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A Review On Autotransplantation Of Tooth

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Abstract

Tooth autotransplantation, the surgical relocation of a tooth from one site to another within the same individual, is a biologically sound and effective treatment for tooth replacement, especially in young patients. This procedure offers significant advantages, including the preservation of alveolar bone, natural aesthetics, and the maintenance of proprioception. Success depends on key factors: selecting a donor tooth with incomplete root formation, meticulous surgical handling to preserve the periodontal ligament (PDL), and minimizing extraoral time. Technological advancements like cone-beam computed tomography (CBCT) and 3D-printed replicas have refined preoperative planning and surgical execution, reducing trauma and improving outcomes. Reported success rates range from 75% to over 95% with proper technique. While potential complications exist, autotransplantation remains a predictable and cost-effective alternative to conventional prosthetic options and implants, offering a natural and functional solution for missing teeth.

Keywords: Autotransplantation; Periodontal ligament; Tooth replacement; Pulp revascularization; Dental surgery

Introduction

Tooth autotransplantation, defined as the surgical relocation of a tooth from one site to another within the same individual, has emerged as an important biologically based treatment modality for tooth replacement, particularly in young patients where conventional prosthetic options and dental implants are often contraindicated due to ongoing craniofacial growth. Unlike artificial replacements, autotransplanted teeth integrate naturally into the alveolar bone, maintain periodontal ligament vitality, and preserve proprioceptive function, offering both functional and esthetic rehabilitation.[1] The procedure is indicated in a wide range of clinical scenarios, including traumatic loss of anterior teeth, agenesis such as congenitally missing premolars or lateral incisors, teeth with extensive caries or root resorption, and orthodontic space management where premolars or third molars serve as donor teeth. Its success depends on careful donor tooth selection, with incomplete root formation (approximately two-thirds to three-quarters complete) providing the highest potential for pulp revascularization and continued root development, as well as meticulous surgical handling to preserve the periodontal ligament and minimize extraoral time.[2] Biological processes such as alveolar

bone remodeling, periodontal healing, and pulpal regeneration further contribute to long-term stability and integration of the transplanted tooth. Over the years, refinements in surgical protocols and advances in imaging technologies, particularly cone-beam computed tomography (CBCT), have improved preoperative planning and recipient site preparation.[3] Additionally, innovations such as three-dimensional (3D) prototyping and printed donor tooth replicas have minimized surgical trauma and extraoral handling, thereby enhancing survival rates. Reported success rates for autotransplantation range from 75% to over 95% when appropriate case selection and technique are followed, highlighting its reliability as a cost-effective, biologically sound, and patient-centered solution. As a result, tooth autotransplantation has gained renewed interest in contemporary dentistry, bridging the gap between traditional prosthodontics and modern regenerative approaches by combining natural tooth biology with digital surgical precision.[4] This article gives an overview on autotransplantation of tooth.

Essential Clinical Considerations in Tooth Autotransplantation

The success of tooth autotransplantation largely depends on several critical biological and clinical factors. The viability of the periodontal ligament (PDL) is paramount, as it supports healing and ensures long-term stability of the transplanted tooth . Donor teeth with immature apices demonstrate superior outcomes, with survival rates exceeding 97%, owing to their capacity for pulp revascularization and continued root development. Equally important is the surgical approach: techniques such as piezoelectric surgery and the use of 3D prototyping have been shown to minimize trauma to both the donor tooth and recipient site, improving predictability and reducing complications.[5] Donor selection typically favors teeth morphologically similar to those in the recipient quadrant, with upper third molars often used to replace lower molars. To preserve PDL integrity, atraumatic extraction is crucial, and the donor tooth should ideally be placed in a biocompatible medium such as milk, Hank's Balanced Salt Solution (HBSS), or saline, with milk being widely regarded as the most practical and cost-effective option for maintaining PDL viability. Recipient site preparation should precede donor extraction to minimize extraoral time, and modifications such as removal of the intraalveolar septum may be required to seat multirooted teeth. Throughout the procedure, copious saline irrigation is recommended to prevent thermal injury during socket adjustments.[6] Stabilization of the transplanted tooth, usually in an infraocclusal position, is achieved using splints, wires, or composite fixtures to avoid occlusal trauma, with periodic monitoring to prevent drifting. Patient selection also plays a vital role candidates must be systemically healthy with good oral hygiene, while donor teeth should ideally exhibit incomplete root formation with an open apex (>1 mm) to favor regeneration. Nonetheless, even fully developed donor teeth can yield predictable outcomes when handled with minimal trauma.[7] Adherence to the principle of reducing extra-alveolar time, preserving Hertwig's epithelial root sheath, and ensuring optimal surgical planning now enhanced by cone-beam computed tomography (CBCT) and 3D modelling further contributes to the high success and long-term prognosis of this biologically sound treatment modality.[8]

