

Case Report

Surgical transpose of an impacted maxillary canine with bone flap replacement

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Abstract – Introduction: Management of an edentulous area when the tooth is impacted is often a challenge. Usually, treatments are by far orthodontic traction followed by tooth removal with dental implant placement. With piezosurgery, minimally invasive auto-transplantation can be an alternative. **Observation:** A 27-year-old patient presenting terminal mobility of the tooth no°63 consulted for replacement. Among the different therapeutic solutions, a surgical transposition of her impacted tooth no°23 with a conservative bone window replacement was decided. After a 12-month follow up period, X-rays showed no sign of ankylosis, root resorption or apical pathology, while clinical criteria such as tooth function, mobility and aesthetic integration were all satisfying. **Commentaries:** Space closure, dental implant and bonded bridge were alternatives. The interest of this clinical case is to restore the functional and aesthetic roles of the canine without compromising any potential implant placement later. Also the patient can still have the possibility to opt for an implant-supported crown in the long-term thanks to the bone volume maintained. **Conclusion:** When orthodontic realignment is considered as not possible, auto-transplantation of a tooth can be a good choice before going on dental implant therapeutic.

Introduction

The first drafts on dental transplantation dates back from the third millennium BC, but the real first clinical studies were described in the 1950s. Thanks to the work of Andreasen from the 90s and Mejare *et al.*, auto-transplantations are now a well-documented surgical procedure for replacing missing teeth [1–3]

They are mainly used in replacement of decayed first molar and in dental traumatology for incisor replacement. Surgical transposition of impacted tooth should be considered for some specific cases. Usually, the main donor teeth are third molars, but it can be any dental organ as long as it remains healthy.

Except from the wisdom tooth, maxillary canine are the most frequent impacted teeth (0.9–2.2%) and surgical exposure followed by orthodontic realignment is considered the standard treatment for this situation [4].

When this option is too difficult or impossible, auto-transplantations can offer an interesting alternative to tooth removal plus prosthetic solutions.

This case report combines the surgical auto-transplantation of a mature impacted canine without endodontic treatment and minimally invasive bone management with piezosurgery including bone flap replacement.

Observation

A 27-year-old woman came in the Oral Surgery Department of Hospices Civil de Lyon for replacement of her moving deciduous canine no°63. The patient had no relevant medical or surgical history and no previous orthodontic treatment.

Clinical examination revealed the following:

First, the left deciduous maxillary canine had reached a terminal mobility because of a physiological root resorption. A CBCT (Cone Beam Computerized Tomography) was performed to locate her permanent left maxillary canine in order to determine treatment options and anticipate potential difficulties. Then, radiological examination showed an impacted left maxillary canine with no signs of ankylosis (presence of dentoalveolar ligament). The tooth was located 5 millimeters above crestal bone, with a hook shaped apex right under the nasal cavity (Fig. 1).

The first issue was to determine whether the dental traction of the impacted canine was achievable. In concertation with the Orthodontic department, it was decided that dental traction or space closure remained too difficult and hazardous. After considering all solutions of replacement with the patient, and discussing about the surgical outcomes, the transplantation of the enclosed permanent canine was considered as the first-line option.

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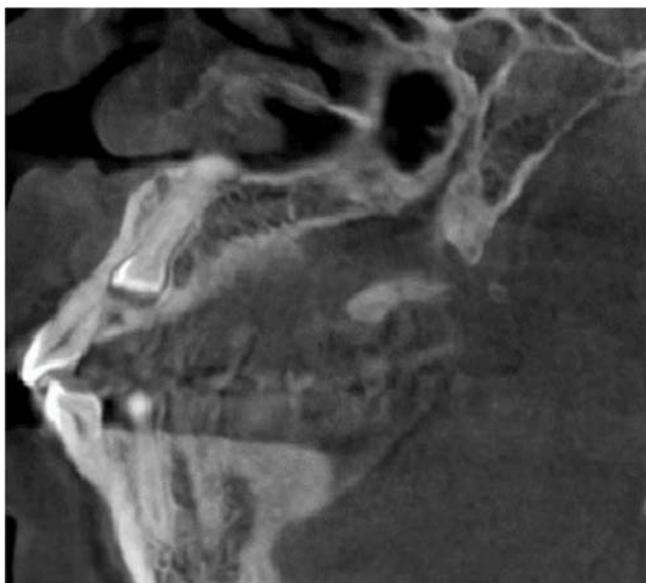


Fig. 1. Pre-operative CBCT.

– Surgical management:

The surgery was performed under local anesthesia (Articaine 4% + epinephrin 1:1,00,000).

