Case Report

Root fracture of immature permanent incisors – a case report

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Abstract – This 7-year-old girl experienced pain in her upper central incisors following a fall to the ground. Radiographic examination revealed immature upper central incisors with midroot oblique and horizontal root fractures. Splinting was performed. When at 3 months, an electric pulp test was positive for both injured teeth, and after 5 months, the fracture lines had disappeared on the radiographs, the splint removed. After 2 years, clinical examination showed normal tooth color and position, with a positive response to the pulp test. Radiographs demonstrated continuous root development, although root canal narrowing was noted at the healed fracture sites.

Hsiao-Hua Chang¹, Yin-Lin Wang¹, Hong-Jiun Chen¹, Guay-Fen Huang^{1,2}, Ming-Kuang Guo^{1,2}

¹Pediatric Dentistry, Department of Dentistry, National Taiwan University Hospital, Taipei, Taiwan; ²School of Dentistry, College of Medicine, National Taiwan University, Taipei, Taiwan

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Dr Ming-Kuang Guo, No. 1 Chang-Teh Street, Department of Dentistry, National Taiwan University Hospital, Taipei 100, Taiwan

Tel.: +886 2 23123456 ext 6848 Fax: +886 2 23831346 e-mail: mkguo@ha.mc.ntu.edu.tw Accepted 14 December, 2004

Horizontal root fractures of permanent teeth are rare, accounting for approximately 0.5-7% of all dental trauma, and most frequently occur in the middle third (1, 2). The prognosis is poorer if the fracture level is in the coronal third (3). Horizontal root fracture appears primarily in the maxillary anterior area, especially when the tooth is fully erupted with complete root formation. If the root is immature, the frequency of fracture is usually low (4).

We describe treatment and 2-year follow up of oblique and horizontal root fractures on the immature right and left upper central incisors of a 7-yearold girl.

Case presentation

A 7-year-old girl came to the Pediatric Dental Clinic of the National Taiwan University Hospital because of a painful sensation on the upper incisors following an accidental falls in school approximately 15 h earlier. There was slight swelling of her upper lip, but no other facial or head injuries or neurological

signs and symptoms were noted. Intra-oral examination revealed that the patient was in the mixed dentition stage with two permanent maxillary central incisors, a left permanent maxillary lateral incisor, four permanent mandibular incisors, and four permanent first molars. Blood clot covered the gingiva around the maxillary central incisors; slight swelling and ecchymosis of the gingiva around the injured teeth and upper labial frenum areas were also noted. However, the injured teeth showed no obvious displacement, and no coronal cracking or chipping was found. The teeth presented slight mobility on palpation and were very sensitive to touch. Radiographic examination showed that the upper incisors were immature, at stage 4 (3/4 of the)root length) of root development according to a classification suggested by Moorrees et al. (5). A horizontal fracture was noted on the left central incisor at the middle third of the root and an oblique fracture inclined apically from the distal to the mesial side of the right central incisor at the level of the middle third of the root (Fig. 1). There was no displacement of either incisor.



Fig. 1. Initial occlusal radiograph showed immature upper central incisors with mid-root oblique and horizontal root fractures on right and left central incisor, respectively.

Repositioning of the incisors was not required but rigid immobilization with 0.7 mm stainless steel round wire bonded with self-curing resin was performed immediately after cleansing the injured area. A soft diet and avoidance of chewing on the upper incisors were suggested. One week after fixation, tenderness and percussion pain persisted on both central incisors but swelling and ecchymosis of the soft tissue had subsided. By the third month, pain was no longer present on percussion and the mobility reduced. Both teeth exhibited positive reactions to the electric pulp test. Although the fractures were apparent on a periapical radiograph, further root formation was noted. Five months after fixation, the fracture lines had disappeared (Fig. 2),



Fig. 2. Five months after stabilization, intra-canal calcifications were noted (\nearrow) at previous fracture areas.



Fig. 3. Two years following treatment, completed root development was shown.

and intra-canal calcifications were noted around the healed fracture areas. The splint was removed. An electrical pulp test showed a positive response, which was similar to that of the adjacent lateral incisors.

Clinical examination at 2 years revealed no adverse signs or symptoms for these two incisors. Continuous root development of both incisors was apparent on radiographs and root canal narrowing was noted in the area of the healed fractures (Fig. 3).

Discussion

The prognosis of a tooth with a root fracture depends on the extent of dislocation of the fragments, the root development, and the pulp tissue condition at the time of injury (1, 3, 6). A tooth with a root fracture without displacement has a higher likelihood of maintaining its vitality than a displaced tooth without root fracture (7). It has been reported that dental pulp necrosis occurs in 20-44% of root fracture cases (7-9), whereas in luxated teeth without root fracture, necrosis occurs in at least 43% of cases (9). Additionally a wide immature apical foramen in a traumatized tooth favors pulp survival (10). The clinical and radiographic examinations of our patient showed no obvious displacement, and the root apices were at Moorrees' fourth stage of root development. Spontaneous healing of teeth that maintain pulp vitality may occur in 70-80% of intra-alveolar root fracture cases (11).

However, the relation between the coronal and apical segments following impact is essential in determining the vitality of the pulp (12). Therefore, repositioning appears to enhance the likelihood of both pulp healing and hard tissue repair. In this case, the displacement of the coronal fragments of the roots was minimal, the root canals were wide and the apices of the roots were widely open; all of these conditions favoured healing, which agrees with Feiglin's requirements for healing by hard tissue across the fractured segments (3). It has been suggested that to determine the vitality of an injured tooth, observation for longer than 1 year may be necessary (9). After splinting for 5 months, the fracture lines had diminished on the radiographs, and hard tissue healing was observed. In this case, maintenance of vitality and repair of the fractured areas were observed in both injured teeth at 2 years.

Approximately 75% of teeth with root fractures exhibit calcification nodules, which narrow the pulp space (13). In this case, healing of dentin and cementum was noted, and calcification nodules that narrowed the root canal space were observed. Some observers believe that the reparative dentin deposition and subsequent reduction of the pulp space has a close relation with dental pulp revascularization or reinnervation (2). The present case reaffirms the likelihood of hard tissue healing and maintenance of pulp vitality in injured immature teeth (14).

For the treatment of root fracture, rigid fixation for at least 2–3 months is recommended (15). A retrospective study on a sample of 208 teeth with intra-alveolar root fractures found no significant effect of the duration and types of splinting on fracture healing (12). Our patient received rigid fixation for 5 months until complete union of the fracture line was seen, which is longer than suggested by Cvek et al. (12).

Conclusion

This case illustrates the favourable prognosis of two immature permanent teeth with root fractures and minimally displaced coronal fragments. Pulp vitality and hard tissue repair followed 5 months stabilization and 2-year follow up.

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