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Autotransplantation of Ectopically Impacted Teeth : Two Case Reports

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Abstract

Numerous therapeutic approaches are available for impacted teeth, including orthodontic retraction, implantation, and autogenous tooth transplantation. Autotransplantation is a promising method, especially for juvenile patients, as it enables preservation of the function of the periodontal tissues, as well as continued alveolar bone growth. This report describes autotransplantation in two cases in which the tooth was fully-ectopically impacted.

With case 1, an ectopically impacted premolar was extracted and transplanted in an upright position, and regenerative endodontic treatment was performed using a platelet-rich fibrin clot and mineral trioxide aggregate (MTA). With case 2, a calcifying odontogenic cyst with an impacted left mandibular second molar was treated by enucleation. The tooth was transplanted into the proper position 3 months after enucleation, and endodontic treatment was performed using MTA.

In both cases, autotransplantation appeared to provide a simple and rapid treatment option for patients with ectopically impacted teeth.

These cases demonstrate that autotransplantation of ectopically impacted teeth is a viable treatment option rather than implant placement or prosthesis, especially in juvenile patients.

Key words : Autotransplantation, Ectopically impacted tooth, Platelet-rich fibrin, Calcifying odontogenic cyst

Ⅰ. Introduction

Autotransplantation of teeth involves the transplantation of embedded, impacted, or erupted teeth into surgically prepared sockets or extraction sockets[1]. Autotransplantation of teeth was first reported in the 1950s, and has become widely accepted since 1960 in juvenile patients[2].

Successful autotransplantation has advantages over dental implantation because it preserves the periodontal ligament (PDL), so proprioceptive function of the transplanted tooth is restored, as well as natural biological responses. Moreover, autotransplantation permits normal alveolar bone development[3]. In recent long-term study, autotransplanted teeth had a success rate of 81% (175 of 215) in cases of premolar transplantation[4].

However, the procedure is technique-sensitive, and predicting accurately the success rate and aesthetic results is difficult[5]. Moreover, there are potential complications due to root resorption, ankylosis, and fracture during extraction of the impacted tooth[6,7].

There have been cases of severe ectopic teeth in which autogenous transplantation would have been a considered as an alternative treatment to implantation and

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prosthesis. The aim of this study is to describe cases of autotransplantation of fully formed, ectopically impacted teeth.

Ⅱ. Case Reports

1. Case 1

A healthy 13-year-old girl was referred from a local clinic to a pediatric dentist with a complaint of an ectopically impacted mandibular left second premolar. The patient had no other systemic or oral health disease. Periapical and panoramic radiographs as well as computed tomography (CT) images of the impacted tooth were acquired. The radiographs revealed that the left mandibular second premolar was impacted horizontally and tilted mesially (Fig. 1, 2). Orthodontic retraction was recommended because of the proximity of the deeply impacted premolar to the inferior alveolar nerve. However, the patient's parents refused the procedure because of its expense. Autotransplantation was suggested as an alternative and the risks and benefits of the procedure were explained to the patient and her parents, who provided written informed consent. All procedures were performed under nerve block and local anesthesia. The deciduous second molar was extracted, and the impacted tooth was fully luxated. However, the root apex fractured during extraction because of dilaceration. The apical fragment, which was close to the inferior alveolar nerve, was not extracted in order to avoid paralysis induced by damage to the inferior alveolar nerve. The luxated tooth was immediately transplanted into its proper position (Fig. 3D). Because of the instability of the transplanted tooth during primary fixation, owing to the absence of bone beneath it, the transplanted premolar was secured using a rigid orthodontic appliance (0.7-mm-diameter stainless steel round wire). The patient was prescribed antibiotics (250 mg Augmentin) and a nonsteroidal anti-inflammatory drug (200 mg Carol-F) for 6 days. The patient was instructed to rinse her mouth with 0.2% chlorhexidine for a week in order to prevent infection. The sutures were removed 7 days after the surgery.

