Review Article

Autogenous transplantation of teeth – A literature review
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Abstract
Autotransplantation has been long looked past, as clinicians have chosen implants and other fixed prostheses for restorative treatment. It gives the practitioner as well as the patient a chance to replace their unsalvageable teeth with their very own donor tooth. The process is demanding and requires skill to select the appropriate case and formulate a treatment plan to carry it out successfully. The present article aims to provide an overview of autogenous transplantation, criteria for case selection, indications, contraindications, the surgical procedure, and their success rate.

Introduction
Autogenous transplantation suggests the surgical transfer of a tooth or a tooth bud from one socket to another in the same individual. The tooth may be vital or endodontically treated.[1] The donor tooth could be impacted, embedded, or fully erupted tooth. The recipient socket may be surgically prepared.[2] The most common scenario for autotransplantation in the published literature includes dental caries involving the unsalvageable mandibular first molar, which is replaced by a mandibular 3rd molar.[2] Other indications may include traumatic loss of teeth, congenitally missing teeth, and extensive carious lesions that cannot be restored, chronic infections, severe periodontal disease, and developmental anomalies such as anodontia, regional odontodysplasia, and cleidocranial dysplasia.[3]

History of tooth transplantation is reported back to the ancient Egyptians, where the slaves had to give their teeth forcibly to the Pharaohs.[4] In wars, like the Napoleonic war, the soldiers had to give their teeth to the officers who lost their teeth in the battle.[5] In 1772, John hunter reported a successful tooth allotransplantation in a gentleman in London. In 1883, Stack stated that transplants should be done for people who cannot afford a prosthesis.[5]

Successfully transplanted teeth have proven to function just like normal teeth. It has been known to maintain the alveolar bone volume by stimulating the periodontal ligament (PDL). It serves the patient with better mastication by providing proprioception during function, unlike a fixed, or removable prosthesis. Financially, costs lesser compared to restorative or orthodontic treatment options. Last but not least, it offers improved facial esthetics, arch form and integrity, speech, and overall dentofacial development.[6]

Case Selection
The sequence to be followed for autotransplantation:[5]
1. Clinical and radiographic examination
2. Diagnosis and treatment planning
3. Surgical procedure
4. Endodontic-orthodontic-restorative treatment
5. Follow up.

Key Factors for Successful Autotransplantation
General factors
1. Healthy patient with good oral hygiene
2. Patient cooperation and understanding the value of treatment
3. Regular follow-up as per the dentist’s instructions.

Local factors
1. The recipient alveolar socket should have adequate bone support.
2. Should be free of any inflammation or chronic infection
3. The anatomic shape of the donor’s tooth should match with the recipient site
4. Atraumatic extraction of the donor’s tooth
5. Teeth having open or closed apices\(^7\)

**Teeth with closed apices**
They require root canal treatment after the transplantation and may be done before the removal of splint.\(^8,9\)

**Teeth with open apices**
The best prognosis is for teeth which are between half and 2/3rd root completion stage. Root end closure occurs physiologically with no requirement of root canal treatment.

**Clinical Conditions in which Autotransplantation Can be a Treatment of Choice**
- Loss of tooth due to caries: Most commonly encountered with mandibular 1\(^{st}\) molar. Third molars can be considered for replacement.\(^10\)
- The traumatic loss of teeth: Most frequently involves maxillary incisors. Autotransplantation with mandibular 2\(^{nd}\) premolar was reported by Zachrisson to the maxillary anterior region.\(^11\)
- Ectopic canines: In severely ectopic canines, autogenous transplantation can provide a fast, economical, and reliable treatment in some cases where it is difficult to perform surgical exposure and orthodontic extrusion.\(^12\)
- Congenitally missing teeth in one arch and crowding in the opposing arch: To correct crowding or reduction of overjet in the maxilla, extracted maxillary premolar can be transplanted to the mandibular 2\(^{nd}\) premolar site.\(^13\)
- In cleft lip and palate patients: As it preserves the alveolar bone volume and induces bone formation during pubertal stages of the individual. Comparatively, it has better clinical predictability compared to other treatment options.\(^2\)

**Contraindications**
- Patients having poor oral hygiene.\(^14\)
- Patients with cardiac anomalies.\(^3\)
- Inadequate buccolingual or buccopalatal bone width at the recipient site as this might cause resorption of the alveolar ridge.\(^15\)
- The patient lacking motivation to follow-up.\(^3\)

