Autotransplantation: A Reliable Treatment Modality for Severely Malpositioned Teeth

Mi Sun Kim*/ Hyo-Seol Lee**/ Ok Hyung Nam***/ Sung Chul Choi****

Maxillary canines are the most commonly impacted teeth, second only to third molars. Various treatment methods may be used to recover impacted maxillary canines. This is a report of a 14-year-old girl with a severely malpositioned impacted right maxillary canine which accompanied severe root resorption of adjacent tooth, treated by autotransplantation with a computer aided rapid prototyping model as a surgical guide. This case report demonstrates that autotransplantation can be a reliable treatment alternative, in cases with a severely malpositioned impacted canine, providing acceptable prognosis.

Key words : Impacted canine, Autotransplantation, CARP model.

INTRODUCTION

Maxillary canines play critical roles in facial appearance, dental esthetics, arch development, and functional occlusion, and thus, several complications may result from maxillary canine impaction, such as, esthetic and phonetic compromises, loss in arch length, and referred pain[1,2].

Canine impaction can be caused by various systemic and local factors. Primary etiological causes of maxillary canine displacement include space deficiency, disturbances in tooth eruption sequence, trauma, primary canine retention, premature root closure, rotation of tooth buds, and localized pathological lesions, such as, cysts and odontomas[1]. Canine impaction has also been associated with development in the deep maxilla and the longest path to travel compared with any other teeth[3].

Various treatment methods may be used to recover impacted maxillary canines. Treatment options include observation, interceptive treatment, surgical exposure followed by orthodontic treatment, autotransplantation, and extraction. This case report presents a 14-year-old girl treated by autotransplantation with a computer aided rapid prototyping (CARP) model as a surgical guide and suggests autotransplantation be considered a reliable alternative.

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Case report

A 14-year-old girl was referred from a local clinic because of an impacted right maxillary canine. There was no significant medical history and no family history of dental anomalies. Clinical examination showed prolonged retention of the right maxillary primary canine and peg lateral on the right maxillary lateral incisor. Due to the peg lateral, there was enough space for the impacted right maxillary canine. A radiographic examination revealed impaction and malposition of the right maxillary canine and external root resorption of the right maxillary central incisor (Fig. 1).

Before the surgical operation, dental cone beam computed tomography (CBCT) was performed to assess the three-dimensional (3D) position of the impacted tooth and to measure the dimensions of the graft tooth and bone volume of the socket. From obtained CBCT imaging data, the 3D configuration of the graft tooth was created using OnDemand3D (Cybermed, Seoul, Republic of Korea) software. The tooth length was 18.20mm and the width of the cervical region was 7.80mm (Fig. 2). The replica of the donor tooth was produced by computer-aided design/computer-aided manufacture (CAD/CAM) software from 3D CBCT images.

Under local anesthesia, the right maxillary primary canine was extracted and a mucoperiosteal flap was raised. The recipient socket was drilled by surgical round burs with abundant saline irrigation in appropriate size and structure adjusted to fit the replica prepared beforehand. The relations with the adjacent and opposing teeth were also examined. The impacted right maxillary canine was extracted as atraumatically as possible and repositioned in the recipient site. A resin wire splint was placed for 2 weeks. At one week postoperatively, canine and periodontal tissue healing was evident (Fig. 3).

Two months after the operation, patient visited with discomfort of the right maxillary canine area. The percussion test of the right maxillary canine was positive and electric pulp test (EPT) was negative. At three months after the operation, patient still felt discomfort and the percussion test of the right maxillary canine was still positive. To fully assess the vitality of the right maxillary canine, cavity test was performed and the response was negative. Therefore, it was

Figure 1. (A) Cone beam computed tomography image (frontal view) obtained prior to treatment, and (B) 3D image obtained using OnDemand3D (Cybermed, Seoul, Republic of Korea) software showing impaction of the right maxillary canine. (C) Periapical view prior to treatment showing root resorption of the maxillary central incisor.

