçlüsünde meydana gelir. Bu olgu raporunda üst sol kesici dişin kökünün orta ve apikal üçlüsü arasında oluşan kırığın teşhis ve 3 yıllık takibi sunulmuştur. Radyografide eliptik olarak tespit edilen ve keskin bir radyolüsent çizgiyle birbirinden ayrılan kırık parçalar, kompozit rezin kullanılarak 3 sarımlı tel ile 4 ay süreyle splintlenmiştir. Üç yıl sonra, klinik ve radyografik değerlendirmede, dişin asemptomatik ve vital olduğu, kırık parçaların ikinci tip iyileşme ile iyileştiği ve kırık parçaların arasında fibröz dokunun geliştiği gözlenmiştir.

Anahtar Kelimeler: Diş kırıkları; splintler; diş pulpası kalsifikasyonu; kırık iyileşmesi

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Horizontal root fractures occur in 0.5-7% of all types of traumatic injuries.¹ These fractures frequently occur as a result of facial trauma to the anterior teeth. They generally occur in the middle-third of the root of maxillary central incisors and are most frequently seen followed by apical and coronal third fractures of the teeth. These fractures are mostly oblique and detection of the fracture is very difficult. Fractures at the coronal third are rare and their prognosis is worse than the prognosis of a root fracture at the middle or apical third.^{2,3}

Teeth with root fractures often do not respond to pulp testing. Recent evidence suggests that a negative initial response is significantly related to later pulp necrosis.⁴ If a root fracture occurs horizontally, the coronal segment may displace to a varying degree. The apical segment is generally not

displaced, thus the apical pulpal circulation is not disrupted. Therefore, there is less occurrence of pulp necrosis in the apical part of a tooth. Pulp necrosis of the coronal segment displacement occurs in about 25% of the cases.^{4,5}

During the initial examination, obvious tooth crown malposition or fracture lines cannot be detected by inspection or radiography. The position and the direction of the fracture line may vary mesiodistally and buccolingually, and the radiographic image is affected by the direction of the X-ray beam. The fracture line may appear doubled because of the angulation of the fracture.⁶ This image may give an incorrect impression of an elliptical double fracture of the root. Therefore; several radiographic projections may be required to identify the fracture line. If the initial parallel film does not demonstrate a fracture, occlusal films may be required.⁷ Variation of the vertical angle may also be useful to detect the position of the fracture line.⁸

This paper reports on the apparent healing of an upper left-central incisor with horizontal root fracture without any endodontic treatment and the follow-up for over 3 years.

CASE REPORT

A 17-year-old female was referred to the Department of Endodontics, Faculty of Dentistry, Süleyman Demirel University with mobility on the maxillary incisor. The patient reported that a bicycle accident had occurred 3 weeks prior. Her medical history was unremarkable. On extraoral examination, there was no abnormal condition. On intraoral examination, there was no discoloration at the coronal segment of all mandibular and maxillary anterior teeth. There was no sensitivity to percussion and a palpation test. The upper right central incisor exhibited grade I mobility. All of the teeth showed positive response to the vitality test except for the left maxillary central incisor. There were no other clinical signs or abnormalities observed. The periapical and occlusal radiographs revealed an elliptical horizontal root fracture between the apical and middle third of the root of the upper left central incisor (Figure 1 and 2).



FIGURE 1: Initial occlusal radiograph showed crown fracture and elliptical horizontal root fracture on left lateral and central upper incisors, respectively.

The coronal fragment of left central incisor was splinted with 1x3 twisted wire (3M Unitek, Monrovia, California, USA) exceeding from the right central tooth to left canine tooth (Figure 2). The immobilization was maintained for 4 weeks and follow-up radiographs were taken. Root canal treatment procedures were not performed during the follow-up and the tooth was checked for its vitality via an electrical pulp test the maintenance period. The splint was removed after 4 weeks. The splint period was extended to 4 months due to continued tooth mobility. The tooth was determined



FIGURE 2: Periapical radiograph of the upper central incisor with an elliptical horizontal root fracture.

to exhibit a positive reaction to the electric pulp test. At the end of the fourth month, the splint was removed because tooth mobility had disappeared.

At the end of the first year, clinical examination showed that the tooth survived its vitality and the mobility was within physiologic limitations. The obliteration in the apical part of the upper left central incisor was detected at the radiographic examination (Figure 3). Three years after the initial injury, the fractured tooth responded to an electrical stimulation test indicating vitality. The radiographic examination revealed a normal periodontal ligament, rounding of the borders of the fragment and pulp obliteration of the apical and coronal fragments. The distal edges of the fragments were rounded and the healing of this area was likely related to fibrous tissue healing (Figure 4).