First, sulcular incision from 11 to 25 was performed with distal posterior slitting incision. Subperiosteum flap was elevated in order to expose bone from anterior nasal spine to zygomatic pillar including nasal cavity. Osteotomy was made by piezosurgery approach (Insert OT7-20 Mectron) with a trapezoidal cut (Fig. 2a). Cleavage of the bone was made with an osteotome and mallet, and the window was conserved in isotonic solution of NaCl. Once the tooth was exposed, root section was performed with a Zekria bur (Fig. 2b) and apex was left inside.

Then, dento-alveolar luxation was managed with a dental elevator on the crown to ensure the absence of any potential damage on the root periodontal cells. A slight enamel breakage of mesial ridge occurred during luxation. Right after this, avulsion of 63 was made. The neo-socket was achieved with round tungsten carbide bur 27/10 mm mounted on dental handpiece. Conservation of a solid vestibular ridge was important to preserve the volumes of bone and consequently soft tissue support in this aesthetic smile area.

The measured Extra-alveolar time (EAT) was 12 minutes. During this time the tooth was conserved into a compress soaked with sterile solution of NaCl.

Tooth replacement was possible without any alteration to the crown and transplant-root (Fig. 2c).

Donor site was filled with Pangen collagen and the bone window was replaced on it to protect the whole and enhance osteogenesis (Fig. 2d). 3/0 silk with horizontal papilla mattress sutures was used to close the flap and a semi-rigid steel contention wire, bonded with composite flow on 22, 23 and 24 to fix the transplant (Fig. 2e).

To avoid any occlusal traumatizing overbites, a light enameloplasty was made with blue occlusal paper (40µm).

Finally, an immediate post-operative orthopantomogram was performed after (Fig. 3).

– Medications:

The patient started antibiotics (Amoxicillin 3 g per day for 7 days) and anti-inflammatory (Solupred 60 mg per day for 4 days) the morning of the surgery. Antibiotherapy was driven by the bone milling and the bone flap repositioning.

She was also prescribed painkillers (Paracetamol + Tramadol if needed) and mouthwashing (0.12% Chlorhexidine) twice a day for 14 days. Medical instructions were local application of ice 3 times a day, cold liquid feed during 48 hours then transition to soft food for the subsequent 6 weeks.

A close clinical monitoring was implemented in order to anticipate the occurrence of any endodontic treatment on necrotic pulp symptoms.

This supervision started at seventh day with stitch removal. The patient experienced light pain episodes during the first week (grade 3 on EVA scale) and described a discomfort attributable to swelling rather than pain.

28 days later, the contention was removed and slight mobility was evaluated at 2 on Miller scale (5) (Fig. 4a). At third month, the vitality test was positive by simple blinded cryo test. Axial and lateral percussion test was negative, and mobility was physiologic compared to the contralateral canine (Fig. 4b). At 6 months, vitality test remained positive still and percussion test yielded negative result with a physiologic tone. Mobility was evaluated physiologic. The first follow-up CBCT showed up good results: new primary bone filled up the empty socket, while the bone window was completely osteointegrated (Fig. 5a).

Neither radiolucency, nor symptoms and/or any discomfort were perceived by the patient regarding the tooth apex left in place. She also received an aesthetic composite treatment in order to soften enamel breakage. After 12 months (Fig. 4c), the test results (vitality, percussion, mobility) were unchanged. Also, there was neither dyschromia, nor significant pocket depth on probing. The patient announced she was 8-week pregnant. As a precautionary principle of this physiologic condition, instead of CBCT it was decided to make a retroalveolar X-ray with lead apron. This radio showed up satisfying results: no peri-apical radiolucency and the presence of dento-alveolar ligament signing the absence of ankylosis (Fig. 5b).

Commentaries

The originality of the clinical case lies in the fact that transplantation was performed using a mature tooth sectioned at the apex level for enhancing revascularization. Murta *et al.* suggested that under close supervision, apicoectomy on some auto-transplanted teeth with complete apical formation presented the potential to undergo vascularization [6]. Then, other studies [7,8] supported the statement that apicoectomy could enlarge the foramen of the transplant and so achieve high rates of revascularization. Pulp regeneration result from ingrowth of new cell-rich connective tissue which replaced the necrotic residual pulp tissue within 120 days.

