AUTOTRANSPLANTATION OF TOOTH IN MIXED DENTITION—A REVIEW

Abu-Hussein Muhamad, Abdulgani Azzaldeen

ABSTRACT

Autotransplantation involves the transfer of teeth from one site to another in the same individual. Even though the indications for autotransplantation are limited, adhering to proper patient selection and surgical techniques bring good prognosis and can avoid the placement of an implant-supported prosthesis or other form of prosthetic tooth replacement. This paper reviews the recommended surgical techniques as well as the associated success rates of autotransplantation in the mixed dentition.

Keywords: Auto transplantation; Children; Mixed Dentition; clinical indications; healing factors; cryopreservation

Introduction

Autotransplantation involves the transfer of teeth from one site to another in the same individual. If the procedure is done with a full understanding of the applicable biological principles and if the proper clinical techniques are used, it can be very successful. Autotransplantation of teeth ensures maintenance of alveolar bone volume by physiological stimulation of the periodontal ligament (PDL). High initial success rates and also long-term results are reported. Autotransplantation is an underutilized technique which, when used within a multidisciplinary team, can offer an ideal treatment option for child or adolescent patients with missing or failing anterior teeth. This paper reviews the recommended surgical techniques as well as the associated success rates of autotransplantation in the mixed dentition.

History: Autogenous tooth transplantation was first well documented in 1954 by M.L. Hale. The major principles of his technique are still followed today. Successful autotransplantation of immature mandibular third molars was reported by Fong as early as 1953. A method for autotransplantation of immature premolars was described in 1967 and 1974 by Slagsvold and Bjercke. Autotransplantation involves the transfer of embedded, impacted, or erupted teeth from one site to another in the same individual into extraction sites or surgically prepared sockets. It can be thought of as a controlled avulsion and re-implantation of a tooth in a new, surgically prepared socket.

The mixed dentition: It is the developmental period after the permanent first molars and incisors have erupted, and before the remaining deciduous teeth are lost. Treatment is usually done early in this period. The American Association of Orthodontists recommends all children should see an orthodontist by age seven. A favorably developing occlusion at this stage has these characteristics. Many dental development problems can be headed off in the mixed dentition; for example, anterior cross bites. In-time removal of a deciduous tooth could prevent a cross bite, but once the permanent upper incisor is caught on the lingual of the lower incisors, treatment is needed. The anterior cross bite can cause tissue damage around the affected lower incisor. Another example is the displaced lower midline as a result of the early loss of a lower deciduous canine. Mixed dentition treatment goals often focus on skeletal rather than dental correction. To design a treatment plan, the clinician must understand the growth and development patterns, and the known effects of the chosen treatment modality.

Advantages: Successful tooth transplantation offers improved esthetics, arch form, dentofacial development, mastication, speech, and arch integrity. The autotransplanted natural tooth has the capacity for functional adaptation and preservation of the alveolar ridge, which is advantageous when compared to a prosthesis or an ossointegrated implants that are stationary and do not erupt to compensate for further growth. This is an important consideration when dealing with missing teeth, whether congenital or acquired, in orthodontics of young patient.

Indications: The one of the main indications for performing auto transplantation in children include tooth loss due to dental caries i.e., mandibular first molars are concerned. First molars erupt early and are often restored. Auto transplantation in this situation involves the removal of a third molar, which may then be transferred to the site of an non-restorable first molar. Autotransplantation can be considered during tooth agenesis (particularly of premolars and lateral incisors), shock tooth loss, atopic outbreak of canines, root resorption, large endodontic lesions, cervical root fractures, localized juvenile periodontitis, trauma, intrusion of teeth as well as other pathologies.

Prognosis: Successful transplantation depends on specific requirements of the patient, the donor tooth, and the recipient site. Successful factors of the transplantation of teeth will be the healing of the PDL, no progressive root resorption, healing of gingival tissue and alveolar bone, and healing of the pulp and continuation of root development. A success rate of 82% was reported by Kristerson and Lagerstro¨m for transplantation to the upper incisor region, and Kugelberg et al. also achieved favorable results: 96% of immature premolars and 82% of mature premolars transplanted to the maxillary inci-
Autotransplantation of tooth in mixed dentition- A review.

Donor Site: A tooth with total or near complete root configuration will usually require root canal therapy, while a tooth with an open apex will remain vital and should carry on root development after transplantation.15,22

Recipient site: The recipient site should be free from acute disease and chronic irritation and must have enough alveolar bone support in all dimensions with sufficient attached keratinized tissue to allow for stabilization of the transplanted tooth.13,22

Surgical procedure: Pre-operative administration of antibiotics is recommended a few hours before surgery. Following disinfection and anesthesia of the surgical sites extraction of tooth at the recipient site is advised. In case of immediate transplantation, the tooth to be extracted in the recipient site should be extracted before the donor tooth. Before preparing the recipient socket, the donor tooth should be extracted and examined for anatomical form, size and PDL condition. Care must be taken not to damage the PDL. An intra-crevicular incision is made before luxation to preserve as much PDL on the root as possible and the donor is extracted slowly and atraumatically as possible. The donor tooth should be placed back in its original socket after it is removed and waiting to be placed in the donor socket. If any extra-oral time is anticipated, the tooth should be stored in a storage medium like Hank's balanced salt solution that will maintain the viability of the periodontal ligament cells.24