Eligibility and Prognosis in Tooth Autotransplantation

Autotransplantation is a valuable treatment modality primarily indicated in cases of traumatic tooth loss, congenital agenesis, ectopic tooth eruption, developmental anomalies such as cleidocranial dysplasia and tooth aplasia, and when orthodontic space closure is impractical or unpredictable. It is particularly beneficial in young patients where implants are contraindicated due to ongoing craniofacial growth, offering a natural and biologically integrated replacement option. Ideal candidates are healthy individuals with good oral hygiene and motivation, while donor teeth with incomplete root formation and wide apices are preferred due to their greater potential for pulp revascularization, periodontal ligament (PDL) healing, and continued root maturation.[9] Studies have reported survival rates exceeding 90% when optimal case selection, surgical expertise, and postoperative care are ensured, with CBCT and 3D modeling further improving accuracy and reducing extraoral time. Multidisciplinary involvement of orthodontists, pediatric dentists, oral surgeons, and restorative dentists enhances outcomes and ensures comprehensive care. Prognosis is strongly influenced by PDL vitality, root development stage, alveolar bone support, and atraumatic handling of the donor tooth.[10] Contraindications include systemic conditions such as cardiac abnormalities, poor oral hygiene, lack of patient compliance, insufficient soft tissue or alveolar bone volume, and the presence of active infection at the recipient site. If alveolar bone resorption occurs, or if transplantation is delayed

beyond two months, the success rate may be compromised. While autotransplantation can offer outcomes comparable to implants, potential complications include root resorption, ankylosis, pulp necrosis, and the need for adjunctive orthodontic or endodontic interventions. Nevertheless, when proper protocols are followed such as maintaining infraocclusal positioning, minimizing extra-alveolar time, and ensuring early stabilization autotransplantation remains a predictable, cost-effective, and biologically favorable treatment option, especially in growing patients.[11]

Step-by-Step Surgical Procedure for Tooth Autotransplantation

The surgical procedure for tooth autotransplantation involves meticulous planning and execution to ensure periodontal ligament (PDL) preservation and long-term success. The process begins with the creation of a replica of the donor tooth, generated from CBCT-based DICOM data, which allows for precise socket preparation while minimizing mechanical trauma to the PDL. After disinfecting the surgical field, local anesthesia is administered to both donor and recipient sites. In immediate autotransplantation, the non-restorable recipient tooth is extracted first, with careful removal of granulation tissue in case of periapical lesions while avoiding unnecessary curettage of the socket.[12] In delayed cases, extraction is carried out 3–4 weeks prior to transplantation to allow initial healing but should not be delayed beyond 2 months to prevent alveolar ridge resorption. A gingival sulcus incision is then made, and a flap is elevated to expose the alveolar ridge, followed by preparation of the recipient socket using a surgical round bur and implant drill under copious saline irrigation at approximately 2000 rpm. A replica of the donor tooth is tried in the socket to assess the fit and necessary adjustments are made by selectively enlarging or reshaping the socket, ensuring no damage to adjacent anatomical structures such as the mandibular canal or maxillary sinus. Occlusal adjustment is generally avoided in immature teeth to preserve pulp vitality, with the transplanted tooth positioned deeper to negate the need for grinding.[13] Once the recipient site is prepared, the donor tooth is carefully extracted, either directly or by raising a flap in case of impaction, ensuring maximum PDL attachment preservation. After extraction, the donor tooth is temporarily placed in the recipient socket and radiographically verified for adaptation. The transplant is then removed and preserved in saline or the original socket while gingival flaps are sutured, ensuring tight adaptation. The tooth is reinserted, and cross or crisscross sutures are applied for stabilization, with donor site flaps also sutured. Postoperative care includes wound dressing, antibiotics for 3 days, and chlorhexidine rinses to prevent infection during early healing. Sutures and dressings are removed after 7 days, and in cases of mobility, additional fixation with wire and resin may be required, typically removed after 1 month but extended if significant bone defects persist.[14] Follow-up is critical, with monthly radiographs during the first 3 months to monitor for resorption, followed by recalls at 6 months, 1 year, and annually thereafter. In immature teeth, favorable outcomes such as pulp revascularization, canal obliteration, and continued root development are expected, with positive electric pulp testing (EPT) responses typically observed within 6–12 months.[15]

