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Intentional replantation of an immature permanent lower incisor because of a refractory peri-apical lesion: case report and 5-year follow-up

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Summary. We performed an intentional replantation of an immature lower incisor that had a refractory peri-apical lesion. The incisor was extracted and the peri-apical lesion was removed by curettage. The root canal of the tooth was then rapidly irrigated, and filled with a calcium hydroxide and iodoform paste (Vitapex®), after which the tooth was fixed with an arch wire splint. Five years later, no clinical or radiographic abnormalities were found, and the root apex was obturated by an apical bridge formation. A team of two dentists is essential to prevent a prolonged operation time, thus eliminating any of the causes of ankylosis. Furthermore, calcium hydroxide and iodoform paste, along with an arch wire splint retained with composite resin, led to good healing of the periodontal tissue after the intentional replantation. Our results indicate that intentional replantation is a useful method for an immature tooth with refractory peri-apical problems.

Introduction

Effective endodontic techniques and instrumentation have recently been developed to treat apical lesions affecting mature permanent teeth. Conventional therapies, however, sometimes fail because it is difficult to reduce the amount of infected peri-apical tissue. An apico-ectomy is a helpful method when faced with a refractory peri-apical lesion of the anterior teeth since it allows complete removal of the affected tissue and sure obturation of the root canal apically [1]. In immature permanent teeth, however, this technique is contraindicated because of the open apex of the roots.

Apexification is usually chosen as conservative endodontic therapy for non-vital immature teeth, and often includes repeated treatments with calcium hydroxide in order to facilitate final root filling. However, although the technique shows a high percentage of periodontal healing, it is not always successful [2–4].

To avoid the loss of a permanent tooth owing to endodontic failure, intentional replantation has been performed for peri-apical problems with mature teeth [5,6]. We performed intentional replantation of an immature lower incisor in a patient with a refractory peri-apical lesion that emerged after apexification therapy, and then followed the case for 5 years.

Case report

A 7-year-old boy was referred to the Pedodontic Clinic of Osaka University Dental Hospital, Osaka, Japan, with pain on occlusion and mobility in the region of the lower central incisors. One and a half years before the visit he had experienced a bicycle accident that resulted in crown fractures of the lower central incisors and received immediate dental

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Fig. 1. Clinical photograph showing the subject's lower central incisors taken at the first examination.

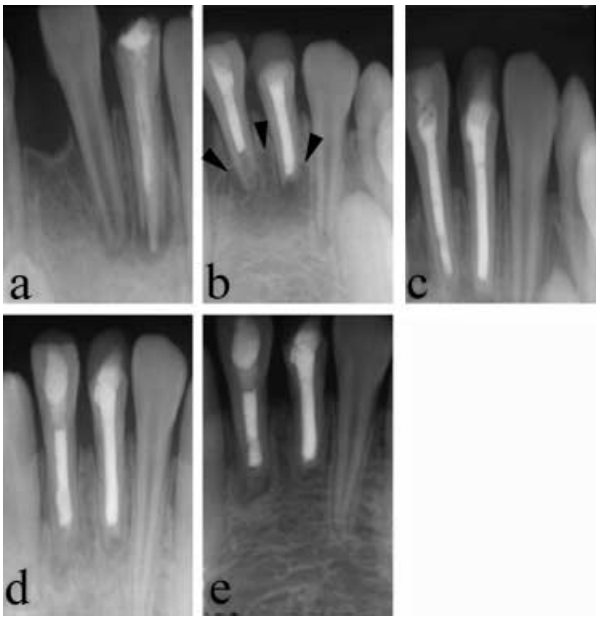

Fig. 2. Dental radiographs taken: (a) at the first examination; (b) 5 months after apexification (the arrowhead shows the boundary of the peri-apical lesion near the lower left central incisor); (c) 2 months after intentional replantation; (d) 5 months after intentional replantation; and (e) 5 years after intentional replantation.

treatment by his family dentist. Otherwise, the patient appeared to be well-developed with an uneventful medical history and no known allergies.

Clinical examination revealed a mixed dentition composed of fully erupted lower permanent central incisors, with the lower left permanent lateral incisor and upper central permanent incisors erupting into the oral cavity (Fig. 1). The lower central incisors showed coronal fractures and had already been with glassionomer cement. The central incisors showed moderate mobility and pain on percussion, while pulp vitality tests using an electric pulp tester indicated that both incisors were non-vital. A radiographic examination showed peri-apical radiolucent areas associated with the lower central incisors. Their root apices were open and the root canal on the left had been filled inadequately with gutta-percha (Fig. 2a). No root fractures were evident. The lower right lateral incisor was thought to be congenitally missing.

