Autotransplantation of a mandibular third molar, using a customized reservoir

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Abstract

Autogenous transplantation is a fast and economical option when a suitable donor tooth is available for the replacement of nonsalvageable teeth. The preservation of the periodontal ligament (PDL) cells is considered to be critical for the success of a transplanted tooth. This article presents a successful case report of autotransplantation of a mandibular third molar using a novel technique to store the donor tooth extraorally during the surgical procedure and preserve the viability of PDL cells. One year of clinical and radiographic examination revealed no signs or symptoms suggestive of any pathology and the marginal adaptation of gingiva around the donor tooth appeared to be satisfactory. Inappropriate cases, this treatment approach may be considered as an alternative to conventional prosthetic rehabilitation or implant treatment.

Keywords: Autotransplantation; custom-made reservoir; mature third molar; periodontal ligament cells

INTRODUCTION

Autotransplantation refers to transposition of a tooth from one tooth extraction site to another or a surgically formed recipient site in the same individual. It is an effective treatment option and is often overlooked as an alternative. Trauma or caries are some of the most common causes of early loss of teeth. Autogenous teeth transplantation was documented for the first time by M.L. Hale in 1954; however, a French dentist by the name of Ambroise Pare in 1564 recorded the first surgery with details about tooth buds transplantation. Conventionally, impacted maxillary canines were the teeth first selected for transplantation as they played a key role in dentofacial esthetics. Autotransplantation can be carried out when a suitable donor tooth is available and is a cost-effective treatment option as opposed to implants. This procedure can be carried out in teeth with an immature or open apex or in teeth where root development has been completed. Previous studies that were conducted determined no significant difference in the success rate of autotransplantation between mature and immature teeth.

Autotransplantation of mature teeth is a highly technique sensitive procedure and requires maintaining the viability of the periodontal ligament (PDL) cells which possess the ability to undergo regeneration of the periodontal tissues. Failure to do so may otherwise lead to complications such as root resorption, ankylosis, or loss of attachment. The success of autotransplantation depends on the tissue healing process after the surgery since a total rupture of the neurovascular bundle and periodontal fibers occurs during the extraction of the donor tooth. Important criteria for the successful autotransplantation include the selection of (a) the patient, (b) the donor tooth, and (c) the recipient site with sufficient alveolar bone support and adequate attached keratinized tissue for the stabilization of the transplanted tooth, and (d) the absence of infection at the recipient site.

It is of utmost importance that the patient maintains good oral hygiene and is capable of following postoperative instructions and follow-up visits. This report demonstrates a successful case of autologous transplantation of a mandibular third molar using a custom-made reservoir.

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CASE REPORT

A 17-year-old female patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of a decayed tooth in the lower left back region of the jaw. Clinical examination revealed a grossly mutilated lower left second molar (37) and a partially erupted lower left third molar (38) [Figure 1a]. Radiographic examination showed caries involving enamel, dentin, and pulp chamber space with 37 [Figure 1b]. The 38 appeared to be sound with the absence of any carious lesion. There was no tenderness on percussion or palpation, no noted swelling, and no sinus tract was seen. Periodontal examination revealed mobility, probing depth, and gingival tone within the normal limits. Tooth 37 was nonrestorable, had a poor prognosis, and was indicated for extraction. Thirty-eight appeared to be a sound, mature tooth with the presence of two roots, two canals, and the absence of calcifications hence was found to be ideal for transplantation.

Informed consent was obtained from the patient before starting the procedure. A cone-beam computed tomography (CBCT) image of the patient was made to analyze the volumetric size of the donor tooth and to assess the proximity to the inferior alveolar nerve [Figure 2c]. The mesiodistal and buccolingual dimensions of the donor tooth were found to be lesser than the dimensions of the recipient socket.

As there was soft-tissue impaction associated with the mandibular third molar, operculectomy was performed to provide desired access to carry out root canal treatment of third molar [Figure 1c]. Root canal treatment of 38 was performed using a standard protocol of ProTaper rotary instrumentation (Dentsply Maillefer, Ballaigues, Switzerland) and obturation, with minimal removal of tooth structure during access cavity preparation, before the surgery [Figure 1d-f].

Preparation of the customized reservoir for storage of tooth extra orally

The customized reservoir was made using a modification of the novel technique advocated by Niemczyk. In the technique used by Niemczyk, the extracted tooth was kept moist continuously during the extraoral period, with the help of an impression made using condensation silicone putty material. The customized reservoir that was used in the present case report provided better stability and also ensured that the tooth was in constant contact with saline.

A rubber base (Coltene Speedex putty, Whaledent) putty impression of the lower right quadrant of the patient was made and the cast was poured using dental stone (Kerr Dental) [Figure 1g]. The cast was retrieved and an 8 mm groove was prepared using a micromotor (NSK Ltd) and a straight fissure bur (Mani Inc. Japan), circumferentially surrounding the crown of 38 [Figure 1 h]. Following this, an impression of the cast was made using rubber base (Coltene Speedex putty, Whaledent) putty impression material and the custom-made mold was obtained that would hold the donor tooth. Impression material was then adapted to the further build the walls of the prepared mold cavity, so as to only leave 3 mm of the root surface exposed for performing apicectomy [Figure 2a and 2b]. Surfaces of the tooth were marked on the walls of the mold as mesial (M), distal (D), buccal (B), and lingual (L). The mold was disinfected by wrapping it in a 2% glutaraldehyde-soaked paper towel and sealed in a plastic bag for 10 min before the surgery.