2 weeks after surgery, an access cavity was prepared, and the root canal was lightly irrigated with 2.5% NaOCl and saline, and dried using sterile paper points. Equal proportions of ciprofloxacin and metronidazole were mixed with distilled water to form a thick paste with uniform consistency. Although minocycline is a commonly used component of triple antibiotic paste, it was not included in the mixture because of its potential to cause tooth discoloration. The antibiotic mixture was placed into the canal using an amalgam carrier and endodontic pluggers. The access cavity was temporarily sealed using a temporary filling material (Caviton, GC Corporation, Tokyo, Japan). After 11 days, the antibiotic mixture was removed using hand instruments, and the canal was irrigated with 2.5% sodium hypochlorite. To form the apical matrix barrier, a platelet-rich fibrin (PRF) membrane was prepared as follows: 12 mL of whole blood was intravenously drawn from the patient's right antecubital vein and centrifuged at 3000 rpm for 10 min. This formed three layers in the tube : a layer of red blood cells at the bottom, an acellular plasma at the top, and a PRF clot in the middle[8]. The PRF clot was separated and pressed between two gauzes to create a

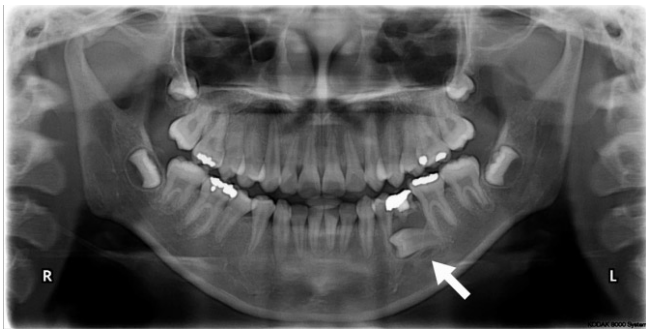

Fig. 1. Preoperative panoramic radiograph of the 13-year-old female patient. The left mandibular second premolar was fully ectopically impacted, and the left mandibular second deciduous tooth was retained.

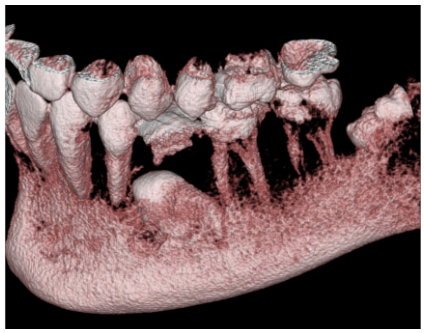

Fig. 2. Preoperative computed tomography (CT) image of the 13-year-old female patient.