Healing, Advantages, and Complications of Tooth Autotransplantation

The healing process in tooth autotransplantation primarily involves the recovery of the periodontal ligament (PDL) and surrounding bone. PDL cells are highly sensitive and may be damaged mechanically during extraction or biochemically due to unfavorable conditions such as dehydration, pH shifts, or osmotic stress. Successful healing is more predictable when donor teeth are extracted atraumatically and preserved in optimal storage media before transplantation. Immediate reimplantation into a fresh recipient socket, similar to reimplanting an avulsed tooth, yields favorable PDL recovery, while healing in artificially prepared sockets is less predictable though still possible due to progenitor cells in the socket walls. Bone healing occurs rapidly through bone induction, with new lamina dura formation around the transplanted tooth, typically without the need for grafts, making autotransplantation advantageous compared to implants.[16] The technique offers several benefits, including cost-effectiveness, preservation of alveolar bone, maintenance of proprioception, natural aesthetics, and the ability of transplanted teeth to continue eruption and respond to orthodontic forces. Additionally, donor teeth are inherently biocompatible, eliminating rejection risks and reducing the complexity of treatment compared to prosthetic or implant-based solutions.[17] However, potential complications must be carefully considered, as issues such as ankylosis, infection, root resorption, inadequate root growth, periodontal breakdown, bite discrepancies, or the need for additional endodontic or orthodontic interventions can compromise outcomes. While the advantages of autotransplantation such as

preservation of normal oral function, bone integrity, and aesthetics—are substantial, the disadvantages, including susceptibility to root resorption, risk of ankylosis, dependency on oral hygiene, and the need for possible secondary treatments, highlight the importance of careful case selection, meticulous surgical execution, and diligent follow-up for long-term success.[18]

Technological Advancements in Autotransplantation

Autogenous tooth transplantation, involving the relocation of a tooth within the same individual, has emerged as an effective treatment for severe cases of ectopic eruption that might otherwise require extraction. Recent technological innovations, particularly in 3D additive manufacturing, have significantly enhanced the predictability and efficiency of this procedure.[19] By creating a surgical replica of the donor tooth, clinicians can pre-shape the recipient socket with precision, thereby minimizing mechanical trauma and reducing the tooth's extraoral time a critical factor for preserving the vitality of the periodontal ligament. Additionally, 3D prototyping facilitates meticulous preoperative planning, while guided surgical techniques enable accurate placement of the donor tooth, protecting adjacent anatomical structures and improving overall success rates. These advancements collectively streamline the transplantation process, enhance clinical outcomes, and contribute to the long-term stability and functionality of the transplanted tooth.[20]

Conclusion

Autotransplantation is a highly predictable and effective treatment for replacing missing teeth, particularly in young patients where growth considerations limit the use of dental implants. With careful case selection, meticulous planning, and precise surgical execution, this procedure can achieve excellent long-term functional and aesthetic outcomes. Despite being underutilized in favor of conventional treatments such as implants or bridges, autotransplantation offers distinct advantages, including preservation of natural tooth structures, maintenance of alveolar bone, and the potential for continued eruption and orthodontic movement. Its high success rates and biological compatibility make it a valuable and viable option in appropriately selected clinical scenarios.

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