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Revascularization of an immature permanent tooth with periradicular abscess after luxation

CASE REPORT

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Abstract – An immature permanent mandibular central incisor with periapical involvement in a 7-year-old boy was treated to promote revascularization. The tooth suffered from acute apical periodontitis after periodontal treatment by a general practitioner. An access cavity was prepared in the tooth and the cavity was left open until the next visit to achieve drainage through the canal. The root canal was not mechanically cleaned during the treatment period, but was irrigated with hydrogen peroxide and sodium hypochlorite. Calcium hydroxide compound was used for disinfection. At the fifth visit vital tissue appeared in the canal near the apical region, and calcium hydroxide compound was placed in contact with the soft tissue in the root canal. The access cavity was sealed with glass–ionomer cement followed by an adhesive composite resin filling. Radiographic examination 30 months after the initial treatment confirmed closure of the apex and thickening of the root wall. The case was observed for up to 13 years and root development was confirmed.

Successful cases of revascularization of immature permanent teeth with infected root canals have been reported (1–11). As it has been observed in these reports, revascularization probably occurs predictably in teeth with open apices under appropriate treatment.

In the case report here, an immature mandibular central incisor with periapical involvement in a 7-year-old boy was treated to promote revascularization using copious irrigation with dressing of calcium hydroxide compound for disinfection. The case was observed for up to 13 years and root development was confirmed. The follow-up period in the reports in the past are mostly shorter than 3 years. Most of the reported cases have been mandibular premolar teeth, and the rest have been mainly maxillary incisors.

Case report

The patient was a 7-year-old boy. He received a scaling of lower incisors with a hand instrument by a general dentist in May of 1996. Soon after the treatment, he complained of pain and movement of both mandibular central incisors. He visited Tohoku Welfare Pension Hospital for special treatment in June of 1996.

The clinical findings of the patient were as follows; gingival swelling around the mandibular anterior teeth with mobilities of these teeth $+_1$ for the right central incisor and lateral incisors and $+_2$ for the left central incisor. Radiographic examination revealed that both central and lateral incisors had incomplete root formation and a periodontal ligament space in the left central incisor was widened (Fig. 1). Positive response to thermal (Pulper Dental Coolant, GC, Tokyo, Japan) and electric (Pulp Tester; AT Analytic Technology, Redmond, WA, USA) sensitivity testing were confirmed from the right central and lateral incisors but not from the left central incisor. A diagnosis of subluxation was made for the right mandibular central incisors and lateral incisors and a diagnosis of lateral luxation and suspected apical periodontitis was made for the left central incisor.

Based on the diagnosis, the anterior mandibular teeth were stabilized using adhesive resin, and antibiotics (Amoxicillin 600 mg per day for 3 days) were prescribed for the patient. 19 days after the initial visit, gingival swelling and abscess formation occurred on the left central incisor (Figs 2 and 3). Therefore, the diagnosis of the left central incisor was changed to acute apical periodontitis, and root canal treatment was initiated. The fixation was prolonged for 2 weeks for a total of 4 weeks.

When the access cavity was prepared on tooth 31, bloody and purulent exudate discharged from the pulp chamber. The patient had no pain sensation when the access cavity was prepared and also when a smooth broach was inserted into the canal. The tooth was left open until the next visit to achieve drainage through the canal.

The patient visited the hospital weekly and the discharge of exudates stopped by the second visit. Until the fifth visit the access cavity was opened to the canal orifice and the upper part of the root canal was irrigated using 5% sodium hypochlorite and 3% hydrogen

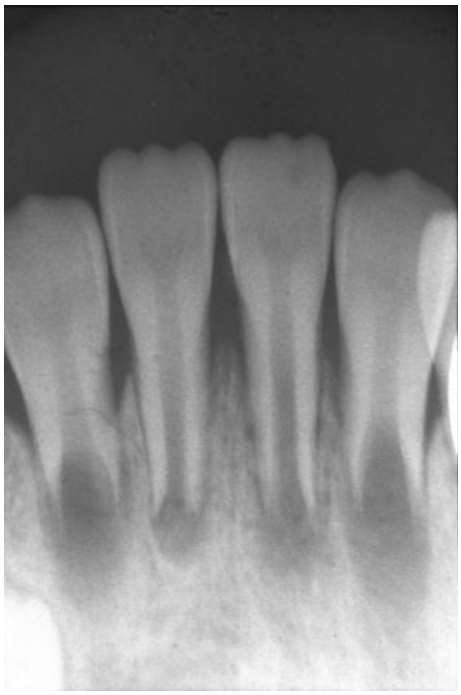

Fig. 1. Radiograph of mandibular incisors region taken at the initial visit. Both central and lateral incisors had incomplete formed roots. Periodontal ligament space in the left central incisor was widened.

