

AUTOGENOUS TRANSPLANTATION OF AN ECTOPIC LOWER CANINE: CASE REPORT

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ABSTRACT

Dental autotransplantation or autogenous dental transplantation is defined as the surgical removal from one site and insertion in another site of a dental element from one position to another, within the same person. The indications are advanced caries, trauma, agenesis, and severe ectopias. In our case, we tried to provide a therapeutic alternative to an ectopic canine that is very difficult to recover orthodontically, through reimplantation in the correct eruption site. An 11-year-old patient had the left lower canine in mesial ectopic inclusion, difficult to recover orthodontically, with persistence of the deciduous canine in the arch. Autogenous transplantation of the definitive canine was performed in the post-extraction socket of the deciduous canine, in the same operating session, and splinted for 2 weeks. One month and 11 months follow-up, there was absence of mobility, good integration with the periodontal tissues, absence of ankylosis with good representation of the periodontal ligament on the radiographic examination, absence of recessions and/or pathological probing. Tooth auto-transplantation can be considered an alternative oral rehabilitation approach for some clinical situations. Autotransplantation can be a valid therapeutic alternative in selected cases; however, the high failure rate must be carefully evaluated in the treatment planning phase. It would be desirable to have studies that can provide follow-up for many years and possibly be able to draw up an operating protocol that can provide evidence of correlation with the result.

KEYWORDS: *dental autotransplant, ectopic canine, impacted canine, retainer*

INTRODUCTION

One of the most frequently malpositioned teeth in the dental arch is the canine (1). Surgical exposure, with or without orthodontic treatment, is generally performed in children and adolescents. In these patients, tooth transplantation might be a treatment of choice (2). Tooth auto-transplantation is regarded as a valuable treatment approach based on the utilization of the patient's own tooth (3). Dental autotransplantation or autogenous dental transplantation is defined as the movement of a dental element from one position to another, within the same person (4).

The key to the success of the tooth transplant procedure depends on understanding and respecting some biological principles, such as an intact and vital periodontal ligament. All authors agree that the preservation of the integrity of the periodontal ligament on the donor element represents the basis of clinical success (5). To maintain its vitality, it is essential to perform an avulsion of the tooth that is as atraumatic as possible, reduce extraoral residence times to a minimum, and avoid osmotic shock to the ligament.

Recipient sites with infections in the periapical area are contraindicated for this treatment. However, in the case of mild signs of periapical inflammation of the recipient site, curettage of the most apical region of the alveolus seems to prevent any significant influence on the prognosis of the transplant (6). In order to limit infectious complications, almost all studies on post-traumatic reimplantations and dental autotransplants include an antibiotic coverage scheme.

For the transplant procedure, it is necessary to have a healthy donor element of the appropriate size available, comparing its dimensions with those of the recipient site during the planning phase of the operation, through clinical and radiographic examinations. Some adaptations of the recipient site can be performed in a more or less straightforward way: if the mesiodistal diameter of the recipient site is insufficient to accommodate the donor element, it is possible to intervene orthodontically to generate space before the transplant; if, however, it is the bucco-lingual thickness that is lacking, a bone graft or a greenstick fracture may be alternatives to be evaluated. Finally, the apical-coronal diameter must be carefully assessed via radiographs, comparing it with the length of the roots of the donor tooth. If necessary, a vertical preparation of the socket can be performed to increase the depth of the recipient site (7).

A semi-rigid extracoronary splint guarantees stability during the post-operative period (14-30 days). It is necessary to avoid excessively rigid splinting to allow some functional movement of the element during the healing phase to stimulate the activity of the periodontal ligament cells and bone repair. It has been shown that long-term rigid fixation applied after external trauma leads to a greater incidence of dentoalveolar ankylosis compared to less rigid short-term fixation (8).

