

Case Report

## Delayed Autotransplantation of Permanent Impacted Maxillary Canine

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**Abstract**—Tooth autotransplantation is the extraction of a tooth from one location and its replantation in a different location in the same individual. It provides an alternative approach for treating severely impacted tooth when orthodontic treatment is ineffective. This case report presents a patient with buccally impacted left maxillary canine. Alveolar bone grafting (ABG), autotransplantation and orthodontic treatment were carried out. A 4 month review shows good prognosis of the transplanted tooth with no bone resorption.

**Keywords** - autotransplantation, impacted canine, alveolar bone grafting

### I. INTRODUCTION

Maxillary permanent canine is the second most common impacted tooth after mandibular third molar. It is more common in females [1]. Approximately 45.2% impacted maxillary permanent canines are usually labially impacted, 40.5% are at the palatal side and 14.3% are in the mid-alveolus [5]. The aetiologies are a) presence of supernumerary teeth, b) cysts or tumours, c) space loss, d) primary tooth retention, e) trauma, f) root dilacerations, g) ankylosis and h) cleft lip and palate reconstructive surgery [2]. The general causes include a) irradiation, b) febrile illness, c) endocrine disorders, d) cleidocranial dysostosis and Yunis–Varon syndrome. Radiographic techniques for investigating impacted canines include occlusal view, lateral cephalometry orthopantomogram, computed tomography (CT) and cone beam computed tomography (CBCT) [3]. Impaction may cause aesthetic and phonetic compromises;

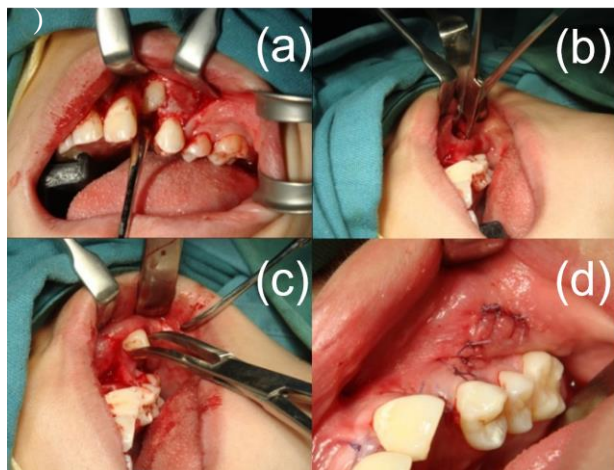
neighbouring tooth migration; arch length loss; internal or external root resorption of adjacent teeth; and dentigerous cyst formation.

### II. CASE REPORT

A 13-year-old Chinese male presented with unerupted left maxillary canine. He was diagnosed with left unilateral complete cleft lip and palate. Cheiloplasty, palatoplasty and alveolar bone grafting were carried out previously. Orthodontic treatment was initiated when he was 11 years old to correct his crowding and class III malocclusion. Clinical examination revealed edentulous canine space. Orthopantomogram radiograph showed an impacted 23 with crown tip mesial to the midline, and root formation was 75% complete.

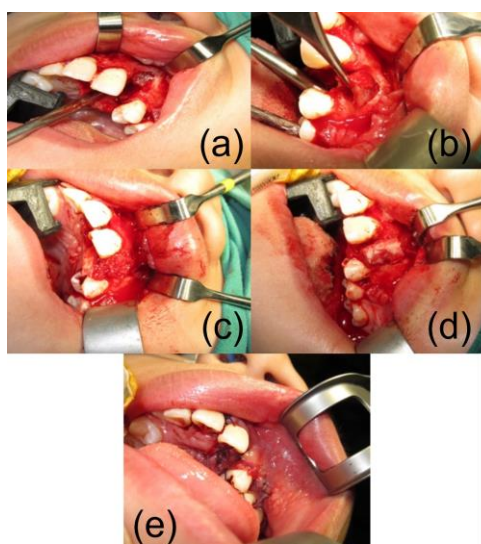
A decision was made for autotransplantation of the impacted 23 under general anaesthesia. Intraoperatively, a mucoperiosteal flap was raised for the exposure of the

overlying cortical bone of the impacted 23 and recipient site, but the buccopalatal width of the recipient site was thin with insufficient cancellous bone volume and was unable to accommodate the impacted 23, indicating that the previous ABG failed. Given that the stability of 23 may be compromised, the tooth was stored in a pouch under the buccal mucosa, and the recipient site was grafted in the subsequent surgery session (Fig. 1).