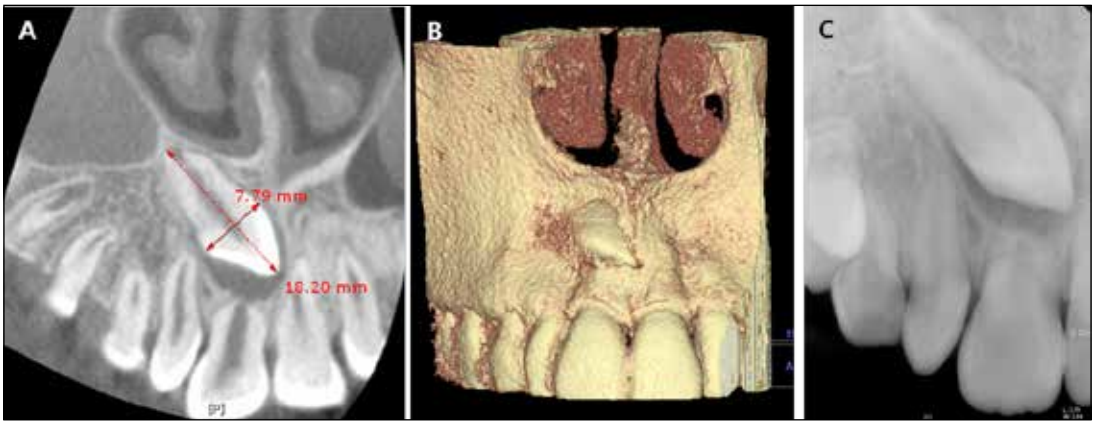


Figure 2. 3D images and replica. (A,B,C) 3D images obtained using OnDemand3D software (D) CARP model used in the surgical procedure.

