

Management of a root fracture in an immature permanent tooth

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A 9-year-old girl with trauma to the maxillary right permanent central incisor is reported. Clinically the tooth appeared extruded with one third of the root visible. The radiographic examination revealed a root fracture. The extruded tooth was repositioned and splinted with a heavy wire and adhesive resin, after which a resorbable collagen tissue was placed to cover the buccal region. Subsequent to the injury, swelling was observed and the patient complained of pressure pain in the periapical region of the tooth with no response to electric pulp testing. It was treated successfully with periodontal therapy and endodontic therapy with Vitapex®.

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INTRODUCTION

Traumatic dental injuries are common during childhood. Luxation and avulsion injuries are often seen; however, root fractures are uncommon, in traumatized permanent teeth.¹⁻⁴ Moreover, a root fracture in an immature permanent tooth is even less common than in a primary tooth. Generally, if the fracture is located at the cervical third of the root, the incisor should be extracted, and as the fracture migrates more apically, prognosis correspondingly improves. Permanent incisors are important to esthetics as well as function; therefore, clinicians should attempt to keep the traumatized incisor intact when possible.

In this case, we report a successful case of a root fracture in an immature anterior tooth.

CASE REPORT

A 9 years 6 months girl involved in a bicycle accident, presented in an emergency basis to the Pediatric Dentistry clinic at Kyushu Dental College with her parents. She presented an injury to the maxillary right central incisor and a laceration to the soft tissue of the upper lip. (Figures 1:A-B) Based on a radiographic and clinical examination, the traumatized incisor had an immature root formation with a mid root horizontal fracture



Figure 1. Initial visit. Note extrusion.

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Figure 2. X-rays showing the fractured area and the incomplete root formation.

and luxation of the coronal crown. (Figures 2:A-B) After the patient and her parents gave an informed consent, treatment was initiated under local anesthesia. After removing some alveolar bone fragments within the socket, the tooth was repositioned. It was then splinted with wire (0.18 stainless steel, strengthened wire for resin denture[®], Sankin Co Ltd, Osaka, Japan) and adhesive resin (Super-bond C&B[®], Sun medical

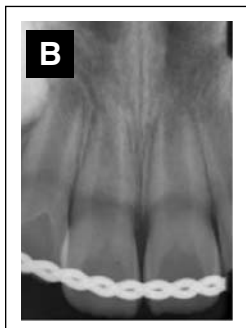


Figure 3. Repositioning and splinting

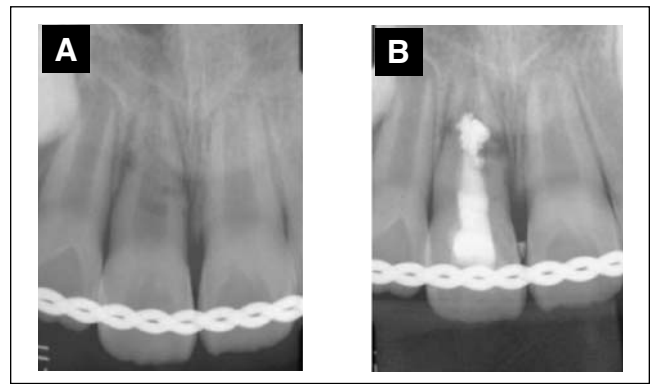


Figure 4. Intra-oral radiograph of maxillary anterior teeth after 2 month of treatment.

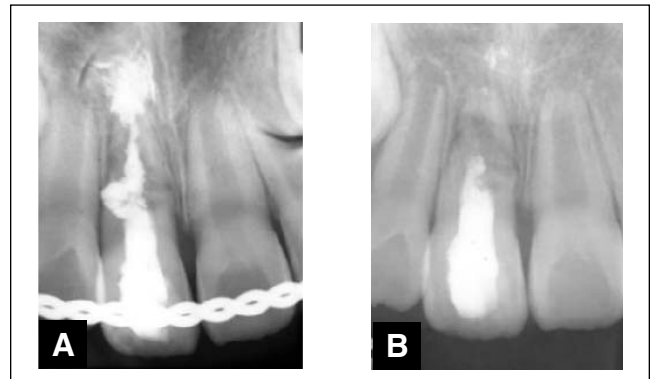


Figure 5. Intra-oral radiograph of maxillary anterior teeth 8 months (A) and 9 months (B) after the treatment. Note the inflammatory response.

