

Autogenous tooth transplantation: an alternative to replace extracted tooth

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ABSTRACT

Background: The gold standard treatment to replace missing tooth is dental implants, however, in certain cases, such as in young patients its placement is contraindicated. Autogenous tooth transplantation, which has been widely done in Scandinavian countries for many years, may become a good alternative to overcome this problem. **Purpose:** This article attempted to provide information about the indication, treatment planning, surgical technique and the successful result of autogenous tooth transplantation. **Case:** a fifteen year old male patient presented with large caries and periapical disease of his lower left first molar, which was partially erupted and the roots was not fully formed in radiograph. **Case management:** Autogenous tooth transplantation procedure was performed consisting of extraction of #36, odontectomy of #38 followed by its implantation to socket #36 and fixation of the transplanted tooth to the adjacent teeth. Post operative evaluation was done on regular basis within 18 months period. There was no complaint, the tooth was clinically stable and no evidence of periodontal problem. Serial radiographs showed healing of alveolar bone and periodontal tissue, and the complete root formation was evident by 18 months post operatively. **Conclusion:** Autogenous tooth transplantation is a potential alternative to replace extracted tooth. Provided that the case be properly planned and operation carefully performed, successful result of this treatment can be achieved.

Keywords: autogenous tooth transplantation; extracted tooth; incompletely formed root

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INTRODUCTION

Replacement of lost or extracted tooth can be done by several ways, either with removable denture or fixed prosthesis such as bridge work and dental implant-supported crown. The fast development in osseointegrated dental implant system has made it the most desirable treatment option in replacing lost teeth because of its predictable and long-term results. However, dental implants should not be used in young patients whose alveolar bone are still actively growing because it may cause infraocclusion, poor esthetic result and interdental gaps with the adjacent teeth later in life.¹ Another alternative implant treatment is, therefore, required to be used in patients with growing alveolar bone. One of the treatment options suitable for such individuals is autogenous tooth transplantation

Autogenous tooth transplantation is transplantation of buried, partially erupted or fully erupted tooth from one location to another in the same individual.² Donor teeth are transplanted from donor to recipient sites which can be post extraction sockets or surgically prepared sites. Tooth transplantation is frequently indicated for children or adolescence to replace fractured or missing incisors due to trauma or defective molars due to large caries.³ Autogenous tooth transplantation consists of few steps, i.e. minimally traumatic tooth extraction, surgically removed donor tooth followed by its transplantation into the recipient socket. This requires that strict case selection, type of donor and recipient sites, and rigorous surgical procedure be met to achieve successful result.⁴ The objective of this article is to provide information regarding the potential successful treatment with autogenous tooth transplantation

if it is properly planned and carefully performed. This article presented successful treatment using autogenous tooth autotransplantation to replace extracted tooth in adolescence.

CASE

A fifteen year old male patient came to the author's private dental clinic with chief complaint of his lower left molar having large cavity since one year ago causing discomfort during eating. There was no history of dental treatment. Intra oral examination showed that #36 presented with large occlusal caries with furcation perforation which was found to be non-vital. There was no sign of acute periodontal or periapical infection. Tooth #37 was partially erupted while #38 was not clinically seen (Figure 1). Panoramic x-ray showed radiolucency of alveolar bone in bifurcation and periapical region of #36. Tooth #38 was partially erupted and impacted mesioangularly to #37 as well as the overlying bone, while the roots were seen to be incompletely formed (Figure 2).

The parents of the patient were explained of the poor condition of tooth #36 and the poor prognosis of root canal treatment and restoration of the tooth, therefore tooth extraction would be the treatment of choice. They were also informed that tooth #38 was impacted and non-functional which most likely needed surgical removal in the future to avoid damage to tooth #37 structure. They were offered treatment with autogenous tooth transplantation, i.e. extraction of #36, surgical removal of impacted #38 followed by transplantation to #36 socket. Realizing the advantages of this treatment the parents signed the informed consent.

CASE MANAGEMENT

Clinical and radiographic evaluation were done prior to the surgery to measure the crown dimension of donor tooth as well as the recipient site. The donor tooth crown width was 1.5 mm lower than the width of the recipient site which was the space between distal wall of tooth #35 and mesial wall of #37. The result suggested that tooth #38 was a good candidate for donor tooth.