After informed consent (to a protocol approved by the Ethics Committee of Osaka University Dental Hospital) was received from the patient and his parents, we removed the gutta-percha from the lower left central incisor, and attempted to achieve apexification with a calcium hydroxide and iodoform paste (Vitapex®, Neo Dental Chemical Product Co., Tokyo, Japan) in both incisors. The fractured crowns were restored temporarily with composite resin and a crown-forming matrix. The infection was controlled using systemic administration of ampicillin (Viccillin®, Meiji Seika, Tokyo, Japan).

Five months after the apexification treatment, a circular radiolucent area accompanied by a clear boundary around the root apex of the lower left central incisor was evident on radiographs (Fig. 2b). The incisor also showed moderate mobility and pain on percussion, whereas the lower right central incisor had no pathological findings. The radiolucent area gradually increased despite root canal treatment that was repeated once a week for 3 months. Because of the continued failure, intentional replantation was chosen to treat the incisor.

To reduce the operation time, the procedure was carried out by a team of two dentists, one who was concerned with the operative procedure in the oral cavity of the patient, and the other who was in charge of the endodontic therapy for the extracted incisor. The patient was pre-scribed ampicillin one hour before the operation. After local anaesthesia was administered, the incisor was extracted gently with forceps. The apical lesions were carefully removed by curettage so as to conserve the periodontal membrane fragments on the socket wall. After extraction, the crown was held in wet gauze during instrumentation, and the canal was washed with sterilized saline, dried and then filled with Vitapex®. The tooth was replaced into the socket a few minutes after extraction, held at the original location with the operator's fingers for approximately 10 min, and then

Fig. 3. Clinical photograph showing the lower central incisors taken at the 2-year postoperative follow-up.

stabilized using a soft, rectangular wire and a light-cured composite resin.

The patient received ampicillin for 3 days and the splint was removed 2 weeks after the operation. Clinical examinations following the procedures were carried out once every 2 weeks for the first 2 months, and are still continued at intervals of 4 months. The tooth was asymptomatic except for slight mobility and pain on percussion, which disappeared 2 months later. A dental radiograph also showed no signs of inflammation (Fig. 2c). No root resorption was revealed in a radiograph taken 5 months later, and a normal periodontal ligament space and lamina dura were also seen (Fig. 2d). Furthermore, the wide immature apices of both lower incisors and the lower right central incisor were closed by a hard-tissue barrier. The Vitapex® was removed and the root canal was filled with gutta-percha and sealer 2 years after replantation since the apical bridge was by then fully formed (Fig. 3). In the 5 years after the operation, the patient received a total of 19 dental examinations, during which radiographic evaluations revealed no pathological changes (Fig. 2e) and the tooth remained firmly in the socket with no symptoms.

Discussion

In various types of replantation, including those following traumatic avulsion, most failures are a result of inflammatory root resorption and replacement root resorption including ankylosis [6,7]. The former is caused by the presence of infection as a result of improper root canal therapy and results in loss of the tooth shortly thereafter, while the latter is influenced by the extra-alveolar period [8,9]. Both can usually be diagnosed clinically using radiographic means within a year [7,10].

Experimental data have indicated that inflammatory root resorption is related to the presence of an infection in the root canal [8,9,11]. Hence, antibacterial properties as well as ease of use are essential characteristics for the filling material used in an intentional replantation procedure. Furthermore, a pharmacological effect resulting in closure of the open apex (apexification) is necessary. It is considered that Vitapex®, which contains calcium hydroxide, iodoform and silicone, provides favourable conditions the intentional replantation of an immature permanent incisor because the material possesses antibacterial as well as mineralization activity for closure of an open apex [12,13]. The peri-apical lesion found 5 months after apexification with Vitapex® was not caused by bacterial infection. The single radiolucent area had a clear circular boundary, and only slightly yellowish lucent exudate without pus came into the root canal. The histopathological investigation of the extracted tissue revealed that it was a radicular cyst composed of non-keratinized squamous epithelium partially surrounded by connective tissue. It was considered that the injury and/or treatments might have stimulated Malassez's epithelial rests and promoted proliferation of these epithelial remnants.