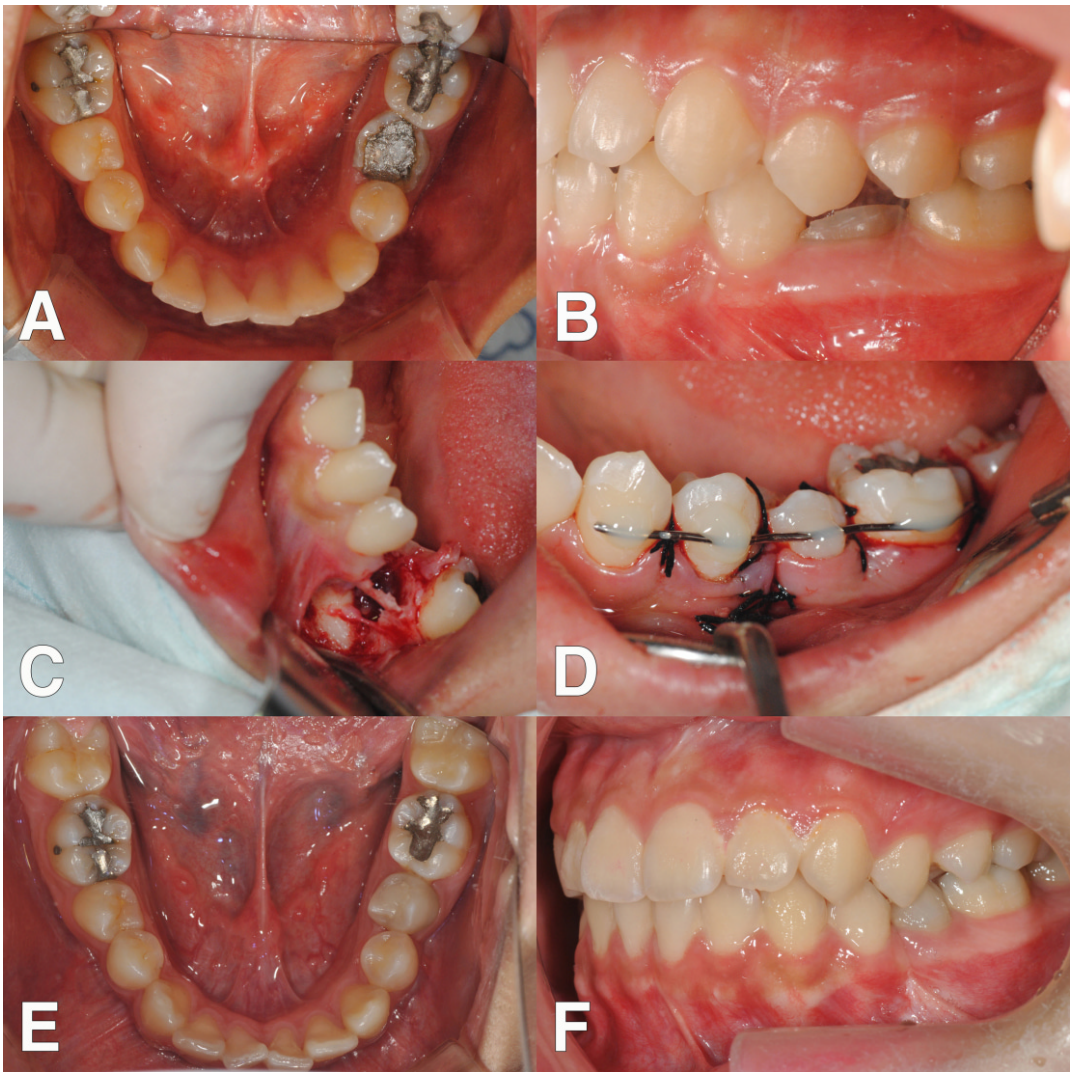

Fig. 3. Intraoral view of the 13-year-old female patient. (A, B) Initial clinical view. (C) Surgically exposed impacted tooth. (D) The autotransplanted tooth was fixed using wire bonded to the tooth and to the adjacent teeth using composite resin, and was splinted for 2 months. (E, F) Postoperative intra-oral occlusal and buccal views 9 months after autotransplantation.

membrane. The resulting PRF membrane was inserted into the canal up to the level of the cementoenamel junction over the apex. A 4-mm-thick layer of mineral trioxide aggregate (White ProRoot MTA®, Dentsply, Tulsa, OK, USA) was mixed to form a thick paste with a creamy consistency according to the manufacturer's instructions, and the paste was placed directly over the PRF clot (Fig. 4C). A moist cotton pellet was then placed over the MTA layer, and the tooth was provisionally restored using temporary filling material.

After 10 days, the provisional restoration was removed and permanent restoration was performed using a composite resin. The previously applied wire splint was replaced by a flexible orthodontic appliance (0.5-mm-diameter twist flex wire). Clinical and radiological examinations were performed at 4 weeks and at 3, 6, 9, 12, and 17 months. At the 17-month follow-up, radiographic findings confirmed apical closure in tooth #35 and the formation of an apical barrier and lamina dura, with no root resorption and with complete periapical healing and bone formation (Fig. 4E, 5). The autotransplanted tooth was functioning well and remained asymptomatic.