The procedure of tooth transplantation was done under local anesthesia. After disinfection with povidone iodine solution and mandibular block anesthesia with 2% lidocaine tooth #36 was extracted. The extraction was done with split technique to minimize trauma to the adjacent bone and gingiva. Upon complete delivery of the two segments, thorough curettage was done to remove granulation tissue in the socket, which then irrigated with 0.9% saline solution and covered with sterile moist gauze. The next step was odontectomy of tooth #38. After trapezoidal incision and flap reflection were made judicious amount of bone surrounding the crown of #38 was removed using round



Figure 1. Intra oral situation preoperatively. Tooth #36 presented with large caries with darkening of the crown, #37 was clinically partially erupted while #38 was totally unerupted.



Figure 2. Panoramic x-ray pre-operatively. Tooth #36 was seen to have deep caries and radiolucency at furcation and periapical area, tooth #38 was partially erupted and impacted mesioangularly against #37 with the roots being incompletely formed.

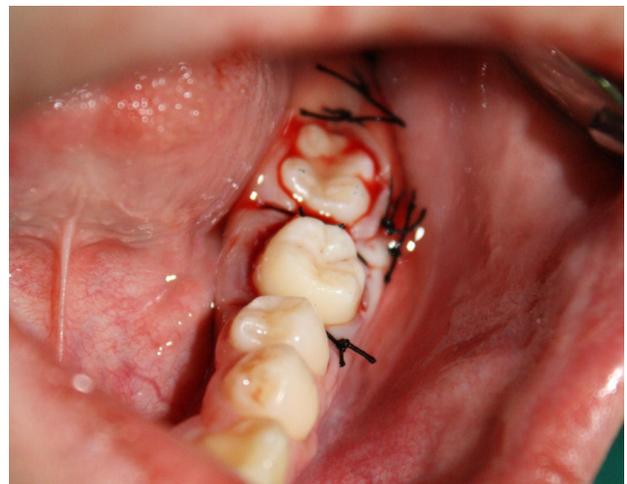


Figure 3. Transplantation of donor tooth in the recipient socket. After transplantation the interdental papillas at #36 region and the odontectomy flap were sutured with 3-0 black silk suture, followed by fixation of the donor tooth to the adjacent teeth.



Figure 4. Periapical x-ray immediate after surgery. The mesio-distal dimension of donor crown which was smaller than the recipient site facilitated transplantation procedure and minimized manipulation of the donor tooth and recipient socket. It was fixed to the adjacent teeth with glassionomer cement in an under-occlusion position.

bur down to the level of cemento-enamel junction. A great care was taken during bone removal with drilling so that it did not cause any injury to the surface of the root's cementum. The dental follicle was carefully detached from the adjacent fibrous tissue using amalgam carver. The tooth was then delivered out from its socket with Bein elevator and wrapped in moist sterile gauze to keep it from unexpected drying.

Preparation of socket #36 was made by removing the blood clot and irrigating with sterile saline solution. The donor tooth was then placed in the recipient socket by holding its crown with extraction forceps. There was not much of manipulation required to implant the donor tooth as the crown and root dimension of the donor tooth were smaller than the that of the recipient site. The tooth was placed slightly infraposition so that it did not contact with the opposing tooth and then the post-odontectomy flap and interdental papillas at the recipient site were sutured with black silk sutures (Figure 3). The tooth was then fixed with glassionomer cement to the adjacent teeth and periapical x-ray taken immediately afterwards (Figure 4).



Figure 5. Three months post-operative review. The donor tooth was in good alignment showing normal marginal gingiva without any sign of inflammation (left); the donor tooth was in contact with the opposing teeth indicating spontaneous vertical movement associated with clinical eruption (right).

