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## Dental autotransplantation

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### Abstract

**Introduction:** Dental autotransplantation is an economical and viable alternative for the replacement of teeth with closed apex. The use of piezoelectric surgery is a beneficial tool and is considered a less invasive technique, ideal for autotransplantation of dental organs.

**Objective:** To analyze the literature on dental autotransplantation using 3D replicas of donor teeth, as well as the prognosis of treatment in teeth with immature apex and complete apex, the use of piezoelectric for the extraction of the donor tooth and the use of tissue regeneration in the transplanted teeth.

**Methodology:** A review was carried out in the databases Scopus, PubMed and Google Scholar with the keywords "tooth autotransplantation", "guided tooth autotransplantation", "mature donor teeth", "3D replica model", "platelet-rich fibrin".

**Results:** The use of a 3D guide helps to know the anatomy and achieves accurate repositioning of the donor tooth, taking care of adjacent structures, reducing surgical time and periodontal ligament damage, to achieve higher long-term survival rates. Transplanted teeth with immature apex have a survival rate of more than 97% and their postoperative recovery is more comfortable, less painful and more bone tissue is preserved. Tissue regeneration contributes to the reduction of postoperative pain, helps healing by reducing inflammation, which increases the success rate of the transplanted teeth, but does not prevent future complications.

**Conclusion:** Dental autotransplantation is a valuable treatment option achieving successful long-term results with multiple advantages.

**Keywords:** Tooth autotransplantation, guided tooth autotransplantation, mature donor teeth, 3D replica model, platelet-rich fibrin

### 1. Introduction

Dental autotransplantation is an economical and viable alternative for the replacement of dental organs helping to maintain dental functionality and harmony, as well as bone preservation in comparison with the usual prosthetic rehabilitation or dental implants <sup>[1]</sup>.

Dental autotransplantation is a surgical procedure performed since the 11th century by Albucasis, it was introduced by Fauchard in 1728 in his book *Le Chirurgien Dentiste* and it was until 1950 when the first publications of cases performed with this technique began, which consists of extracting a tooth from its original position to place it in another area of the dental arch in the same individual <sup>[2-5]</sup>.

The prognosis of this therapeutic option has improved thanks to advances in the understanding of bone, periodontal and pulp healing, as well as technological advances that today are more easily accessible for clinical practice to achieve success rates between 75.3-91% <sup>[6]</sup>.

This technique has been an option in the face of tooth loss due to various causes, such as trauma, root fractures, periodontal disease, caries, perforations, failed endodontic treatments, among others, and has been ignored by clinicians for decades, since there are many factors that can influence the prognosis of this treatment <sup>[7, 8]</sup>.

Among the factors to be taken into account for success are that the periodontal ligament of the donor tooth is intact, the degree of maturity of the dental organ, the extraoral time, the experience of the operator and the use and knowledge of all the necessary technological tools such as cone beam computed tomography (CBCT) and intraoral scanner to make 3D guides and replicas to obtain a simpler and more predictable procedure<sup>[9]</sup>.

Nowadays there is no adequate justification about the benefits obtained from performing dental autotransplantation with advanced technology in combination with the use of tissue regeneration, therefore the aim is to analyze the literature about dental autotransplantation using 3D replicas of donor teeth, as well as the prognosis of the treatment in teeth with immature apex and complete apex, use of piezoelectric for the extraction of the donor tooth and use of tissue regeneration in transplanted teeth.

## 2. Materials and Methods

Articles on the subject published through PubMed, SCOPUS and Google Scholar databases were analyzed, with emphasis on the last 5 years. The quality of the articles was assessed using guidelines, i.e., identification, review, choice, and inclusion.

The quality of the reviews was assessed using the measurement tool for evaluating systematic reviews. The search was performed using the Boolean logical operators AND, OR and NOT; with the keywords: "tooth autotransplantation", "guided tooth autotransplantation", "mature donor teeth", "3D replica model", "platelet-rich fibrin". The keywords were used individually, as well as each of them related to each other.