One of the most widely used radiographic classifications for staging root development is the classification system established by Moorrees et al. (9), where stages 1 to 4 represent the developmental quarters of the expected root length, stage 5 represents the full length with a patent foramen, and stage 6 represents the full length with a closed apex. In general, the transplant of a germ with less than half-formed roots seems to compromise further root development and result in root reabsorption phenomena. In contrast, the surgical manipulation of elements with fully developed roots is possible. Still, the increased length of the donor element makes the surgical procedure more complicated both during the atraumatic avulsion phase and in the positioning of the transplant in the donor site. According to Tsukiboshi (10), the transplant should be performed when an element is at its maximum root length but still has the potential for pulp regeneration (radiographic apex > 1mm).

Last but not least, patient selection is significant for the auto-transplantation success. Candidates must be in good health, demonstrate excellent oral hygiene, and be amenable to regular dental care; otherwise, the successful outcome of auto-transplantation could be jeopardized. Patients must be able to follow post-operative instructions and be available for follow-up visits; co-operation and comprehension are essential to ensure predictable results (11).

Hale (12) suggested preoperative radiographic measurements of the transplanted element (mesiodistal dimension) where there was no acute infection in the recipient site, a splinting time of 2 to 3 weeks for the transplanted tooth, and the local administration of penicillin G in the recipient site.

CASE REPORT

An 11-year-old patient comes to our attention with persistence of element 73 in the mandible and absence of 33. Following a radiographic investigation with orthopantomography of the dental arches, it was possible to verify the state of inclusion of element 33, located in an ectopic mesial position with part of the crown having passed the mandibular midline. This position made the element difficult to recover orthodontically, with the associated risk of damage and lower incisor rhizolysis. Given the patient's unwillingness to undertake orthodontic treatment and the good level of oral hygiene and compliance demonstrated, we opted for the recovery and autotransplantation of the 33, which included following the avulsion of 73 (Fig. 1).

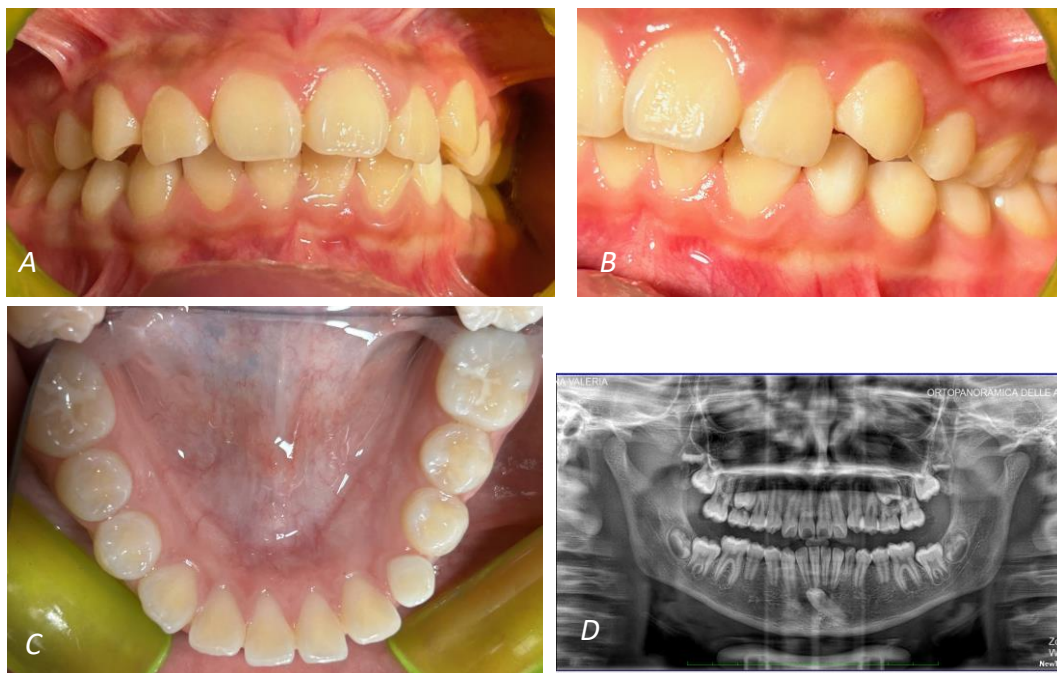


Fig. 1. Pre-operative pictures and radiograph. A): pre-surgical frontal picture; B): view of the deciduous canine; C): occlusal view of lower arch; D): initial orthopantomography.