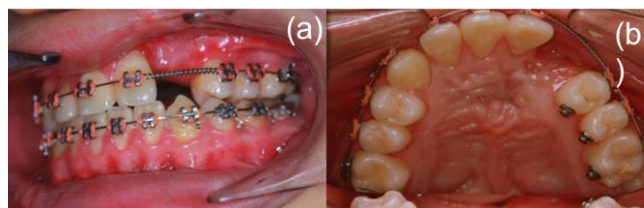


**Fig. 1** a) Exposure of 23; b) Pocket creation at buccal mucosa; c) Placement of 23 into the pocket; d) Flap closure with Vicryl ® 3/0

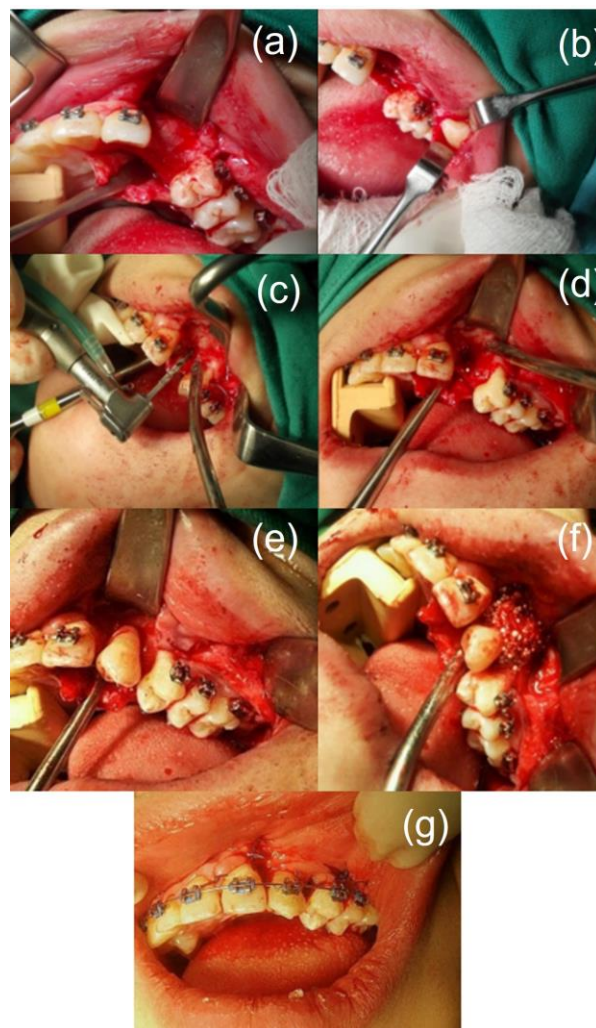
After 2 months, alveolar bone grafting was performed. The cortical iliac bone was placed at the nasal floor and the labial and palatal walls of the recipient site before the placement of cancellous bone. A membrane (bovine pericardium) was placed over the grafted site (Fig. 2 & 3).



**Fig. 2** a) Surgical site exposure; b) Fibrous tissues removal and nasal lining created to provide support for the graft; c) Cancellous bone placement; d) Cortical bone placement at the buccal aspect of the grafted site; e) Flap closure with Vicryl ® 3/0