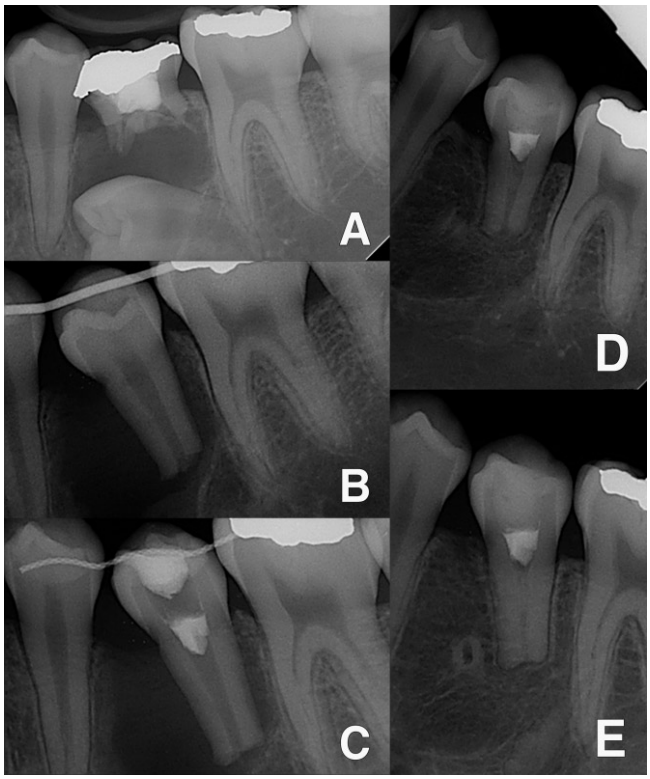

Fig. 4. (A) A preoperative periapical radiograph. (B) The transplanted tooth was placed in infraocclusion and fixed with resin and a wire splint following extraction of the impacted tooth. (C) Platelet-rich fibrin (PRF) was inserted into the root canal, and mineral trioxide aggregate was placed directly over the PRF clot. The wire was replaced with a 0.5-mm-diameter twist-flex wire. (D) A postoperative periapical radiograph at 9 months following surgery. (E) At 17 months, continued thickening of the dentinal walls was observed. A continuous lamina dura surrounding the root was also noted, with no resorption at the root surfaces.

Fig. 5. Radiograph acquired at 17 months after surgery.

2. Case 2

A 15-year-old boy was referred to the Department of Pediatric Dentistry, Chonnam National University Dental Hospital, with an unerupted left lower second molar and pus discharge around the unerupted region. Intraoral examination revealed an ovoid swelling and pus on the left retromolar pad area (Fig. 8A). A panoramic radiograph revealed a large, well-defined, unilocular radiolucency surrounding the crown of the impacted tooth as well as an irregular radiopaque mass in the distal area of the left mandibular first molar (Fig. 6). Because of the lesion, the left mandibular second molar had submerged to the lower border of the mandible, with its crown embedded in the lesion. Computed tomography (CT) imaging was performed to evaluate the size and location of the lesion (Fig. 7). The preliminary diagnosis of the lesion was a calcifying odontogenic cyst (COC), adenomatoid odontogenic tumor, or calcifying odontogenic epithelial tumor.

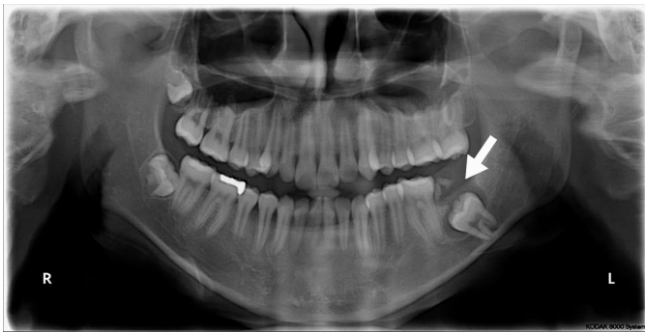

Fig. 6. Preoperative panoramic radiograph of the 15-year-old male patient. The radiograph shows a unilocular radiolucent lesion surrounding the crown of the impacted tooth (#37), as well as an irregular radiographic lesion around the upper part of the crown.

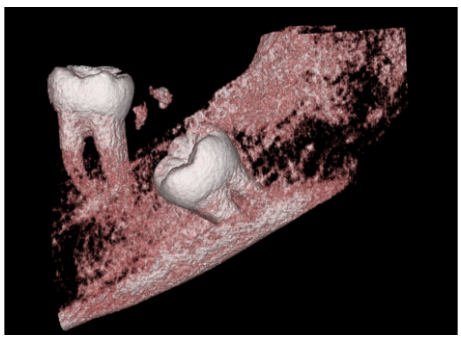

Fig. 7. A preoperative computed tomography (CT) image of the 15-year-old male patient.