Fig. 2. Clinical view taken 19 days after the initial visit. Abscess formation associated with the mandibular left central incisor was observed.

peroxide. Calcium hydroxide compound (Calcipex, Nippon Shika Yakuhin, Shimonoseki, Japan: Calcium hydroxide 24%, Barium sulphate 24%, distilled water and others 52%) was placed in the upper part of the root canal. The root canal was not mechanically cleaned during the treatment period.

At the fifth visit, existence of vital tissue approximately 10 mm from the orifice was confirmed by visual inspection. Insertion of a smooth broach into the canal elicited a painful response. At the sixth visit, calcium hydroxide compound (Vitapex, Neo Dental Chemical Products, Tokyo, Japan: Calcium hydroxide 30%, Iodoform 40.4%, Silicone Oil 22.4%, Inert 6.9%) was placed in contact with the soft tissue in the root canal, and the access cavity was sealed with glass–ionomer cement followed by adhesive composite resin.

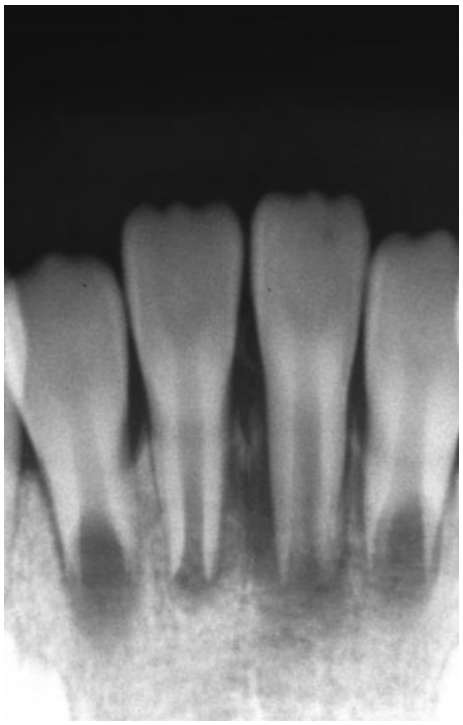

Fig. 3. Radiograph taken 19 days after the initial visit. Periapical radiolucency in the left mandibular central incisor had increased.

A radiograph taken 3 months after application of Vitapex revealed the first signs of apical closure and dentin bridge formation (Fig. 4). Thirteen months after the application of Vitapex, the canal was opened, and using an explorer the formation of a dentinal bridge was found subjacent to the filling material. There was a positive response to electric pulp testing on the surface of the newly-formed dentinal bridge. The upper part of the root canal was filled with warm gutta-percha system followed by adhesive composite resin. Radiographic examination 30 months after the initial treatment confirmed closure of the apex and thickening of the root wall (Fig. 5). Postoperative radiograph after 11 years showed distinct lamina dura (Fig. 6). 13 years after the first visit, the tooth was in good condition without root fracture, obvious discoloration or other problems.

Discussion

In this case report, the mandibular central incisor received an excessively forceful scaling resulting in luxation. We speculate that the infection of the root canal was caused either by direct invasion of bacteria through the periodontal pocket or by bacteremia caused by the injury of the periodontal pocket by the scaler. As far as we can find, revascularization of such a traumatized immature mandibular incisor tooth without any

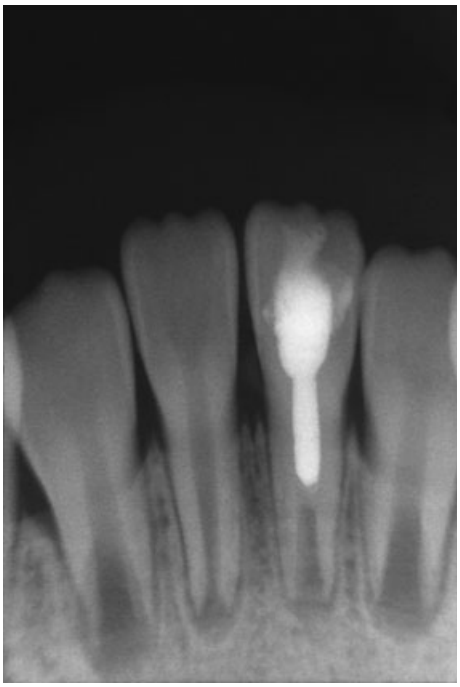

Fig. 4. Radiograph taken 3 months after the application of $Ca(OH)_2$ paste (Vitapex®). Signs of apical closure and dentin bridge formation were observed.