Surgical procedure

Local anesthesia of 2% lidocaine (with 1:100,000 epinephrine) was administered and the donor tooth 38, was extracted.
atraumatically in a buccal-lingual direction, and during the withdrawal movement, and special attention was paid so as to prevent damage to the cementum and the buccal and lingual cortical plates [Figure 2d]. This was followed by the extraction of 37. The extracted tooth 38, was placed in the mold cavity filled with normal saline, and apicectomy of the tooth was carried out [Figure 2e]. The root-end cavity was prepared using stainless steel retro tips (EMS; Nyon) attached to an ultrasonic unit (Piezon master 400-EMS; Nyon, Switzerland), followed by placement of mineral trioxide aggregate (Angelus Soluções Odontológicas, Londrina, Brazil) [Figure 2f and g]. The extraoral time was 6 min and 30 s. Preparation of alveolar socket of 37 was not required, as the dimensions of 38 were smaller than the dimensions of 37. Platelet-rich fibrin was placed in the cavity of 37 so as to provide growth factors for healing. Finally, donor tooth 38 was placed in the recipient socket [Figure 3]. The soft tissues and the transplanted tooth were stabilized with crossover sutures with 3-0 Vicryl (Ethicon, Somerville, NJ) [Figure 2h] and splinted using a semiflexible braided glass, fiber splint-Angelus Interlig (Londrina PR, Brazil) [Figure 2i]. The possibility of premature contacts was eliminated by carrying out occlusal adjustment of the transplanted tooth.

The patient was prescribed amoxicillin (500 mg) twice daily for a period of 5 days and was instructed to perform daily mouth rinsing with 0.2% Chlorhexidine gluconate (Dr Reddy’s Laboratories Ltd) twice a day for 7 days. One week later, the sutures were removed and healing appeared satisfactory. The fiber splint was removed after 3 weeks and was followed by placement of porcelain-fused-to-metal crown. Thereafter, the patient was reviewed after 1 month, 3 months, 6 months, and 1 year [Figure 2j and k]. The occlusion was found to be normal. The characteristic metallic sound of ankylosis was not evident on percussion testing. One-year follow-up revealed no signs of loss of attachment or root resorption [Figure 2l]. Gingival attachment appeared to be satisfactory with the absence of inflammation.

**DISCUSSION**

Despite the widespread use of dental implants, autogenous tooth transplantation is a possible treatment option for the replacement of extracted permanent teeth that are involved with carious destruction, traumatic injury, are malformed.\(^1\)

Autotransplantation has several advantages compared to dental implants which include the maintenance of proprioception, relatively low cost, possible orthodontic movements, and pulpal regeneration with immature teeth. Tsukiboshi reported a 90% survival rate and an 82% success rate in 250 cases after 6 years.\(^4\)

Cells of osteoprogenitor potential present within the PDL, promote bone regeneration. Therefore, it is important
to preserve the viable PDL cells at the recipient site as well as on the donor tooth to induce alveolar bone regeneration without the use of membranes. Changes in pH, osmotic pressure, and dehydration can easily damage the PDL cells. Therefore, precautions need to be taken to minimize the extraoral time. Until recently Choi et al. and Cho et al. have used saline as a root hydration medium. Similarly, in the present case, since the procedure was quick and extraoral time was minimal, saline was used for storing the tooth. Furthermore, the procedure was carried out under aseptic conditions.

Most cases of autotransplantation, make use of a wet gauze soaked in saline or coconut water to hold the tooth while carrying out the extraoral procedures. However, this may still cause some damage to the PDL cells. In the present case, the use of the custom-made mold enabled us to maintain the viability of the PDL cells without touching the cementum. Till date, this technique has not been used. Adequate periodontal healing can be achieved when there is an abundance of HERS. For immature teeth, extraoral time is a key factor affecting the preservation of the HERS. Replacement resorption is the most common complication of increased extraoral dry time. The extraoral time in the present case was 6 min and 30 s. A dry time between 15 and 60 min has shown to have an incidence of replacement resorption in 38.5% of cases.