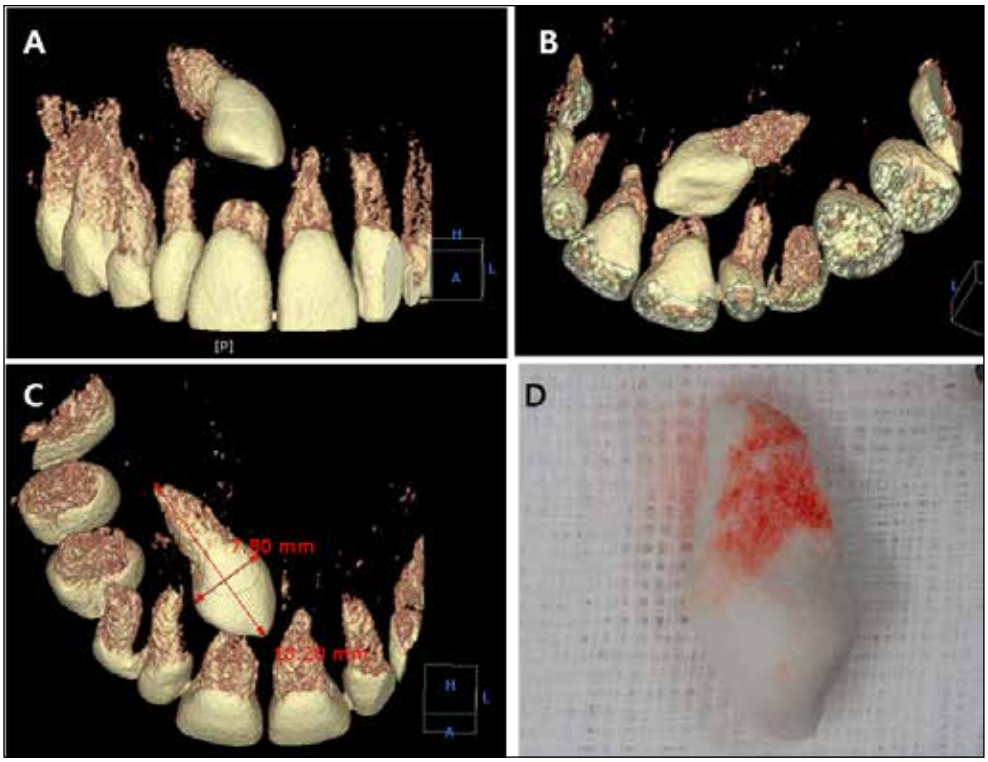


Figure 3. One week after autotransplantation. (A) Intraoral photograph and (B) panoramic view showing healing of the autotransplanted right maxillary canine and periodontal tissue. The resin wire splint was left in position for 2 weeks.

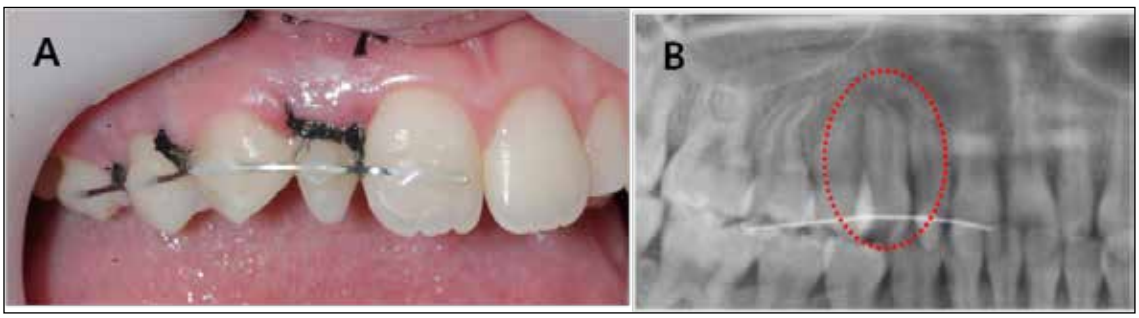
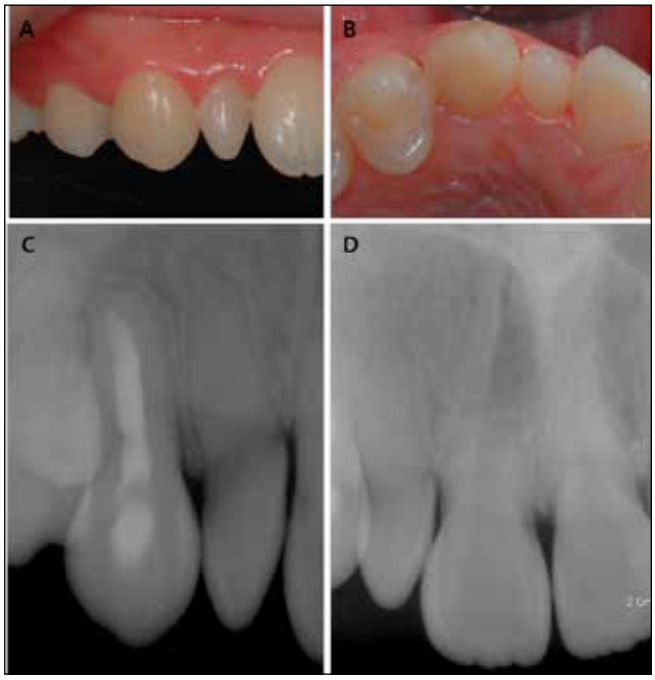


Figure 4. Thirty months after autotransplantation (A and B) Intraoral photographs showing the right maxillary canine, which was well-placed without discomfort or mobility. (C and D) Periapical view shows MTA apexification and no pathologic findings. External root resorption of the right maxillary central incisor had not progressed as compared with that observed in the initial radiograph.