DISCUSSION

Healing of the horizontal root fractures with or without initial treatment is reported to occur in up to 80% of cases.¹ Healing of horizontal root fractures without treatment has been presented in many reports.^{2,9-12} If the displacement of the coronal part during the accident is not severe, the



FIGURE 3: Radiograph taken following repositioning and splinting of the tooth.

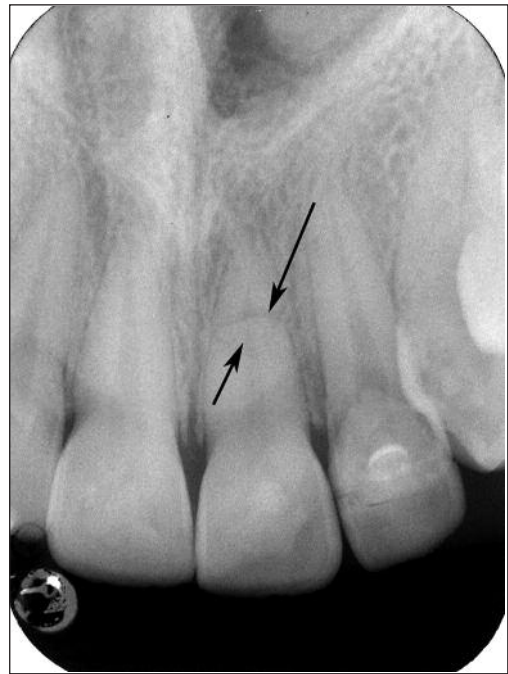


FIGURE 4: After 12 months, obliteration was noted at apical fragments on the left central incisor.

chance of a better prognosis increases.^{3,4,13} If the dental pulp injury is severe, healing does not occur without root canal treatment.³ The prognosis of root fractures depends on the extent of separation of the fracture line, the state of the pulp tissue, occlusion, dislocation of the fragments and the general health condition of the patient. The primary purpose of the treatment of fractured teeth is to maintain the vitality of the teeth.¹⁴ When the vitality of the pulp tissue is preserved, the odontoblasts and the cells from the cementum are usually responsible for the healing process.³ In this case, although the tooth was nonvital when the patient came to our clinic, root canal treatment was not performed. Initially after only one month, the tooth was determined as vital. An electric pulp test should always be performed in all follow-up periods due to its importance in treatment planning and tooth prognosis.

Ideally, the fragments should heal by reunion of the fragments with hard tissue. This type of healing can be achieved by splinting the tooth as early as possible. If a root fracture is diagnosed, emergency treatment involves repositioning of the segments to as close proximity to each other as

possible and fixing in position with a splint to the adjacent teeth for 1-4 months.^{6,7,15} In our case; because the patient came to our clinic three weeks after the trauma, splint application was performed without force. The main purpose of splint application is to protect the tooth from excessive forces. If the patient had come to our clinic immediately after trauma, the fragment would be splinted thru replacement. Therefore, it is the expected that the fragments don't closely approach each other after the splint application. In our case, we splinted the teeth for 4 months without reposition.

The sequence of root fractures may be divided into four categories.¹ The first type of healing is with calcified tissue. In the second type of healing, fibrous tissue develops between the fractured segments. The surfaces of the root fracture are covered by cementum and may undergo some resorption. The segments seem radiographically separated by a narrow radiolucent line, with edges rounded by surface resorption. The pulp may become calcified, but usually remains vital and responsive to pulp tests. The third healing variety is characterized by interposition of bone and connective tissue between the fragments. The fourth type is when root fractures heal thru the interposition of granulation tissue.¹⁶

In the present case, upon radiographic examination, the fragments appeared to be separated by a narrow radiolucent line and the fracture edges were rounded. In addition, it was observed that obliteration began in the coronal and apical parts of the root canal when be compared with the first radiograph. The fractured tooth responded to an electrical stimulation test indicating vitality. This type of healing is likely to be related to the second type.

Although the obliteration in the apical part of the tooth was detected in the radiographic examination in the 6-month follow-up, root canal therapy was not the preferred method of treatment due to a lack of clinical signs or symptoms, and due to a positive response to electric pulp testing. Additionally, there was no evidence of internal or ex-

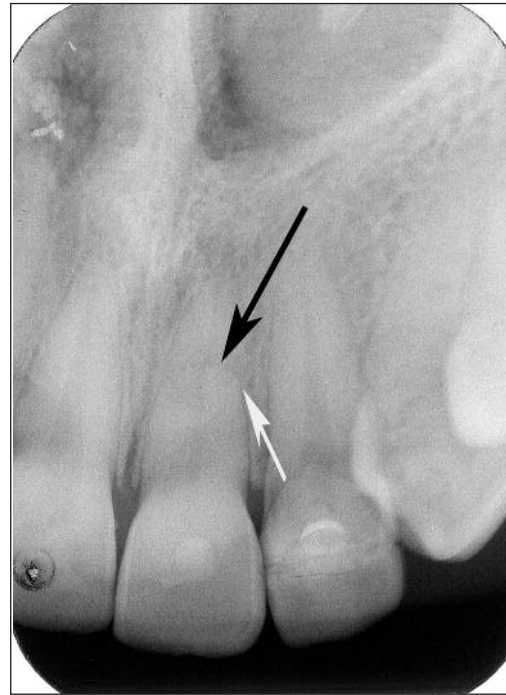


FIGURE 5: The periodontal ligament within normal limits 3 years after the trauma. The borders of the fragments were rounded, the pulp canal was obliterated in both fragments of the tooth.