The mesio-distal width of the root and crown and the length of the root of the donor are measured. The recipient socket is prepared a little larger than the donor using surgical round bars at low speed and cooling with saline. Attempting to place the tooth into the socket with light pressure periodically checks the match between the recipient and the donor sites. Obstacles in the socket wall are removed as encountered. The optimal placement of the donor to the recipient is to establish the biologic width similar to that of a naturally erupted tooth. Deep placement to a position below the occlusal level is recommended into the socket is recommended in every case. Splinting by means of sutures is then performed. If the transplant is not stable after suture splinting or if much more occlusal adjustment is necessary, splinting is changed to one with wire and adhesive resin. If the transplant is not stable but no occlusal adjustment is needed, splinting with wire and resin can be delayed for 2 or 3 days after suture splinting because the former is time consuming and bleeding during the surgical procedure makes optimal results difficult. The occlusion must be checked to ensure that no occlusal interference is present. If a suture is used for stabilization, ideally the occlusal contact should be reduced extra-orally prior to positioning of the donor, taking care not to damage the PDL. It could also be performed intraorally before the extraction of the donor. If a wire splint is used, occlusal adjustment can be done after placing the splint. Occlusal adjustment should be conservative, since a composite restoration will be needed after healing to adjust the occlusion and/or esthetic appearance of the crown of the tooth. A radiograph is taken preoperatively, before and after splinting to evaluate the position of the donor tooth in the new socket. Surgical dressing (periodontal packing) is applied to protect the transplant against infection during the first 2–3 days in the wound healing. This dressing is removed at about 3–4 days post surgery. The sutures are removed 4–5 days after the surgery.24

In some cases auto transplantation may not be possible as a one-stage procedure. Two-stage transplantation has been reported in which an ectopic canine was removed and initially stored in the buccal pouch whilst the recipient site was orthodontically reopened. The potential problem of resorption of the transplanted tooth is minimized if contact between the tooth and periosteum is avoided during storage. In some situations, there may be resorption of the alveolar ridge at the recipient site with insufficient bucco-palatal width to accommodate the transplant. In such cases, specialized investigative techniques (e.g. Scanora, CT tomography) may need to be carried out to ascertain the amount of bone present bucco-palatally. Alveolar bone grafting of the recipient site may be required prior to transplantation.6,27-31

Tooth Cryopreservation: When it is not possible to transplant the tooth immediately, tooth has to be saved to be use later. The cryopreservation of teeth is a promising and alternative choice for the replacement of the missing teeth. Cryopreservation is a process where cells or whole tissues are preserved by cooling to low sub-zero temperatures, such as (typically) 77 K or −196°C (the boiling point of liquid nitrogen). At these low temperatures, any biological activity, including the biochemical reactions that would lead to cell death, is effectively stopped.29 Traumatic injuries in children are increasing at an alarming rate. Avulsion is the most common traumatic injury, which is observed in young growing children. Usually, teeth that are in the developing stages, where less than 1/3rd or 2/3rd of the root is formed are avulsed easily. Due to severe injury, the surrounding tissues may also be damaged and this may prevent the tooth from undergoing replantation. The cryopreservation of such immature teeth, which can be used at a later date, may be a new promising treatment. This may also prevent the rejection of the graft. Cryopreserved teeth...
can also be transplanted in growing children, as the differentiating capacity of the PDL cells can induce the growth of the alveolar bone. The infra occlusion that can be observed when the implant is placed in a growing child can be prevented by transplanting cryopreserved teeth especially in adolescents.12

Factors affecting the success rate: An atraumatic technique and minimal handling of the transplant to preserve an intact periodontal ligament and Hertwig’s root sheath are important considerations. Minimizing the time the tooth is out of the mouth during transplantation is also required for a successful tooth transplant. Availability of sufficient buccolingual width to accommodate the transplant in the recipient site improves the success rate. Adequate immobilization of the transplanted tooth usually requires only a tight suture. The immobilization period can vary from 2 weeks up to 2 months, according to the mobility of the transplant. Orthodontic forces should not be applied to a transplanted tooth during the first 3 to 6 months and, when force is initiated, its amount and duration should be minimized. Successful periodontal healing, which is completed within 2 months in most cases,3-6 is marked by the absence of root resorption and the presence of a lamina dura.18

Reasons for Failure: The causes of failure of the autotransplant is chronic root resorption, inflammatory resorption, replacement resorption i.e., ankylosis, marginal periodontitis, apical periodontitis, caries, and trauma.13 Inflammatory resorption may become evident after 3 or 4 weeks, while replacement resorption may not become evident until 3 or 4 months after transplantation.15

Precautions for Failure: The incidence of both types of resorption can be decreased with atraumatic extraction of the donor tooth and immediate transfer to the recipient site to minimize the risk of injury to the periodontal ligament.15,34

Conclusion
In conclusion with proper patient selection, and presence of a suitable donor tooth and recipient site, autotransplantation should be considered as a viable option for treatment of an edentulous space.

Authors Affiliations
1. Abu-Hussein Muhammad DDS,MScD,MSc,DPhD,FICD, Department of Pediatric Dentistry, Athens University, Athens, Greece. 2. Abdulgani Azzaldeen DDS Ph.D., Faculty of Dentistry, Beit Hanina, Jerusalem, Palestine.

References


How to cite this article

Address for Correspondence
Dr. Abu-Hussein Muhamad DDS,MScD,MSc,DPD,FICD, Department of Pediatric Dentistry Athens University, Athens, Greece.
Email: abuhusseinmuhamad@gmail.com

Source of Support: Nil
Conflict of Interest: None Declared