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Conservation of root-fractured primary teeth—report of a case

CASE REPORT

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Key words: horizontal root fracture; primary teeth; root resorption; tooth replacement

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Abstract – A 3.5-year-old girl presented to our clinic experiencing pain in her maxillary central incisors following traumatic injury during a fall. Radiographic examination revealed both primary maxillary central incisors with mid-root and apical third horizontal root fractures, respectively. Splinting with orthodontic brackets and stainless steel wire was performed. At 2 weeks, resorption of the apical fragments in both injured teeth was observed, and after 3 months, almost complete resorption was noted on radiographs. Tooth mobility at this point was back to physiologic levels and the splint was removed. After 2.5 years, the primary maxillary incisors were replaced by permanent incisors demonstrating normal tooth color, position, and root development. Although this case illustrated the favorable prognosis of two primary teeth with root fractures and severely mobile coronal fragments by a conservative approach, more scientific evidences are needed and frequent recalls are necessary when primary root fractures are attempted to be managed with splinting.

Root fractures, defined as fractures involving dentin, cementum, and pulp, are relatively uncommon among dental traumas, comprising 0.5–7% of the injuries affecting the permanent dentition (1–3). In the primary dentition, root fractures are as rare as about 2–4% (1, 4, 5), due to the plasticity of the developing alveolar bone. They are most frequent at the age of 3–4 years where physiologic root resorption has begun, thereby weakening the root (1). Management of root fractures presented a formidable challenge for clinicians because of the patients' non-cooperation and the difficulty of achieving a stable reunion of the fracture fragments (6).

This report aims to present a case of root-fractured primary incisors, its conservative management, and a satisfactory 2.5-year follow up.

Case report

A 3.5-year-old girl was brought by her mother to the Department of Pediatric Dentistry, School of Stomatology, the Fourth Military Medical University, Xi'an, China, complaining of pain and abnormal mobility of her maxillary left central incisor following an accidental fall at school approximately 16 h earlier. Intra-oral examination revealed that the patient was in the primary dentition stage. A blood clot covered the gingiva adjacent to the maxillary central incisors and the injured teeth exhibited class II mobility with pain on palpation and percussion. The maxillary left incisor was displaced about 1 mm and luxated in a palatal direction (Fig. 1a). Radiographic examination revealed a horizontal radiolucent line in the middle third of the maxillary left central incisor, and a horizontal fracture on the right central incisor at the apical third of the root. The succedaneous permanent incisors were noted at stage Cr. 3/4 (crown 3/4 complete) of crown development according to a classification suggested by Moorrees et al. (7) (Fig. 1b).

Based on clinical and radiographic examinations, the patient was diagnosed with horizontal root fractures and partial luxation of the maxillary primary incisors. Under local anesthesia, the left central incisor was repositioned and a splint made up of orthodontic brackets and 0.5-mm stainless steel wire was placed. The patient was instructed to remain on a soft diet and oral hygiene with frequent recall appointments was reinforced. Along with homecare instructions, amoxicillin and chlorhexidine mouth rinse were prescribed.

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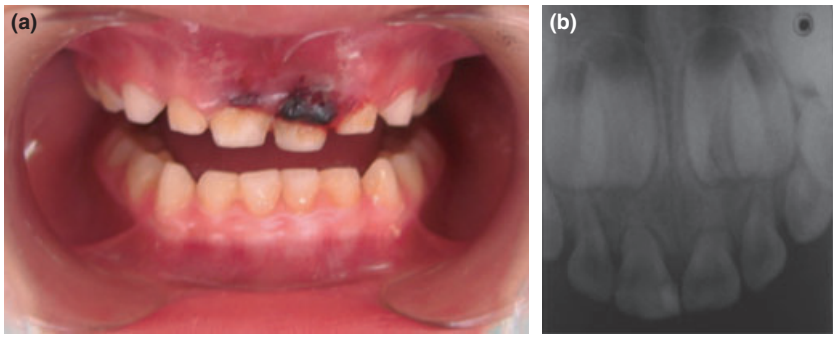

Fig. 1. Initial images showing displaced upper left central incisor. (a) clinical aspect. Initial images showing displaced upper left central incisor. (b) radiographic aspect.