First, avulsion of element 73 was performed. Subsequently, we proceeded with the recovery of element 33. Following a full-thickness intrasulcular flap in the vestibular median mandibular area, dissection, and osteotomy, we proceeded with avulsion of element 33. The post-extraction site of 73 was expanded both vertically and transversely through preparation with drills and greenstick fracture to increase the depth and width of the replantation site. Following washing with physiological solution, element 33 was reimplanted in the dimensionally adapted site of 73.

Element 33 was simultaneously stabilized with the adjacent dental elements using a semi-rigid retainer with braided steel wire extended from 31 to 34. This retainer was left in place for two weeks and then removed. Element 33 immediately showed good integration and a lack of mobility (Fig. 2, 3).

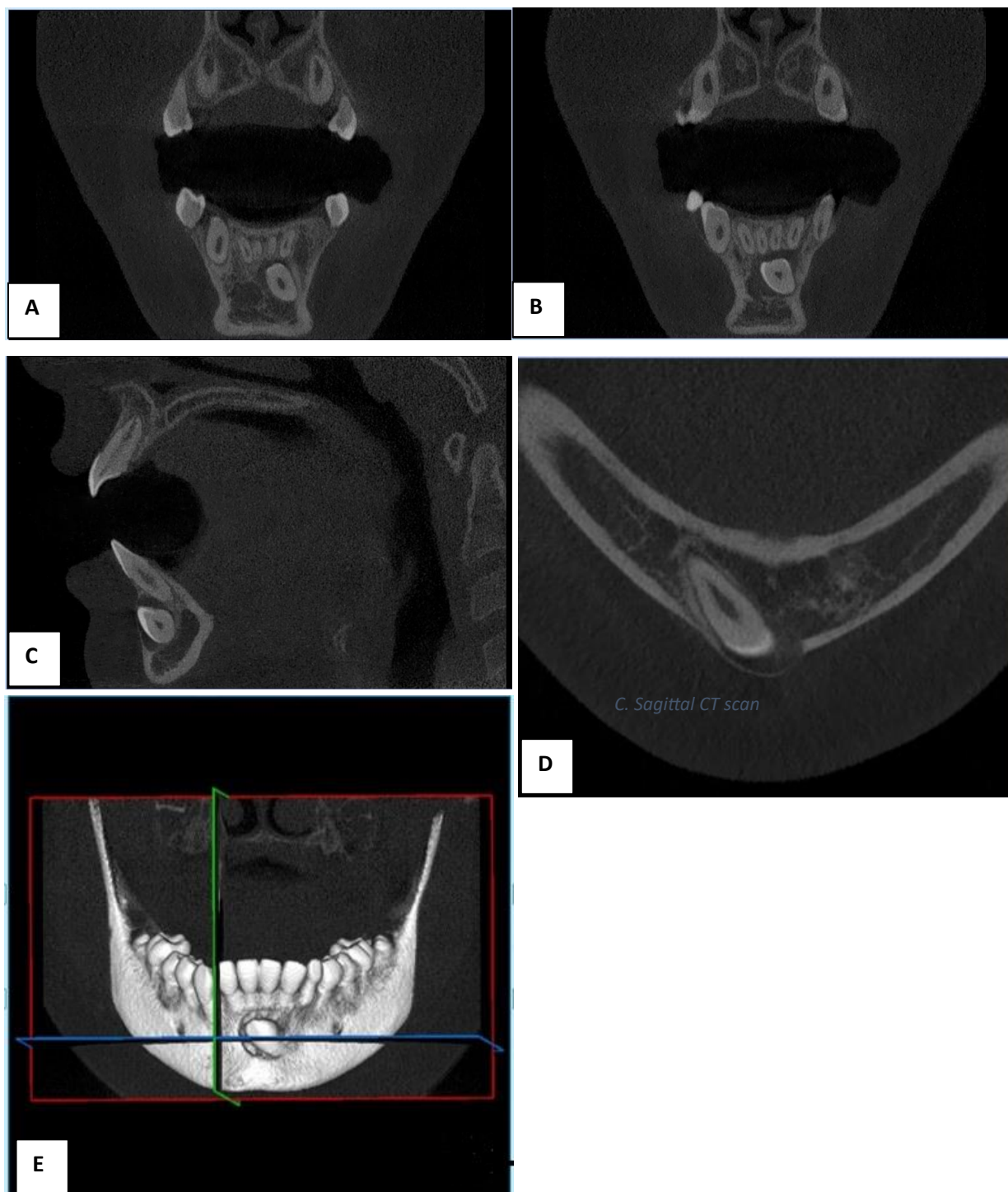


Fig. 2. Pre-operative CT scan. A): axial CT scan; B): axial CT scan; C): sagittal CT scan; D): transverse CT scan; E): volumetric view CT.

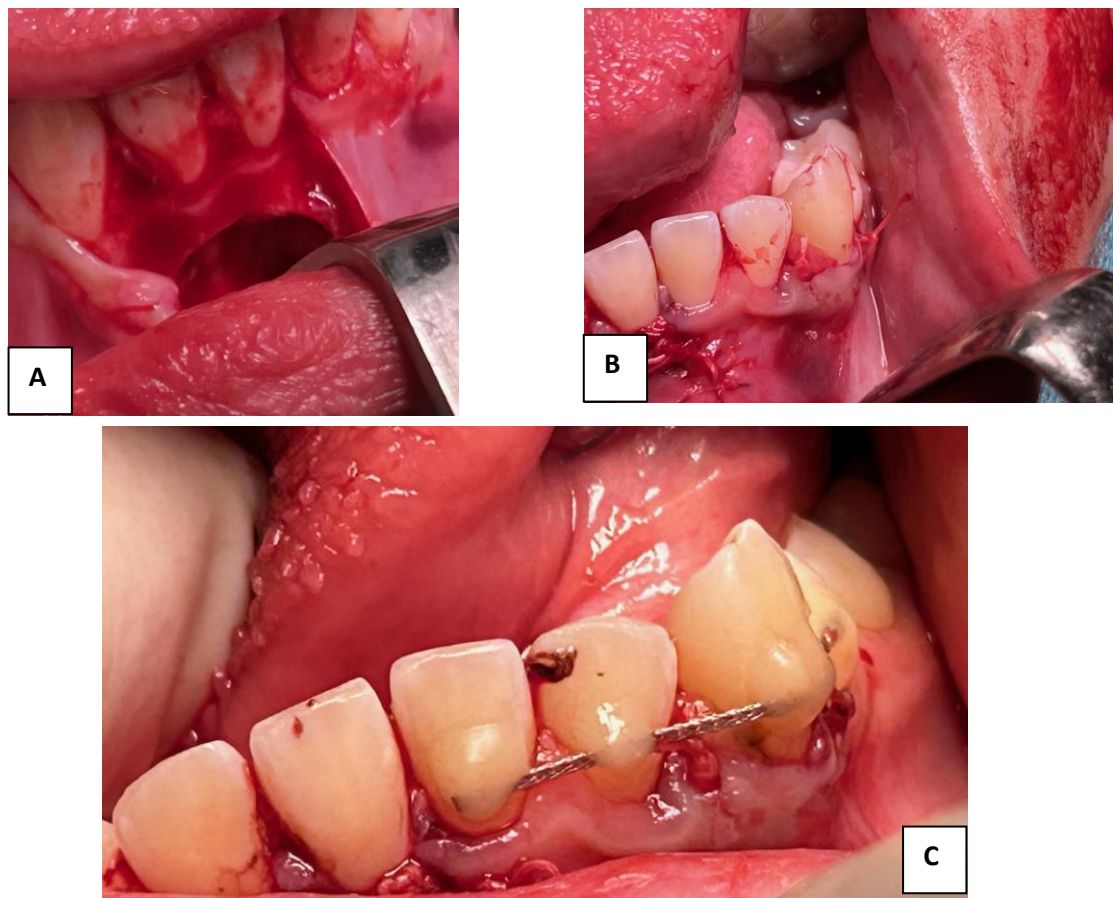


Fig. 3. *Intra-operative pictures. A): intraoperative picture; B): transplanted canine; C): dental splinting.*

All treatment was performed under antibiotic prophylaxis. The patient was previously subjected to antibiotic therapy 1 day before surgery, and for the following 7 days; the antibiotic choice was Amoxicillin 1 gram tablets, with a dosage of 1 tablet every 8 hours for 8 days. After 2 weeks, the element showed a positive response to the cold test; therefore, it was decided to postpone root canal therapy.