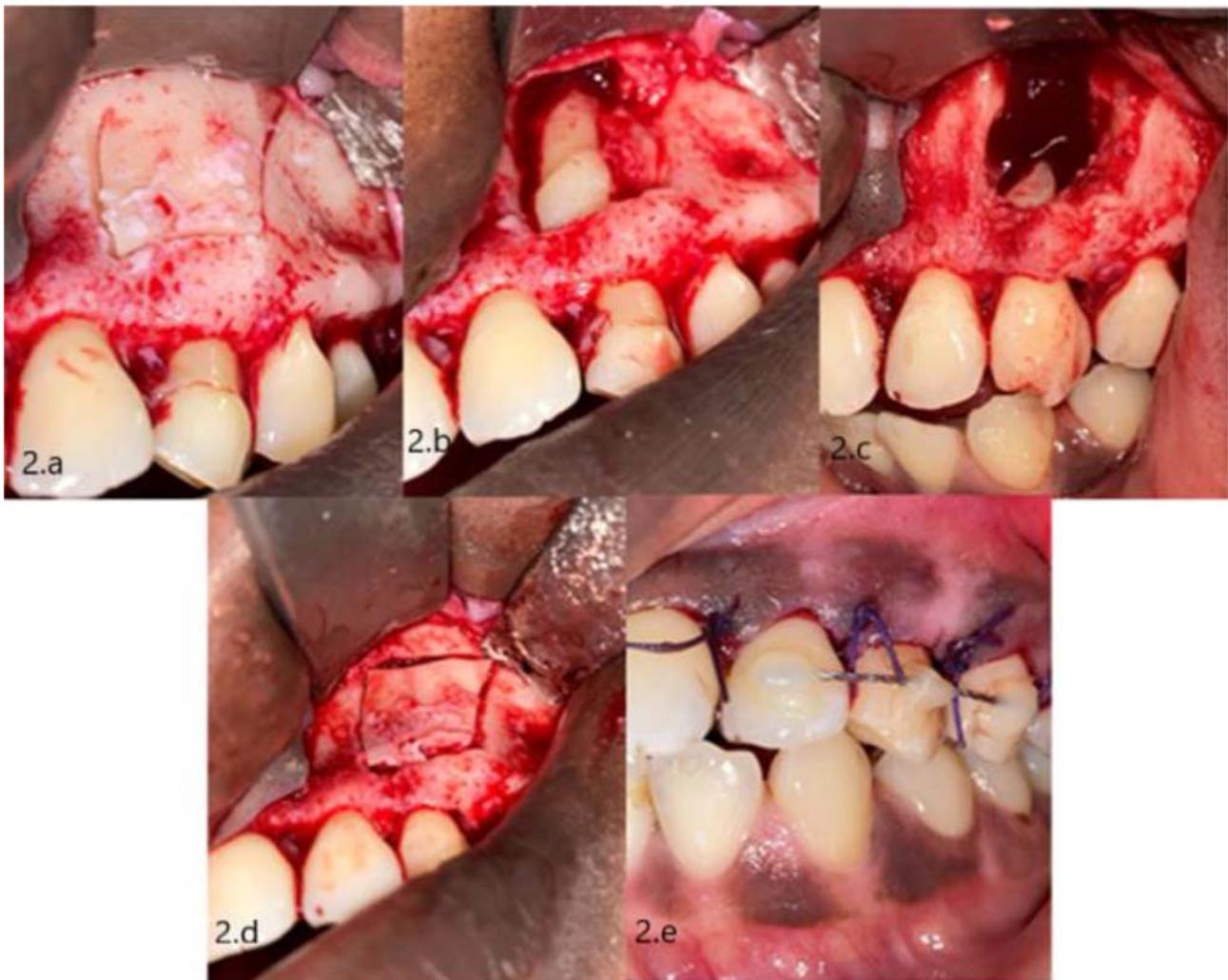


Fig. 2. (a) Trapezoidal osteotomy, (b) tooth exposure, (c) transposition, (d) bone replacement, (e) bonded wire.



Fig. 3. Immediate post operative orthopantomogram.

Classical technique involves preparing the receiving site before removing the donor tooth [9]. Some recent cases suggest to use CBCT and 3D printer to create surgical templates to gain precious EAT [10]. In this case, in order to avoid the risk of damaging the included canine, it was decided to create the

neo-socket for the placement of the transplant after removing the permanent canine. Thereby, surgical template was hardly conceivable.

Difficulties of this case were essentially to ensure a correct osseous conservation, and the hook shaped apex.



Fig. 4. (a) 28 days post-operative, (b) 3 month, (c) 1 year.



Fig. 5. (a) 6 month post-op CBCT, (b) 1 year retroalveolar X-ray.

Concerning the osseous conservation, as described by Bertrand *et al.* [11] keeping a vestibular bone wall was essential to preserve bone volume and soft tissue support indeed. Using microvibrations of piezosurgery aimed to reduce discomfort and a meticulous minimal invasive cut [12]. The hook shaped root of the canine forced the radicular section and apex was left given to prevent any projection into the nasal fossae. The duration of the intervention was also reduced, along with the preservation of periodontal ligament.

Regarding treatments panels, the no therapy alternative was discarded. Indeed, maxillary canine is one of the pillar of the dental occlusion and is essential considering aesthetic and lip support it could be perceived as loss of chance for the patient [13].

Orthodontic canine alignment was not intended due to patient age, the high density of the bone, the vertical position of the tooth and the shape of the root. Several authors reported that canine alignment was not as predictable in adults as in teenagers [14,15]. Space closure would have been indicated

but required the removal of tooth no°23 anyway, with a prolonged orthodontic appliance. Further Space closure is not always feasible for aesthetic and/or functional reasons.