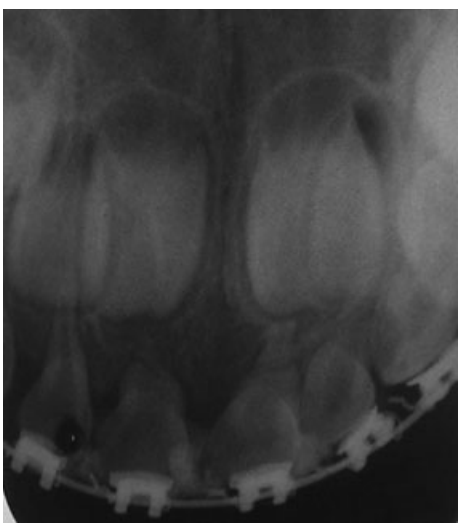

Fig. 2. Radiograph taken 2 weeks after injury showing root resorption of the apical fragments.

Two weeks after splinting, the swelling of gingiva subsided and adequate periodontal healing was noted; however, the injured tooth was still sensitive to percussion. At this point, radiographic root resorption of the apical fragments was also noted (Fig. 2). At 6 weeks, the resorption progressed. By 3 months, the root resorption of both apical fragments was almost completed (Fig. 3a), and the traumatized primary teeth were no longer tender to percussion with their mobility returning back to physiologic levels (Fig. 3b). At this point, the splint was removed. In order to observe if tooth replacement and the development of the succedaneous permanent incisors were affected, the patient was seen with frequent followed ups. During the 30-month recall, the patient complained of no discomfort with her teeth, and clinical examination revealed no adverse signs. Radiographic examination did not reveal any signs of pulpal necrosis of the injured teeth. Root development of the succedaneous permanent incisors was observed in periapical radiographs 10 months after the initial injury, which were at stage R1/4 (1/4 of the root length) with total resorption of the apical fragments (7) (Fig. 4). Twenty months postinjury, the maxillary incisors were at stage R3/4 (root length 3/4) of root development and the resorption of the traumatized primary teeth was almost complete (7) (Fig. 5). At the end of 2.5 years, the erupted permanent incisors demonstrated normal shape, color, and position (Fig. 6).

Discussion

When mitigating the problems involved with trauma to the primary dentition, the objectives of management are as follows: to comfort the child and parents in the acute state, to avoid inducing dental fear and anxiety in young children who may be experiencing their first dental problem, and to minimize the risk of further damage to the permanent teeth (8, 9). Due to the close proximity between the roots of the primary teeth and the permanent tooth germs, the prevalence of developmental disturbances of permanent teeth secondary to primary tooth trauma is reported to be between 12% and 69%, depending on the severity and type of the injury as well as the developmental stage of the permanent tooth (10). Because of these potential sequelae, the treatment protocols for primary root fractures recommended by IADT guidelines are to leave the tooth untreated if the coronal fragment is not displaced or to extract the coronal segment with repositioning and

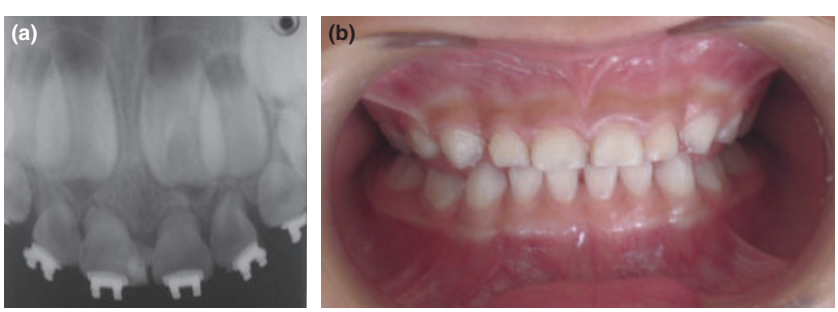

Fig. 3. Images taken at 3-month recall showing normal color and alignment of both maxillary central incisors. (a) radiographic aspect. Images taken at 3-month recall showing normal color and alignment of both maxillary central incisors. (b) clinical aspect.

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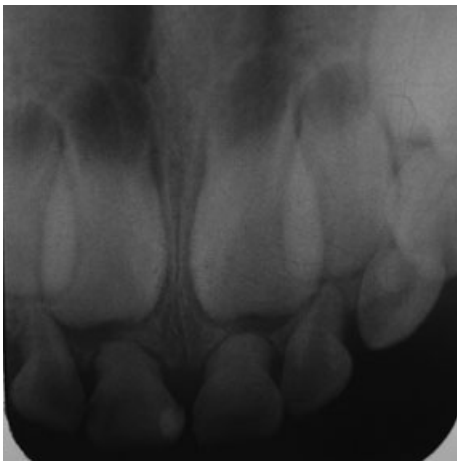

Fig. 4. Radiograph taken 10 months after injury showing complete resorption of the apical fragments with developing permanent incisors.