ternal resorption, no evidence of periradicular pathologic changes, and also radiographic detection of the fragments separated from each other (Figure 5).

It has been reported that the pulp may become calcified, but usually remains vital and responsive to pulp tests.¹⁴ It has also been mentioned that the decision to intervene endodontically in cases of apparent pulp space calcification should be based on evidence of pulp necrosis and not on pulp calcification.¹⁵

Furthermore, in the second type of root fracture healing, fibrous tissue develops between the fractured segments. Fibrous tissue healing of root fractures without treatment has been presented in many reports.¹⁷⁻¹⁹

To sum up, it can be concluded that fractured roots can heal without any endodontic treatment provided that the vitality of the pulp is preserved and displacement of fragments is prevented.

REFERENCES

1. Andreasen JO, Hjørtting-Hansen E. Intraalveolar root fractures: radiographic and histologic study of 50 cases. *J Oral Surg* 1967;25(5): 414-26.
2. Çalışkan MK, Pehlivan Y. Prognosis of root-fractured permanent incisors. *Endod Dent Traumatol* 1996;12(3):129-36.
3. Hovland EJ. Horizontal root fractures. Treatment and repair. *Dent Clin North Am* 1992; 36(2):509-25.
4. Andreasen FM, Andreasen JO, Bayer T. Prognosis of root-fractured permanent incisors--prediction of healing modalities. *Endod Dent Traumatol* 1989;5(1):11-22.
5. Andreasen FM, Andreasen JO. Resorption and mineralization processes following root fracture of permanent incisors. *Endod Dent Traumatol* 1988;4(5):202-14.
6. Tsukiboshi M. Root fracture. *Treatment Planning for Traumatized Teeth*. 1st ed. Honover Park, IL: Quintessence Publishing Co, Inc; 2000. p.56.
7. Trope M, Blanco L, Chivian N, Sigurdsson A. The role of endodontics after dental traumatic injuries. In: Cohen S, Hargreaves KM, eds. *Pathways of the Pulp*. 9th ed. St. Louis: Mosby; 2002. p.610-46.
8. Camp JH. Management of sports-related root fractures. *Dent Clin North Am* 2000;44(1):95-109, vi-vii.
9. Ozbek M, Serper A, Calt S. Repair of untreated horizontal root fracture: a case report. *Dent Traumatol* 2003;19(5):296-7.
10. Tziafas D, Margelos I. Repair of untreated root fracture: a case report. *Endod Dent Traumatol* 1993;9(1):40-3.
11. Görduysus M, Avcu N, Görduysus O. Spontaneously healed root fractures: two case reports. *Dent Traumatol* 2008;24(1):115-6.
12. Artvinli LB, Dural S. Spontaneously healed root fracture: report of a case. *Dent Traumatol* 2003;19(1):64-6.
13. Rintaro T, Kiyotaka M, Minoru K. Conservative treatment for root fracture located very close to gingiva. *Dent Traumatol* 2005;21(2): 111-4.
14. Borelli P, Alibrandi P. Unusual horizontal and vertical root fractures of maxillary molars: an 11-year follow-up. *J Endod* 1999;25(2):136-9.
15. Flores MT, Andersson L, Andreasen JO, Bakland LK, Malmgren B, Barnett F, et al. Guidelines for the management of traumatic dental injuries. I. Fractures and luxations of permanent teeth. *Dent Traumatol* 2007;23(2):66-71.
16. Bakland LK. Endodontic considerations in dental trauma. In: Ingle IJ, Bakland LK, eds. *Endodontics*. 5th ed. London: BC Decker, Inc; 2002. p.808-11.
17. Oztan MD, Sonat B. Repair of untreated horizontal root fractures: two case reports. *Dent Traumatol* 2001;17(5):240-3.
18. Polat-Ozsoy O, Gülsahi K, Veziroğlu F. Treatment of horizontal root-fractured maxillary incisors--a case report. *Dent Traumatol* 2008; 24(6):e91-5.
19. Cobankara FK, Ungör M. Spontaneously healed horizontal root fracture in maxillary first premolar: report of a case. *Dent Traumatol* 2007;23(2):120-2.