Under nerve-block anesthesia, the radiopaque mass and cystic sac were carefully enucleated. An obturator was inserted into a pouch-like opening made after the enucleation to induce eruption of the tooth (Fig. 8B). An incisional biopsy was performed, and the sample was submitted to the Oral Pathology Department at the same center for histopathological evaluation. Based on the histopathology findings, the patient received a definite diagnosis of COC.

At follow-up 3 months after surgery, no spontaneous tooth eruption was detected. It was decided that the impacted left mandibular second molar should be transplanted into its proper position during a second surgery. Under nerve-block anesthesia, the mucoperiosteal flap was elevated, and the tooth was removed atraumatically with gentle luxation of the forceps to limit damage to the PDL fibers (Fig. 8C). Root-end resection and retrograde filling with MTA (White ProRoot MTA®) were performed on the tooth to prevent endodontic complications (Fig. 8D). The left mandibular second molar was transplanted into the enucleated defect and stabilization wire (0.7-mm-diameter stainless steel round wire) was placed on teeth #35, 36, and 37 and retained for 3 months (Fig. 8E).

Root canal treatment of the C-shaped canal of the tooth was performed 3 months after the surgical procedure. A clinical examination performed 3 months after the root canal treatment, revealed no reactions to the percussion and palpation tests. The root canal was obturated with MTA, and a coronal seal was achieved using a resin core.