The primary objectives for a transplanted tooth are the absence of ankylosis and survival of PDL. Prolonged splinting using a rigid splint would increase the chances of ankylosis and therefore should be avoided. Hence, a semiflexible fiber splint was used which helped to maintain physiologic mobility of the transplanted tooth and stimulated the activation of PDL cells (i.e., fibroblasts, osteoblasts, and cementoblasts). Maxillary transplants pose a greater risk of failure, which can be attributed to the variation in the size and shape of the teeth and proximity to the maxillary antrum. In the present case, the transplanted tooth adapted adequately to the recipient site had a simple root morphology, and hence there was no need to prepare the recipient tooth socket, which also helped preserve the PDL cells, thus minimizing the risk of ankylosis. Moreover, due to good bone support and favorable cervical adaptation between the tooth and bone, the chances of uneventful healing were increased. Several studies have carried out root canal treatment of the donor tooth extra orally during the surgery. However, this may increase the chances of desiccation of the viable PDL cells. Root canal treatment in the current case was performed before the surgical procedure, which further reduced the extraoral dry time. Andreasen, in his study involving monkeys reported bone healing by minimizing extraoral time and preserving the PDL cells of the donor tooth even when no bone was present around the recipient root.

CBCT proved to be a useful adjunct as a three-dimensional evaluation of the donor tooth as well as recipient socket and the dimensions of the donor and recipient tooth could be compared. The proximity to the adjacent structures could be evaluated before the surgical procedure.

Autogenous teeth transplantation helps in the regeneration of alveolar bone and the maintenance of the attached gingiva with a natural shape.

CONCLUSION

Autotransplantation is a one-step surgical procedure with good aesthetic results. Furthermore, as observed in the present case, the attached gingiva maintained its natural shape, and the regeneration of the alveolar bone was possible, which may not be the case when dental implants are placed. This procedure is infrequently performed as there was less knowledge regarding the causes and prevention of root resorption of transplanted autogenous teeth. With the advent of CBCT and the availability of a suitable donor tooth, autogenous transplantation can be considered as a suitable alternative to dental implants and prosthetic rehabilitation as it provides a cost-benefit perspective.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Dharmani U, Jadhav GR, Kaur Dharmani CK, Devi TP. Mineral trioxide aggregate pulpotomy in autotransplanted immature mandibular third molar with a 4-year follow-up. J Conserv Dent 2016;19:293-5.
2. Hale ML. Autogenous transplants. Oral Surg Oral Med Oral Pathol 1956; 9:76-83.
3. Gupta S, Goel M, Sachdeva G, Sharma B, Malhotra D. Autotransplantation. J Conserv Dent 2015;18:500-3.
4. Tsukiboshi M. Autotransplantation of teeth: Requirements for predictable success. Dent Traumatol 2002;18:157-80.
5. Kim S, Lee SJ, Shin Y, Kim E. Vertical bone growth after autotransplantation of mature third molars: 2 case reports with long-term follow-up. J Endod 2015;41:1371-4.
6. Abella F, Ribas F, Roig M, González Sánchez JA, Durán-Sindreu F. Outcome of autotransplantation of mature third molars using 3-dimensional-printed guiding templates and donor tooth replicas. J Endod 2018;44:1567-74.
7. Mejare B, Wannfors K, Janson L. A prospective study on transplantation of third molars with complete root formation. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004;97:231-8.
8. Karoussis IK, Salvi GE, Heitz-Mayfield LJ, Brägger U, Hämerle CH, Lang NP. Long-term implant prognosis in patients with and without a history of chronic periodontitis: A 10-year prospective cohort study of the ITI Dental Implant System. Clin Oral Implants Res 2003;14:329-39.
9. Goswami M, Chaitra T, Chaudhary S, Manuja N, Sinha A. Strategies for periodontal ligament cell viability: An overview. J Conserv Dent 2011;14:215-20.
10. Machado LA, do Nascimento RR, Ferreira DM, Mattos CT, Vilella OV. Long-term prognosis of tooth autotransplantation: A systematic review and meta-analysis. Int J Oral Maxillofac Surg 2016;45:610-7.
11. Martin K, Nathwani S, Bunyan R. Autotransplantation of teeth: An evidence-based approach. Br Dent J 2018;224:861-4.
12. Niemczyk SP. Re-inventing intentional replantation: A modification of the technique. Pract Proced Aesthet Dent 2001;13:433-9.
13. Choi YH, Bae JH, Kim YK, Kim HY, Kim SK, Cho BH. Clinical outcome of intentional replantation with preoperative orthodontic extrusion: A retrospective study. Int Endod J 2014;47:1168-76.
14. Cho SY, Lee Y, Shin SJ, Kim E, Jung JY, Friedman S, et al. Retention and healing outcomes after intentional replantation. J Endod 2016;42:909-15.
15. Jang JH, Lee SJ, Kim E. Autotransplantation of immature third molars using a computer-aided rapid prototyping model: A report of 4 cases. J Endod 2013;39:1461-6.
16. Chappuis V, von Arx T. Replantation of 45 avulsed permanent teeth: A 1-year follow-up study. Dent Traumatol 2005;21:289-96.
17. Bae JH, Choi YH, Cho BH, Kim YK, Kim SG. Autotransplantation of teeth with complete root formation: A case series. J Endod 2010;36:1422-6.
18. Chopra V, Mundae H, Comert FD. Auto transplantation of a mandibular third molar with complete root development: A case report. J Dent Health Oral Disord Ther 2017;7:285-9.
19. Andreasen JO. Interrelation between alveolar bone and periodontal ligament repair after replantation of mature permanent incisors in monkeys. J Periodontal Res 1981;16:228-35.