## 3. Results and Discussion

### 3.1 3D guide

Compared to traditional dental autotransplantation, the introduction of CAD (Computer-Aided Design) software combined with 3D printing of the model tooth and surgical guides obviously shortens the preparation time of the alveolus and the extra-alveolar time of the donor tooth, thus reducing the number of trials in the surgical procedure regardless of the deviation in shape between the model and the real teeth, making the technique more precise, it also ensures atraumatic and predictable surgery for both the clinician and the patient and reduces the risk of iatrogenic damage<sup>[10-17]</sup>.

The use of a 3D guide made by intraoral scanning and planned with CBCT helps to know the anatomy and achieves accurate repositioning of the donor tooth, taking care of adjacent structures, reducing surgical time and periodontal ligament damage, thus achieving a more predictable procedure with higher long-term survival rates.

### 3.2 Prognosis: Open apex vs. closed apex

Dental autotransplantation can be considered a valid and reliable procedure to replace missing teeth when indications and protocols are strictly followed, presenting high survival and success rates<sup>[18, 19]</sup>. The key to the success of this technique is the surgical procedure, which should be as atraumatic as possible to preserve the periodontal ligament of the tooth to be transplanted. This rate is linked to the stage of root development, splint fixation and a periodontal probing depth of less than 4 mm after the initial healing period<sup>[20, 21]</sup>. Open apex donor teeth could be considered the gold standard with a described survival rate at 2-year follow-up of greater than 97%, as they show lower complication rates (<5%)

compared to closed apex donor teeth<sup>[22-25]</sup>. With increased awareness and acceptance in the dental profession, autotransplantation will become another viable treatment option for those compromised teeth that still have significant growth potential<sup>[26]</sup>.

Transplanted teeth with immature apex have a survival rate higher than 97% compared to teeth with closed apex, so it is advisable to perform this procedure at an early stage.

### 3.3 Piezosurgery

Piezosurgery is a safe way to perform osteotomies during donor tooth surgery and is considered an alternative technique to conventional rotary systems<sup>[27, 28]</sup>. The main advantages of piezosurgery include soft tissue protection, optimal visibility in the surgical field, decreased blood loss, less vibration and noise, increased patient comfort and protection of tooth structures, reduced postoperative pain, trismus, swelling and the total number of analgesics taken compared to the conventional technique with rotary instrument<sup>[29, 30]</sup>. In addition, it can play an important role in increasing bone density within the extraction socket and decreasing the amount of bone loss from the adjacent tooth, but requires a longer surgery time<sup>[31-33]</sup>. The beneficial postoperative signs and symptoms make ultrasonic surgery a favorable therapeutic option, especially when the integrity of noble anatomic structures is the most important risk factor<sup>[33]</sup>.

The use of piezoelectric results in a beneficial tool being considered a less invasive technique thus reducing the damage to the periodontal ligament at the time of extraction of the donor tooth and leading to a more comfortable, less painful postoperative recovery and preservation of more bone tissue.

### 3.4 Tissue Regeneration

Concentrating growth factor (CGF) helps to reduce postoperative pain and reaction in the early stage of healing and increases the success rate of autogenous tooth transplantation<sup>[34]</sup>. Platelet-rich fibrin (PRF) can induce accelerated and sustainable healing, and can also induce the regeneration process of periodontal tissues and pulp formation, as well as reduce some of the postoperative complications such as pain and swelling<sup>[35-37]</sup>. Platelet-rich plasma (PRP) shows excellent results in promoting root and neurosensory development<sup>[38]</sup>. Platelet- and leukocyte-rich fibrin (L-PRF) promote wound healing processes and angiogenesis. The use of L-PRF in donor sites can enhance the natural revascularization process of transplanted teeth and allows better control of pain and edema compared to the use of standard PRF protocols<sup>[39, 40]</sup>.

There is no clinical difference as to which tissue regeneration method to employ, because all methods contribute to the reduction of postoperative pain, aid healing by reducing inflammation which increases the success rate of transplanted teeth but do not prevent future complications.

## 4. Conclusion

Dental autotransplantation is a valuable treatment option that achieves successful long-term results with multiple advantages and that with the help of new tools such as 3D prototype printing, piezoelectric and tissue regeneration, will optimize the treatment, making it more predictable and more comfortable for the patient, as long as the protocols are followed and the specialist is clear about the prognostic factors that make this technique the best therapeutic alternative.

#### 4.1 Conflict of Interest

Not available

#### 4.2 Financial Support

Not available

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