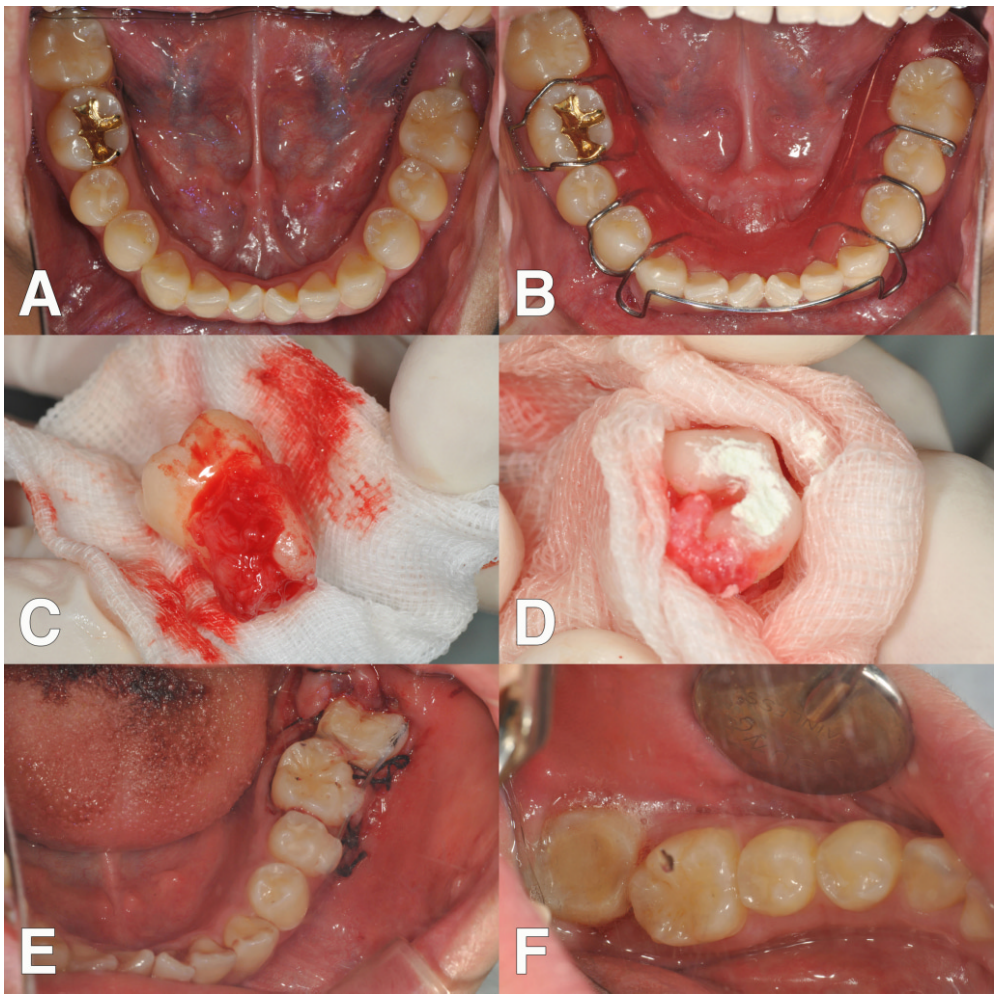

Fig. 8. Intraoral view of the 15-year-old male patient. (A) Initial clinical view. (B) The obturator was inserted one week after the surgical enucleation. (C) The tooth was removed atraumatically (D) Root-end resection and retrograde filling with MTA were performed on the transplanted tooth. (E) The transplanted tooth was fixed with a rigid wire. (F) Clinical view 7 months following autotransplantation.

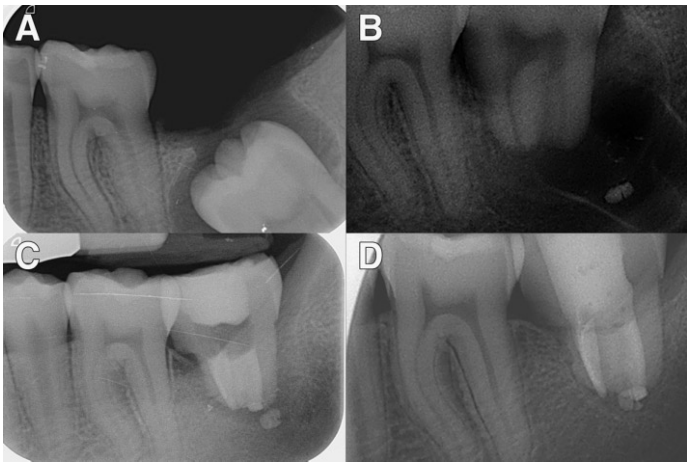

Fig. 9. (A) The irregular radiopaque lesion was removed. (B) The retrograde filling material fell out immediately following autotransplantation. (C) 2 months after the initial endodontic treatment, the root canal was filled for the final time with mineral trioxide aggregate. The mesial root of the transplanted tooth showed external resorption. (D) At the 10-month follow-up after surgery, the radiopacity of the area around the tooth had increased.

At 2 months after the initial endodontic treatment, a radiographic examination revealed external resorption of the mesial surface of the root (Fig. 9C). At follow-up 10 months after surgery, a clinical examination showed no remarkable findings such as tooth mobility or sensitivity to percussion or pulsation. Periapical radiograph revealed the formation of new bone around the transplanted tooth (Fig. 9D).

Ⅲ. Discussion

Autotransplantation can be recommended as a treatment option for ectopically impacted teeth in juvenile patients requiring orthodontic treatment. A number of indications of autotransplantation have been identified. The first case describes a new therapeutic method for the treatment of transplanted teeth with complete root formation using PRF and MTA. There have been few reports of transplantation of a tooth into a site previously occupied by a cyst.

An important factor for successful autotransplantation is preservation of the PDL tissue and pulpal healing[6,9]. The extraoral time of the transplanted teeth should be minimized to reduce damage to the PDL tissue[7]. In Case 1, transplantation was performed immediately following extraction. In Case 2, the extra-alveolar time of the extracted tooth was within 15 min, which should be safe for ensuring the survival of PDL tissue, as the survival rate of the PDL cells rapidly decreases when the extra-alveolar time exceeds 18 min[10]. Non-rigid fixation of the teeth is another method of preserving PDL tissue, which increases the activity of the alveolar ligament cells and promotes bone healing by stimulating the PDL cells[11]. With case 1, the transplanted tooth was fixed using a slightly thicker wire because of concerns of malpositioning owing to the instability of the primary fixation. After 1 month, when the mobility of the transplanted tooth had decreased, it was replaced with a flexible wire to allow physiological movement of the donor tooth. With case 2, fixation with rigid wire was applied for the entire period because rigid primary fixation prevents malpositioning of autotransplanted teeth. Kim et al.[9] reported better outcomes for stable primary fixation following autotransplantation compared with unstable fixation. However, this can lead to excessive pressure on the PDL tissue of the transplanted tooth, potentially affecting external root resorption in case 2.