Ankylosis, which is usually very aggressive in younger patients [14], arises principally from the tooth drying out during a long extra-alveolar period, or from mechanical injuries encountered during extraction and extra-oral treatment. A team of two dentists can reduce the problem of operation time since the extracted tooth can usually be returned to the socket more rapidly than recommended, i.e. within a few minutes [6].

Splinting is necessary to suppress the excessive mobility of the replanted tooth and aid initial periodontal healing. Flexible splinting is more advantageous than rigid splinting since a certain amount of mobility should be allowed to aid periodontal healing [15]. In the present patient, a splint composed of a soft, rectangular wire and light-cured composite resin was applied, and then removed within 2-weeks. Such an arch wire splint, retained with composite resin, has been shown to provide adequate fixation with minimal mobility owing to the elasticity of wire throughout the entire period of immobilization, and can be applied and removed easily without unnecessary damage to the replanted tooth [16].

Résumé. La réimplantation intentionnelle d'une incisive mandibulaire immature, avec lésion apicale réfractaire, a été effectuée. L'incisive a été extraite et la lésion périapicale éliminée par curetage. Le canal radiculaire de la dent a été irrigué et rempli d'hydroxyde de calcium et pâte iodoforme (Vitapex®) en quelques minutes, puis la dent a été réimplantée et fixée à l'aide d'un fil de contention. Après cinq ans, aucune anomalie clinique ou radiographique n'a été détectée et l'apex radiculaire était obturé par une barrière apicale. Une équipe de deux dentistes est un point clé afin d'éviter une intervention trop longue et donc une cause d'ankylose. De plus, l'hydroxyde de calcium et la pâte iodoforme ainsi que l'arc de contention maintenu par du composite ont conduit à une bonne cicatrisation parodontale après réimplantation intentionnelle. Ces résultats indiquent que la réimplantation intentionnelle est une méthode utile lors de problèmes périapicaux réfractaires chez une dent immature.

Zusammenfassung. Wir führten eine intentionelle Replantationsbehandlung eines Unterkiefer-Schneidezahnes mit therapierefraktärer periapikaler Läsion durch. Der Schneidezehn wurde extrahiert und die periapikale Läsion durch Kürrettrage entfernt. Der Wurzelkanal wurde gespült und mit einer Calciumhydroxid-Jodoform-Paste (Vitapex®) innerhalb weniger Minuten, danach wurde der Zahn replantiert und mit einem Drahtbogen geschient. Nach fünf Jahren waren weder klinisch noch röntgenologisch pathologische Veränderungen festzustellen, die Wurzelspitze stellte sich geschlossen dar mit einer apikalen Barriere. Ein Team aus zwei Zahnärzten ist ein Schlüssel um eine verlängerte Operationsdauer zu verhindern und so eine Ursache für Ankylose zu eliminieren. Weiterhin führte die Calciumhydroxid/Jodoformpaste in Verbindung mit einer Drahtkompositschienung zu einer guten Heilung des parodontalen Gewebes nach der intentionellen Replantation. Unsere Ergebnisse Zeigen, dass eine intentionelle Replantation eine geeignete Methode bei der Behandlung von Zähnen mit nicht abgeschlossenem Wurzelwachstum und therapierefraktären periapikalen Problemen sein kann.

Resumen. Realizamos un reimplante intencionado de un incisivo inferior inmaduro que tenía una lesión periapical refractaria. El incisivo se extrajo y la lesión periapical se eliminó por curetaje. Luego se irrigó el canal radicular del diente y se rellenó en pocos minutos con una pasta iodofórmica y de hidróxido de calcio (Vitapex®), tras lo cual se recolocó el diente y se fijó con una férula de alambre. Cinco años más tarde, no se encontraron anomalías clínicas ni radiográficas y el ápice radicular estaba obturado por la formación de un puente apical. Un equipo de dos odontólogos es el punto clave para prevenir una operación prolongada en tiempo y así eliminar una causa de anquilosis. Además, la pasta iodofórmica y de hidróxido de calcio junto con una férula de alambre fijada con composite condujo a una buena curación del tejido periodontal después del reimplante intencionado. Nuestros resultados indican que el reimplante intencionado es un método útil para un diente inmaduro con problemas periapicales refractarios.

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