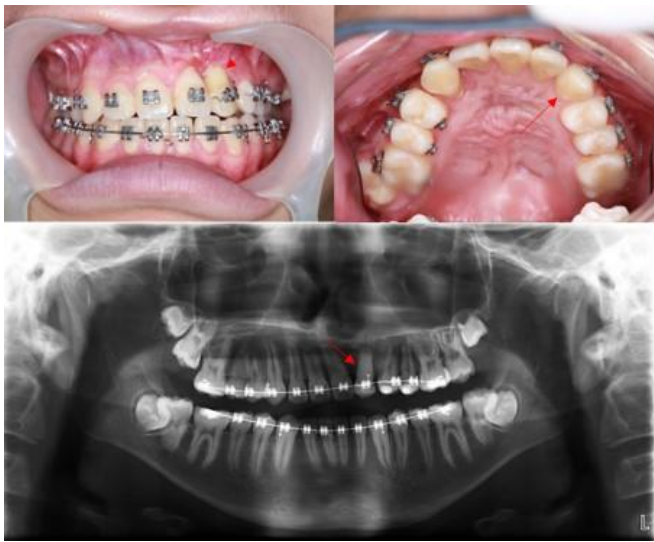


**Fig. 3** Pre-transplantation photographs showed a healing grafted site; a) Lateral view; b) occlusal view



**Fig. 4** a) Recipient site exposure; b) Tooth removed from pouch; c) Recipient site prepared with Dentium® implant drill; d) Prepared recipient site; e) Tooth implantation; f) Bone graft placement; g) Flap closure with Vicryl ® 3/0

After 4 months, the recipient socket was prepared using an implant surgical drill (Dentium). Tooth 23 was removed from the pocket and placed in the recipient site. Orthodontic brackets and wire were used for splinting (Fig. 4). Upon review, no evident bone and root resorption was observed (Fig. 5). Root canal treatment was performed after 4 weeks.



**Fig. 5** Photographs show the transplanted tooth (pointed by red arrow); a) Intraoral anterior view; b) Intraoral upper occlusal view; c) Orthopantomogram

### III. DISCUSSION

When the maxillary canine is severely displaced, autotransplantation is highly suggested [4]. The survival rate of the transplant inserted into the extraction socket was 100%, and the success rate was 95%. In addition, the survival rate for the donor tooth transplanted into the artificially created socket was low (75%), and the success rate was 60%. The low survival and success rates may be due to the increased extraoral time. Transplantation must be carried out as soon as possible after extraction [5]. The recipient site must have sufficient mesiodistal and buccolingual widths. In case that the early extraction of a tooth from the recipient is required, transplantation must be performed within 1 month. The degree of bone resorption at the recipient site increases with time interval, and thus support for the donor tooth decreases [6]. In our case, the mesiodistal and buccolingual widths of the bone of the recipient site were insufficient, and space regeneration was performed orthodontically prior to the transplantation and autogenous bone graft procedures. A tooth is successfully transplanted if it has normal mobility and function and shows good gingival healing without attachment loss and inflammation [7]. Radiographically, it will show a normal periodontal space width and normal root development, the lamina dura is present and no inflammatory root resorption occurs. Transplantation is ideally carried out when root formation is 75%–80% complete [8]. Extraoral time must be minimised in order that the viability of periodontal ligament cells is preserved. Non-rigid fixation for 7–10 days is recommended because it will stimulate the activation of alveolar ligament cells and bone healing, and long-term fixation may cause ankylosis [9]. Initial stability is achieved if a donor tooth shows no severe mobility in a recipient site [10]. Good initial stability ensures sufficient blood supply to the root surface [11]. Bae [14] reported that fixation can be removed after 2–3 weeks only when no vertical mobility is observed. Orthodontic treatment may be started 1 month after the transplantation of a tooth with a closed apex [8]. In

our case, the duration of splinting was 2 months because some degree of mobility was observed after 1 month of splinting. Orthodontic treatment on transplanted teeth with complete root formation may increase the risk of surface and inflammatory root resorption [12]. Viable periodontal ligament is a crucial factor for successful transplantation. Pulp regeneration likely occurs in immature or developing tooth but not in developed teeth [8]. Follow-up must include radiographic and clinical examinations (1 week post-surgery for suture removal, 1 month and then three-monthly basis for 1 year, six-monthly basis in the second year and annually basis after that [13]. The purpose of this review is to monitor pulpal healing, periodontal and root status. In our case, the sutures were removed 1 week after surgery, and examinations were performed after 1 month and then on a three-monthly basis. No evident tooth mobility and resorption were observed.

### IV. CONCLUSIONS

The efficient management of impacted permanent maxillary canine is a challenging task for clinicians. Autotransplantation is one of the options. Compared with osseointegrated implant, a transplanted tooth ensures the preservation of the height and width of the alveolar bone and facilitates the placement of an osseointegrated implant if the resorption of the transplanted tooth occurs.

#### CONSENT TO PARTICIPATE

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

#### CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

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