Follow-ups were performed at 1 month and 11 months. At the 11-month follow-up, a new orthopantomography of the dental arches is examined, an objective examination and vitality test are performed and the following is noted: absence of mobility, good integration with the periodontal tissues, absence of ankylosis with good representation of the periodontal ligament on the radiographic examination, absence of recessions and/or pathological probing (Fig. 4, 5).



Fig. 4. *Intraoral X-ray after 1 month.*

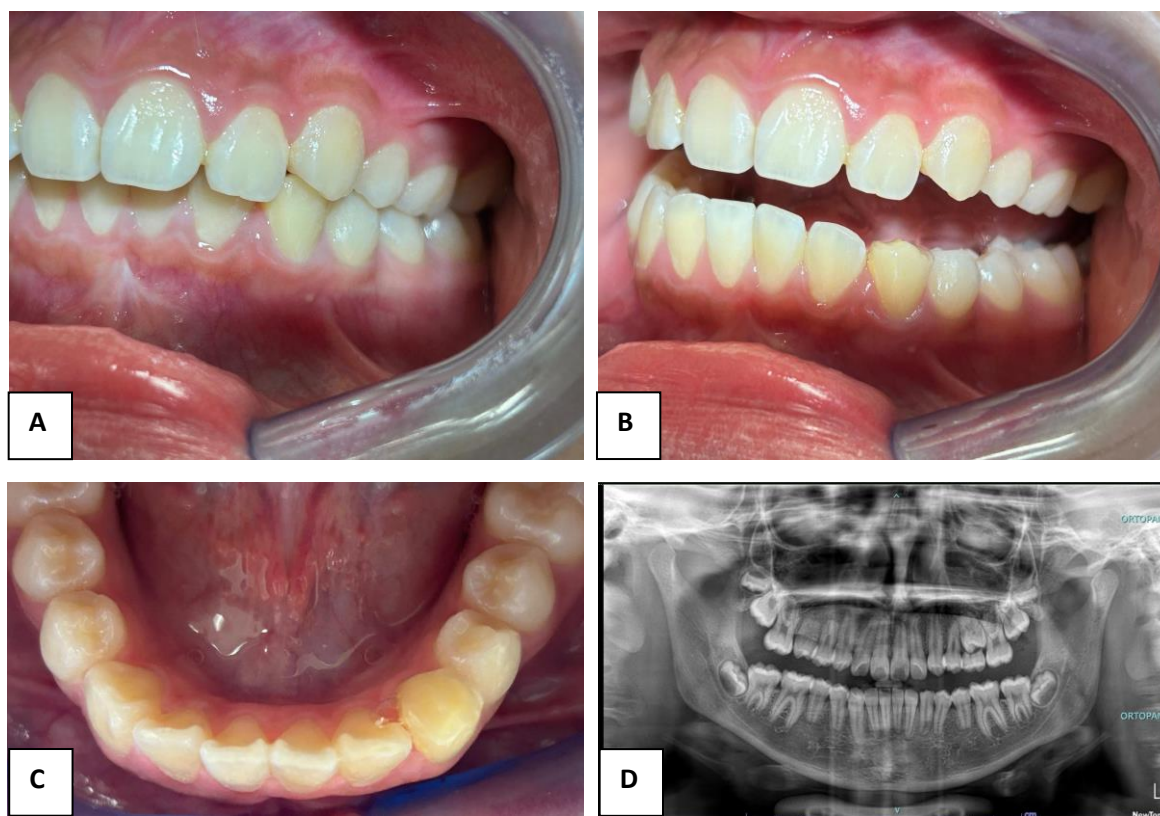


Fig. 5. *Follow-up after 11 months; A): final view of definitive canine; B): definitive canine after transplantation; C): final occlusal picture; D): final orthopantomography;*

Element 33 responded positively to the vitality test. Therefore, it was decided not to perform root canal therapy but to monitor the dental element over time with follow-up every 6/8 months.