Purely prosthetic Maryland bridge supported on tooth no°22 with observation of impacted tooth could have been a possible treatment. It was not retained because bonded bridge cannot afford occlusal forces inherent to the canine guidance role. Additionally, this option is still viewed as a temporary solution [16].

The most arguable treatment was dental implant placement with an immediate aesthetic loading crown. Obviously, this solution requires removing the impacted tooth before [17]. Davarpanah *et al.* showed acceptable results on impacted trans-canine implantation, but this technique is still unconventional and needs more reports and follow up [18]. It could have been more a tempting treatment if the enclosed canine was ankylosed. What makes this case interesting is the use of the graft potential of the existing tooth, with a scientific hindsight technique, without discrediting the possibility of any implant placement later.

Conclusion

At last, the chosen therapeutic option delighted the patient by the immediate results and the possibility of keeping her own tooth. It also preserves the bone for later implantation, keeps the proprioception of the natural tooth and satisfactorily addresses the aesthetic and functional criteria with virtually no biological and financial cost for the patient.

Conflict of interest

The authors declare that there is no conflict of interest.

Informed Consent

Oral informed consent was obtained from the patient.

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Ethical approval

Ethical approval was not required.

References

1. Kvint S, Lindsten R, Magnusson A, Nilsson P, Bjerklin K. Autotransplantation of teeth in 215 patients. A follow-up study. *Angle Orthod* 2010;80:446–451.
2. Andreasen JO, *et al.* A long-term study of 370 autotransplanted premolars. Part III. Periodontal healing subsequent to transplantation. *Eur J Orthodont* 1990;12:25–37.
3. Mejäre B, Wannfors K, Jansson L. A prospective study on transplantation of third molars with complete root formation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endodontol* 2004;97:231–238.
4. McSherry PF. The ectopic maxillary canine: a review. *Br J Orthodont* 1998;25:209–216.
5. Miller SC. *Textbook of Periodontia*, 3rd ed. Philadelphia: The Blaskiston Co 1950;125:212.
6. Murtadha L, Kwok J. Do autotransplanted teeth require elective root canal therapy? a long-term follow-up case series. *J Oral Maxillof Surg* 2017;75:1817–1826.
7. Jakse N, Ruckenstein M, Rugani P, Kirnbauer B, Sokolowski A, Ebeleseder K. Influence of extraoral apicoectomy on revascularization of an autotransplanted tooth: a case report. *J Endodont* 2018;44:1298–1302.
8. Raabe C, Bornstein MM, Ducommun J, Sendi P, von Arx T, Janner SFM. A retrospective analysis of autotransplanted teeth including an evaluation of a novel surgical technique. *Clin Oral Invest* 2021;25:3513–3525.
9. Cross D, El-Angbawi A, McLaughlin P, Keightley A, Brocklebank L, Whitters J, *et al.* Developments in autotransplantation of teeth. *The Surgeon* 2013;11:49–55.
10. Louise T, Pierre-Alexandre C, Olivier S, Victor F. Transplant surgical templates for dental autotransplantation: a technical note. *J Oral Med Oral Surg* 2019;25:25.
11. Bertrand B, Caroline R, Pierre S. Volet osseux et interception tissulaire appliqués au dégagement et à l'avulsion des canines incluses. *Med Buccale Chir Buccale* 2013;(19):45–52.
12. Pavlíková G, Foltán R, Horká M, Hanzelka T, Borunská H, Šedý J. Piezosurgery in oral and maxillofacial surgery. *Int J Oral Maxillof Surg* 2011;40:451–457.
13. Counihan DR, Hegarty DJ. In defence of transplants: a case report. *Dental Update* 1997;24:138–142.
14. Nordenram A. Impacted maxillary canines a study of surgically treated patients over 20 years of age. *Swed Dent J* 1987;11:153–158.
15. Pitt S, Hamdan A, Rock P. A treatment difficulty index for unerupted maxillary canines. *Eur J Orthod* 2006;28:141–144.
16. Krassnig M, Fickl S. Congenitally missing lateral incisors—a comparison between restorative, implant, and orthodontic approaches. *Dent Clin North Am* 2011;55:283–299.
17. Mazor Z, Peleg M, Redlich M. Immediate placement of implants in extraction sites of maxillary impacted canines. *J Am Dent Assoc* 1999;30:1767–1770.
18. Davarpanah M, Szmukler-Moncler S, Rajzbaum P, Davarpanah K, Capelle-Ouadah N, Demurashvili G. Unconventional implant placement. V: Implant placement through impacted teeth; results from 10 cases with an 8- to 1-year follow-up. *Int Orthodont* 2015;13:164–180.