Infection of the dental pulp tissue is the another potential cause of failure of transplanted teeth[7,9]. In Case 1, for pulpal healing and apexification, PRF was used as an apical matrix, and MTA was used as a hard tissue barrier. PRF is an autologous leukocyte- and platelet-rich fibrin biomaterial matrix containing a large quantity of platelet and leukocyte cytokines[12,13]. The combination of MTA and PRF promotes odontoblastic differentiation in human dental pulp cells (HDPCs)[14]. The greatest problem with a wide-open apex caused by an immature root or fracture of the root apex is an apical barrier. The use of a matrix can decrease leakage in the sealing material and avoid extrusion of material into the periodontal tissues, enabling a satisfactory response of periodontal tissues[15]. Moreover, the access cavities were double-

sealed with permanent filling materials to prevent coronal leakage.

With case 1, the periapical radiographs acquired 9 months after surgery revealed a remarkable increase in the radiopacity of the bone. The radiographic findings also revealed a healthy PDL space surrounding the transplanted tooth, the presence of the lamina dura, and apical closure. Although external root resorption was found in case 2, bone regeneration occurred around the transplanted tooth 10 months after surgery. The patient had no clinical symptoms, and masticatory function was satisfactory, with no discomfort. Schwartz et al.[7] reported that a tooth exhibiting external root resorption could function for as long as 10 to 15 years.

This case report suggests that autotransplantation of ectopically impacted teeth is a useful option that improves satisfactory aesthetics and occlusion via a single surgical procedure.

Ⅳ. Summary

In this study, two cases of clinical management have been described, one involving an ectopically impacted premolar and the other involving an ectopically impacted molar.

Autotransplantation is effective for preservation of PDL proprioception and is advantageous in that the natural process of alveolar growth is retained. From a biological point of view, autotransplantation may be regarded as an alternative to implantation or prosthetic rehabilitation in juvenile patients with ectopically impacted teeth.

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국문초록

이소매복된 치아의 자가치아이식 증례

임유란 · 김재환 · 최남기 · 김선미

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매복치의 치료방법으로 교정적 견인, 발치 후 임플란트, 자가치아이식 등 다양한 치료 방법이 있다. 그 중에서도 자가치아이식은 성장하는 환자들에게서 이식치 고유의 치주인대세포의 보존 및 치조골 성장이 가능하다는 점에서 좋은 치료방법이라고 생각된다. 이 증례에서는 성장중인 청소년의 이소 매복 치아를 자가치아이식으로 치료한 두 개의 증례를 소개하고자 한다.

첫 번째 증례에서 이소 매복된 좌측 하악 제2소구치를 발거 후 정위치로 자가치아이식하였고 혈소판 농축 피브린(PRF)과 mineral trioxide aggregate (MTA)를 사용하여 재생 근관 치료를 하였다. 석회화 치성낭으로 인해 이소매복된 좌측 하악 제2대구치를 지닌 두 번째 증례에서 병소의 적출술을 시행하였다. Obturator를 3개월 간 장착하여 매복치아의 자발적 맹출을 기대하였으나 맹출 양상이 없어 자가치아이식한 후 MTA를 이용한 근관치료를 하였다.

두 증례 모두 자가치아이식술로 이소매복치를 간단하고 빠르게 치료하였다. 성장하는 환자에게서 이소매복치의 자가치아이식술은 임플란트나 보철물 수복 대신 좋은 치료 방법이 될 것이다.

주요어: 자가치아이식, 이소 매복 치아, 혈소판 농축 섬유소, 석회화 치성낭