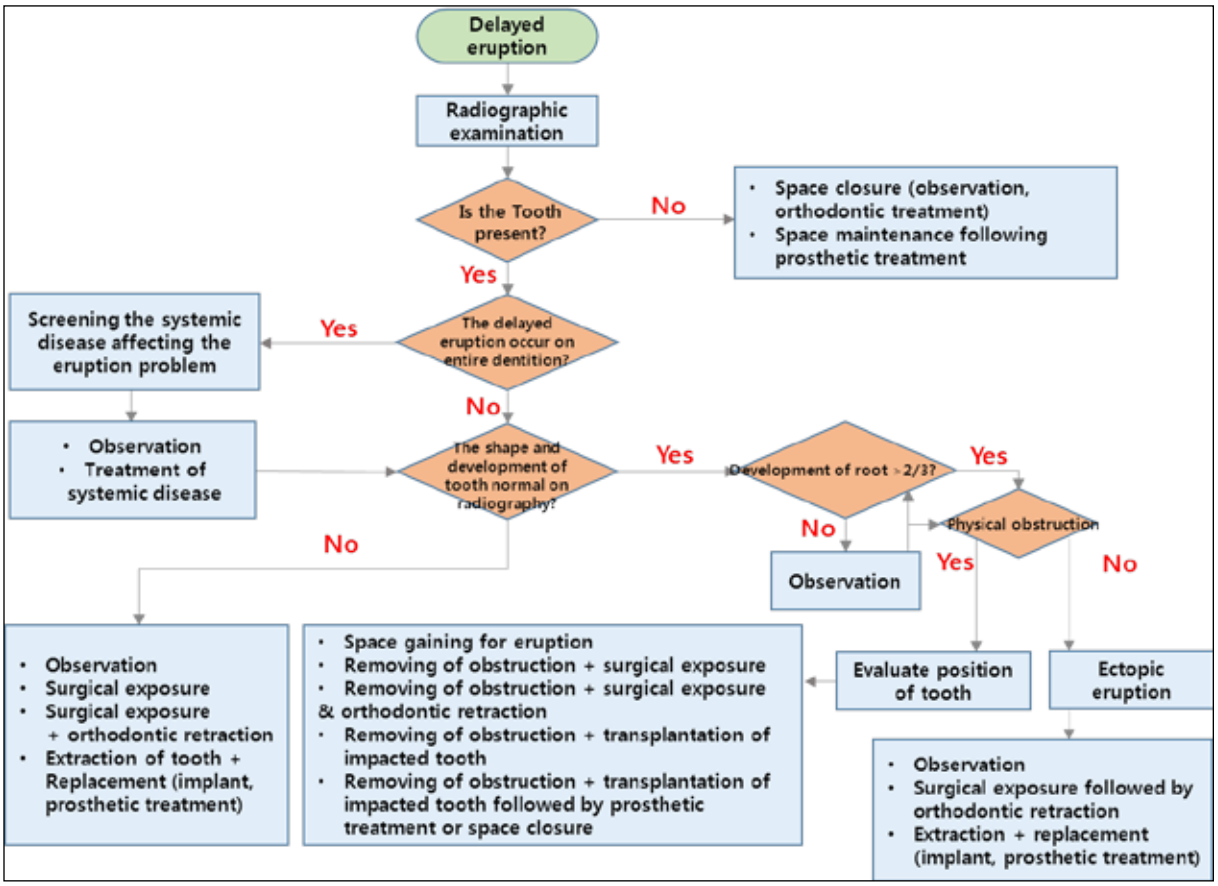
diagnosed that the vitality of the transplanted tooth was lost and Mineral Trioxide Aggregate (MTA) apexification was implemented. At thirty months postoperatively, chewing was satisfactory without discomfort, and the canine was well fixated in its socket without discomfort. The vitality of the right maxillary central incisor was well maintained without any sign and symptom. Furthermore, no radiologic evidence of a pathologic condition was apparent, and external root resorption of the right maxillary central incisor had not progressed as compared with initial radiographic findings (Fig. 4).