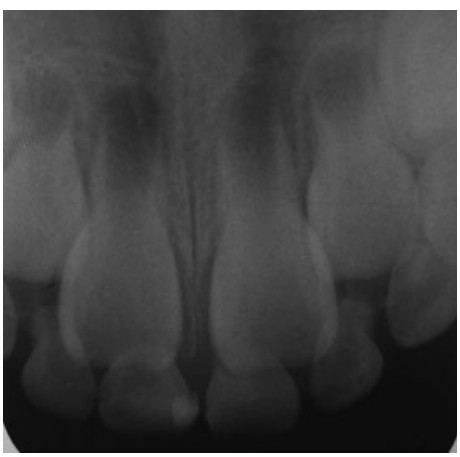

Fig. 5. Radiograph taken at 20-month recall showing continuouly developing permanent incisors with almost completely resorpted primary predecessors.

Fig. 6. Radiograph taken 2.5 years after injury showing erupted permanent maxillary central incisors with no abnormality.

splinting might be considered, if very loose, while leaving the apical segment to go through physiologic resorption (8–13). As a result of this protocol, many root-fractured primary teeth are extracted. This potentially has a negative effect on the child and parent's psyche, potentially inducing dental fear and anxiety in young children therein contradicting the first two objectives of trauma management in the primary dentition.

Root fractures in the primary dentition are usually located at mid-root or in the apical third, with radiolucent lines separating the root into two or more fragments (8, 9). The apical fragment is always left *in situ*, whereas the coronal fragment is often displaced. The injury to the coronal segment can be considered a luxation injury, with resultant trauma to the PDL and neurovascular supply to the coronal pulp. In contrast, the apical fragment remains essentially uninjured (14). Based on this theory, unlike intrusion, root fracture injury itself and the attempt to reposition a displaced coronal fragment are not expected to compromise development of the permanent successor. So far, none unfavorable outcome for the permanent teeth secondary to primary tooth root fractures was reported (13). Thus, a conservative approach, although it is controversial, could be adopted and attempts made to save root-fractured primary teeth, with extraction as the last choice. However, such conservative treatment option carries potential risks on the developing permanent dentition because inflammation and infection might occur from traumatized PDL and the coronal pulp, thus periodical revisits with careful clinical examination and long-term observation until exfoliation are necessary.

In the present case, orthodontic brackets were utilized to splint and immobilize the root-fractured teeth. This splinting mode has the advantage of checking the mobility of the injured teeth without removing the brackets. This is especially convenient and important for very young children, due to the difficulty of gaining their compliance and cooperation during examination, treatment, and recall (15). After 3 months of splinting, the tooth exhibited less than Class I mobility and functioned normally, allowing the splint to be removed.

By following the traumatized teeth with radiographic examinations, we observe healing that differed greatly from that of the permanent teeth (1, 14). Instead of achieving a stable reunion of fractured fragments, the apical segments were quickly resorbed within a short period, as opposed to the normal resorption process due to eruption of the succeeding teeth. This might be related to the triggering of osteoclast formation and activation by the traumatic injury (16, 17), with mechanisms that need to be explored. Finally, the coronal fragment became comparatively stable and functioned naturally until being replaced by the normal erupted permanent incisors 2.5 years later.

The outcome was successful in this case, suggesting that the risk for injuring the underlying tooth germ may be small, in contrast to luxation injuries where necrosis may occur in the primary tooth. From the literature of permanent teeth, we know that the apical fragment is usually vital (14), suggesting that the risk for a conservative approach in root fractures may have been somewhat exaggerated in the literature. Further studies of similar case series are desirable before any change in recommendations can be made.

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Conclusion

This case illustrated the favorable prognosis of two primary teeth with root fractures and severely mobile coronal fragments utilizing a splinting treatment protocol, with frequent recalls and a 2.5-year observation. However, when primary root fractures are attempted to be managed with splinting, more scientific evidences are needed, and frequent recalls are necessary.

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