**Surgical Procedure**
The sequence of surgical procedure:
1. Pre-operative administration of antibiotics before surgery.
2. The surgical site is disinfected and anesthetized.
3. The tooth at the recipient site is extracted first.
4. The donor tooth is extracted next and is clinically examined for its anatomical shape, form, and the condition of the PDL.
5. The tooth is extracted as atraumatically as possible. Before luxating, an intra clavicular incision is made to preserve as much PDL on the root side as possible. Hanks balanced salt solution is used to store the tooth to maintain the viability of the cells of PDL if any extraoral time is expected. Water is contraindicated for use as its hypotonicity will lead to damage of PDL cells.
6. Donor’s tooth is measured mesiodistally for its width of crown and root. Root length is measured.
7. Using surgical round burs at low speed accompanied by saline, the recipient socket is prepared slightly larger than the donor tooth size.
8. The donor’s tooth is attempted to be placed in the recipient socket intermittently using light pressure with the try-in and adjustment method. Obstacles from the socket wall are removed as and when encountered.
9. The gingival flap should be tightly closed using sutures. This aids in re-attachment and prevents entry of bacteria between the bony socket and tooth, where the clot is forming.
10. It is recommended to suture before placement of the donor’s tooth as this helps in achieving closer and tighter adaptation between the gingival flap and donor’s tooth. The flap may need trimming in some cases.
11. As tight adaptation is desired, the gingival opening must be slightly narrower than the mesiodistal width of the tooth.
12. Based on the stability achieved, splinting with wire and adhesive resin is considered if enough stability is not achieved with suture splinting.
13. Occlusal adjustment is done by reducing occlusal contact extraorally before positioning the donor tooth without damaging the PDL. It can also be done intraorally before the extraction of the donor’s tooth. If the wire splint is to be used, then the occlusal adjustment is done after placing the splint.
14. The radiograph is taken pre-operative, before and after positioning of donor’s tooth in its new socket to evaluate its position.
15. A periodontal pack is placed for 2–3 days to assist in healing. It is removed 4–5 days after the surgery along with the sutures.\(^2,16\)

**Post-operative**
- The patient is given oral hygiene measures and dietary instructions. The patient is recalled post 7-10 days for suture removal.\(^17\)
- Radiographic post-operative evaluation and cone-beam computed tomography are also advocated to evaluate PDL and root surface.\(^18\)
- Pulpal perfusion is assessed using dental magnetic resonance imaging along with the administration of a contrast agent.\(^19\)
- Laser Doppler flowmetry is a non-invasive and painless method used to assess revascularization and monitor pulpal response of transplanted teeth.\(^20\)
Advantages
- Maintenance of alveolar bone volume and gingival margin allowing the teeth to erupt with their surrounding dentition
- Autotransplanted teeth can be moved orthodontically
- No requirement to prepare adjacent teeth (as in conventional bridge)
- Cost-effective (as compared to implants)
- Even in cases where healing of the transplant is unfavorable, leading to ankylosis, the bone level is maintained, giving an option of implant later on..

Disadvantages
- Technique sensitive
- Possibility of resorption and loss of tooth
- Requires a multidisciplinary team to provide treatment
- Requires commitment from the patient for regular follow-up.

Criteria for Success
Autotransplantation case is termed as successful when:
- Normal healing takes place, without inflammatory resorption
- The tooth is firm in the socket
- No pain on mastication
- Radiographically, normal lamina dura with no evidence of root resorption
- Minimal inflammatory resorption may be noted after 3–4 weeks, which is considered to be normal.

Success Rates
A study by Bae showed an 84% success rate with closed apex and root canal treatment. Another study by Sugai found a success rate of 96% post 1 year, and 84% success rate 5 years follow up.

In contrast, Schwartz achieved a success rate of only 76.2% post 5 years and 59.6% on a 10 year follow up.

In 416 autotransplanted teeth, a success rate of 72% was found by Pogrel.

Conclusion
Surgical autotransplantation of teeth is rewarding for both the dentist as well as the patient. With the appropriate patient selection and the right methodology, it can be carried out successfully. It is extremely important to understand the histological aspects and preserve the cells of PDL to improve the prognosis of the treatment. It is safe, economical, and a viable option to preserve the alveolar bone and maintain the attached gingiva in its natural shape.

References