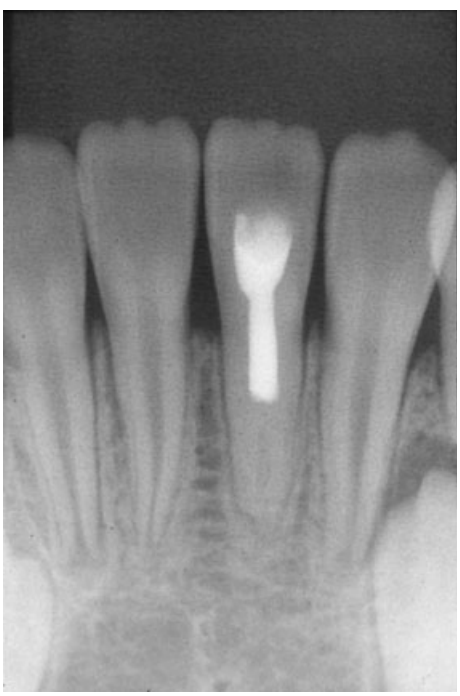

Fig. 5. Postoperative radiograph at 30 months. Completion of the root apex and increase in the thickness of the root canal wall were seen.

pulp exposure has not been reported. In addition, the patient was, as far as we can find, the second youngest among the existing reports on pulp revascularization.

Fig. 6. Eleven-year postoperative radiograph. Distinct lamina dura was observed.

Attempted revascularization of immature permanent teeth with apical periodontitis has been reported in recent years (1–11). According to the previous reports, the typical revascularization protocol advocates placing antimicrobial agents [metronidazole with ciprofloxacin (1), or metronidazole with ciprofloxacin and minocycline (2, 5, 7, 8, 10), or metronidazole with ciprofloxacin and cefaclor (4)] or calcium hydroxide (3, 6, 9). Similar to the other reports, we placed calcium hydroxide compound into the infected root canal. The bactericidal effect of calcium hydroxide is commonly accepted and is frequently used for a root canal dressing.

Banchs and Trope (2) speculated that calcium hydroxide would cause necrosis of tissues with the potential to differentiate into new pulp. Andreasen et al. (12) reported that long term calcium hydroxide as a root canal dressing might increase the risk of root fracture. In the present case report, we considered that the cytotoxic effect of calcium hydroxide was negligible as it was placed only in the coronal part of the canal. However, the application of calcium hydroxide compound for the purpose of revascularization should be carefully evaluated.

The bactericidal efficacy of a mixture of ciprofloxacin, metronidazole and minocycline in the infected root canals has been confirmed in in vitro studies by Hoshino et al. (13) and Windley et al. (14). However, side effects of dressing with a mixture of antibiotics has been also reported. Crown discoloration, development of resistant bacterial strains and allergic reaction to the intracanal medication have been reported (8). Considering this, we did not use a mixture of antibiotics in the present case. In this case report, any noticeable discoloration due to the

use of Iodine-based intracanal medicament (15) was not observed. The length of time and the amount of the medicament used in this case may have had little effect to induce discoloration.

Intentional formation of a blood clot by irritating apical tissue using an explorer and other instruments have been advocated (2, 4–8, 10). In such treatment protocols, mineral trioxide aggregate was placed over the blood clot. Similar to the previous case report, we waited for the growth of vital tissue from the apical area without intentional manipulation. It is uncertain whether intentional manipulation would be effective in cases where growth of vital tissue is unlikely.

It has been reported that teeth with an apical foramen larger than 1.1 mm have the potential for revascularization after replantation (16). The larger the diameter of the apical foramen, the more blood supply into the root canal would be anticipated. In the present case, the diameter was more than 1.1 mm as measured on the radiograph taken at the initial visit. This factor may have contributed to the achievement of revascularization.

Conflict of interest

We declare that there is no conflict of interest.

Acknowledgement

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