Co Ltd, Shiga, Japan) from the left to right primary canine teeth (Figures 3:A-B). In addition, a flap was raised and the buccal area was plated with an absorbable collagen tissue in an attempt to reconstitute the lost bone (Koken Tissue Guide, Koken Co Ltd, Tokyo, Japan).

Two month later, pressure pain and slight swelling over the apex of the maxillary right incisor was observed. Furthermore, there was no response to electronic pulp testing. A root canal treatment was initiated and a temporary root canal filling was placed with Vitapex[®] (Nippon Shika Yakuhin Co Ltd, Yamaguchi Japan), which contained 30.3% of calcium hydroxide, 40.4% of iodoform, 22.4% of silicone. (Figures 4:A-B) Radiographic follow-up evaluations were done on a monthly basis. During this time the splint was removed. Eight months later, inflammation persisted at the fracture line as seen on Figure 5-A. Repeating the same treatment, swelling finally resolved 9 months later. (Figure 5-B) Follow-up was performed every month thereafter with radiographic and clinical examination for 1 year with no significant remarkable changes. A hard tissue stop at the fracture line was confirmed with a reamer. A root canal filling using a vertical condensation was done with the Warm Obtura II Gutta Percha



Figure 6. Intra-oral radiograph of maxillary anterior teeth 1 year and 10 month After the first visit.



Figure 7. Follow up 2 years and 6 months after first visit. Note the healthy periodontal tissue and periapical region.

System[®] (Obtura and Spantan Co Ltd, Missouri, USA) and the traumatized incisor was sealed with resin (Figure 6:A-B-C). Follow-up showed no changes. (Figures 7:A-B)

DISCUSSION

Prior to treatment of a fractured incisor in the mixed dentition phase, careful consideration must be given to the normal development of the permanent tooth. A root fracture can damage dentin, cement, and pulp. If pulpal vitality is not preserved tooth prognosis can be jeopardized. The healing forms of fractures have been classified into 4 conditions.¹³ Hard tissue healing, connective tissue healing, Hard and connective tissue healing and non-healing with inflammation tissue due to infection.

Healing after trauma depends on two conditions, one is whether the pulp is severed and the other is whether bacteria have invaded the fracture line or pulp. If the pulp is intact after injury, a dentin callus is formed between the two fragments, however, if the pulp has been ruptured, revascularization of the coronal aspect of the pulp must take place prior to fracture healing.

If the root fracture is resolved by hard tissue healing, then treatment may be successful.

In the present case, however, the root fracture was complicated with severe extrusion, and pulp vitality was questionable. Guided tissue regeneration (GTR) was necessary, since alveolar bone was destroyed by the injury. We know that invasion of epithelial tissue into the periodontal pocket is faster than the development of neo mesenchymal tissue.^{5,6} On the other hand it has been reported that the quantity of new bone formation and cementogenesis is significantly increased with the use of absorbent GTR film,⁷ while there is an increase risk of inflammatory reaction due to film.⁸ Film resorption results from enzymatic partial dissolution by neutrophils and the following phagocytic action by macrophages.⁹

Calcium hydroxide has an antimicrobial activity against most bacterial species found in root canal infections due to its high pH level and is often used as pulp canal medication in endodontic therapy. However, many calcium hydroxide products used in endodontic therapy contain other components besides calcium hydroxide. We used Vitapex as the first choice in the root canal procedure, for its highly radioopaque and antiseptic capacity from its iodofrom content. We considered that the favorable prognosis was brought about by the high bacterocidal action of the Vitapex applied during the root canal. However eight months later, inflammation persisted. We changed to Calcipex as a root canal medication. It has been reported that when the smear layer from the root canal wall is not thoroughly removed, only the aqueous calcium hydroxide paste could act as an antimicrobial agent.¹⁰ After inflammatory reaction was addressed we refreshed the calcium hydroxide material back to Vitapex[®] for apical closure as shown in previous reports.^{11,12} In the present case, we believe that hard and connective tissue healing has occurred. It is possible that hard tissue healing is needed to prevent the invasion of bacteria and connective tissue into the fracture line. To prevent such invasion, the replacement was performed carefully to follow the fracture line, thought it might be possible that there was a gap at the root fracture line along the labial-oral side.

We are continuing to the follow the case, however, after thirty months prognosis is still good.

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