DISCUSSION

Treatment options for the management of impacted canine include observation, interceptive treatment, surgical exposure followed by orthodontic forced eruption, autotransplantation, and extraction (Fig. 5).

The traditional treatment of choice for ectopically positioned canines is surgical exposure and orthodontic realignment[4]. This procedure has the advantage of maintaining healthy periodontal support and natural tooth color, retaining tooth vitality, and reducing root resorption. On the other hand, the complications of surgical exposure and orthodontic realignment include the absence of adequate keratinized gingiva, reduced sulcular depth, gingival recession, ankylosis, pulpal obliteration, external root resorption of neighboring permanent teeth, marginal bone loss, the prevention of immature tooth root growth, and the possibility of alveolar bone penetration[5,6]. Prognosis depends on the position and angulation of the impacted tooth, treatment time, patient age, degree of patient cooperation, available space in the arch, and the presence of keratinized gingival tissue[7-9].

Figure 5. Flow chart of treatment options for delayed eruption



Sometimes autotransplantation is a reasonable treatment for severely malpositioned teeth located deep in the maxilla, showing large mesial angulation, and has an acceptable long-term prognosis. Autotransplantation offers the advantages of a short treatment period, efficiency, esthetics and cost. In addition, patients likely to be non-compliant, such as, medically compromised patients and physically or mentally disabled patients would probably benefit from minimizing or eliminating orthodontic treatment[3]. The inevitable complication of autotransplantation is pulp obliteration; although other complications such as, pulp vitality loss, reduced or suspended root growth, root deformation, root resorption, or ankylosis may also occur[3,10,11]. Accordingly, autotransplantation of impacted canines may be indicated in selected circumstances.

Many factors favored autotransplantation as the treatment of choice in case 2. First, malposition of the impacted maxillary canine was severe and resulted in root resorption of the central incisor. Second, interference of orthodontic eruption of the lateral incisor meant that surgical exposure followed by orthodontic realignment was not a viable option. Third, the root of the impacted maxillary canine was about 4/5 formed. Open apex teeth have better success rates than closed apex teeth, and transplantation is preferred when 3/4-4/5 of the root is formed[12]. In addition, the space for autotransplantation was sufficient due to the peg lateral on the right maxillary lateral incisor, and thus pre-surgical orthodontic treatment was not needed to create space for the transplant. Furthermore, the patient refused orthodontic treatment because of its long duration.

The most significant factor for successful autotransplantation is to maintain the viability of periodontal ligament cells in the donor tooth[13]. It can be achieved by minimizing the extra-oral time during the surgical operation and optimal distance between the recipient site tissue and the root surface of the donor tooth. The use of a CARP model as a surgical guide helps to contour the recipient socket correctly and minimize the extra-alveolar time of donor teeth. The evaluation of fit to the socket and relationship with the adjacent and opposing teeth could be performed without the donor tooth.

Treatment plans for impacted maxillary canines should be based on comprehensive evaluations of patient condition. It is important to evaluate the patient age, the degree of root development, the position of the impacted teeth, space requirements, treatment duration, and patient compliance. Therefore, in cases with specific indications, after comprehensively evaluating patient condition, autotransplantation can be a reliable alternative treatment, that offers an acceptable prognosis. Furthermore, the most noteworthy attribute of autotransplantation is that the patient can use his or her own teeth rather than extract, with short treatment duration.

CONCLUSION

The management of impacted canine is important in terms of esthetics and function. Clinicians must formulate treatment plans that are in the best interests of patients, and several treatment options should be considered. This report describes the case of a 14-year old girl with a severely malpositioned impacted right maxillary canine with external root resorption of the right maxillary central incisor and a peg lateral on the right maxillary lateral incisor treated by autotransplantation with a CARP model as a surgical guide. Accordingly, autotransplantation can be a reliable alternative, in cases with specific indications when the canine is grossly malpositioned with little scope for orthodontic alignment and the objectives are to shorten the treatment period and to maintain a natural tooth for as long as possible.

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