However, we know that the pulp tissue very often becomes ischemic after tooth avulsion. If the root apex is large (in our case, more than 1mm), the blood vessels and pulp cells around the apex (within Hertwig's epithelial sheath) proliferate into the pulp cavity in a coronal direction after reimplantation.

Since this proliferation proceeds at a rate of about half a millimeter per day, the pulp cavity fills with viable tissue within a few months of replantation. However, the regenerated pulp tissue rarely functions as before, and what is frequently observed is a progressive obliteration of the pulp canal, due to the rapid deposition of hard tissue (osteodentin). The pulp may respond positively to viability tests in the weeks and months following replantation, but its future is

uncertain (13). Therefore, we decided to monitor vitality every 6/8 months; if this is not maintained or there are signs of root resorption, we will proceed with root canal therapy of the element.

DISCUSSION

Our patient underwent transplantation of a mandibular canine to its normal position. He had a successful outcome after 11 months of follow-up, in terms of meeting the criteria established by Kristerson and Lagerström. However, there was a normal response to electrometric pulp testing, and the patient had normal periodontium, complete root development, and no radiographic signs of external root resorption or a periapical lesion. Recently, there has been an increasing interest in tooth auto-transplantation in Dentistry (13, 14). Systematic reviews have reported high survival rates averaging between 75.3%-91% (15) and 93%-100% (16).

The outcome of autotransplantation was studied extensively, and a strong relationship was found among periodontal healing and the stage of root formation, the status of the pulp, and the length of extra-oral storage (17).

In 1990, Andreasen et al. (18) presented a radiographic study in human beings; their findings indicated that the periodontal healing is normal in 100% of the teeth in root stage 0, normal in 96% of teeth in root stage 2, normal in 70% of teeth in root stage 5, and normal in 55% of teeth in root stage 6. They also showed that periodontal healing could be partial (when the periodontal ligament could be traced partially around the root) or complete.

Partial periodontal healing was found 4 weeks postoperatively. However, the majority of the transplants exhibited complete periodontal healing at 8 weeks postoperatively.

The relationship between pulp vitality and periodontal ligament healing suggested that most teeth with vital pulps had normal periodontal healing. Regarding extraalveolar storage, 97% of the teeth that remained in an extraoral location for 11 to 30 minutes had normal periodontal healing.

In another part of the same study, Andreasen et al. (19) examined the tooth survival and pulpal healing after autotransplantation. Pulp canal obliteration was found in almost all the teeth with a positive response to pulp testing. Only 3 teeth had a positive pulp reaction and no pulp canal obliteration. Furthermore, 90% of the teeth reacted positively to electrometric pulp testing. In 6% of the teeth, a previous positive response became negative.

Tooth auto-transplantation can be considered an alternative oral rehabilitation approach for some clinical situations (especially in young patients). It induces bone formation, and re-establishing a normal alveolar process permits tooth movement to distant or opposite sides of the dental arch or even to the opposite jaw (20). This treatment option may also be valued as a temporary measure in young patients because it replaces missing teeth to keep the ridge volume of bone for at least 5 years, and in case of a failure, an intact area remains a possibility for implantation.

According to Iannidu and Markis (17), transplantation could be the treatment of choice in the edentulous areas of the oral cavity when the following specific criteria are met:

1. age (young patients with half-developed to three-quarter-developed roots);
2. extra-alveolar time less than 30 minutes;
3. minimal splinting;
4. absence of trauma to the periodontal ligament;
5. endodontic treatment in teeth with fully developed roots and a previous transplantation.

CONCLUSIONS

In our case, all the criteria mentioned were respected, with the exception of endodontic treatment, as the root was not yet fully developed, and the element responded positively to vitality tests. After 11 months, we obtained a satisfactory result, although it is still premature to be able to affirm that it was a success due to the short post-operative follow-up.

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