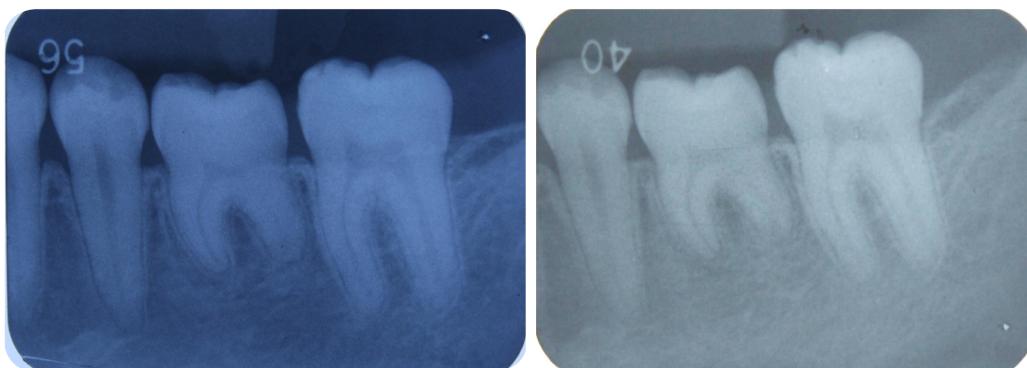


Figure 6. Post operative periapical x-ray. At 9 month review, post extraction socket had been replaced with normal trabecular bone, the roots of donor tooth was seen to have fully formed but the distal apical foramen was still wide indicating incomplete root formation, lamina dura was evident but its density still uneven (left); at 18 month review both roots had fully formed, lamina dura was clearly defined with even density indicating normal bone and periodontal structure (right).

Antibiotic, NSAID, analgesic and antiseptic mouth rinse were prescribed. The patient was instructed to take soft diet and avoid chewing with the left side for 2 weeks.

Post operative review was done on weekly basis for the first month followed by monthly for the next six months. The fixation cement and sutures were removed 2 weeks after surgery. There was no complaint, slight mobility was perceived with finger palpation and the pulp test indicated vital pulp although the vitality level was lower compared to that of the adjacent teeth. At one month review, there was no detected mobility and the pulp test value revealed compared to the previous one. At three months review, the tooth was stable, gingival margin was normal and no periodontal pocket detected (Figure 5), the pulp test indicated higher vitality level compared to the one previously recorded.

Periapical radiograph taken at nine months check up showed root development in which the mesial apex seemed to form completely, while the distal apex has not fully formed. The alveolar bone surrounding the roots showed normal density and trabecular pattern, but lamina dura were not clearly defined. (Figure 6). At 18 months post surgery, the clinical parameters were normal and the pulp test indicated that the pulp of the transplanted tooth was still vital and the recorded vitality value was similar to that of the adjacent teeth. Radiographically, the trabecular bone was normal, both root apices had fully formed, and the lamina dura along the roots was clearly seen with even radiopacity (Figure 6).

DISCUSSION

Procedure of autogenous tooth transplantation had been applied for more than three decades especially in Scandinavian countries during which time success rate was reported as low as 59% to 76% in 5-10 years of observation period.⁵ Interestingly, the success rate was reported to increase dramatically in the past two decades. Andreasen *et al.* reported 95% success rate over 13 years of study, Lundberg dan Isaksson achieved 94% in 5 years, Kugelberg *et al.* reported 94% success rate during 4 years of observation, and Cohen showed 98-99% success rate over 5 years.⁶

Autogenous tooth transplantation was commonly used to replace permanent first molars as these are the first permanent teeth to erupt and most frequently damaged.² Autogenous tooth transplantation can also be considered as treatment of choice in such cases as agenesis of premolars or lateral incisor, tooth loss due to trauma, ectopic canine, root resorption, and root fractures. This procedure is indicated in young individuals whose alveolar bone are still undergoing growth and development which make fixed prosthesis such as dental implants unsuitable. This was best done to replace freshly extracted tooth because delay of the treatment might cause resorption of the alveolar process leading to decrease in the amount of alveolar bone available for the donor tooth.⁷

In order to achieve best result of autogenous tooth transplantation case selection is very important. With this regards, one should consider that donor teeth do not have fully formed root, mesio-distal dimension of donor teeth should be at least the same or smaller than the extracted teeth, there should not be any acute periapical or periodontal infection of the recipient socket.^{7,8} It was suggested that if partially erupted wisdom teeth are to become donor, the best case would be when their occlusal surface were already at the level of cervical part of second molars so that risk of injury to the donor teeth can be minimized.⁴ In the author's experience, transplantation of wisdom tooth germ was not advisable as preserving dental follicle and, especially, dental papilla were extremely difficult during delivery of the germ leading to failure of subsequent root formation. The patient in this case met the above criteria, as he was classified as adolescence, the tooth #38 used as the donor tooth showed incompletely formed root and its dimension was smaller than the extracted tooth and there was no active inflammation at the periapical of recipient site. Besides, the occlusal surface of the donor tooth was above the level of cervical part of the adjacent tooth which made odontectomy procedure relatively uncomplicated.

Apart from good planning, meticulous surgical procedure should be done to achieve successful result comprising of atraumatic tooth extraction and donor tooth removal and judicious manipulation of the socket as well as the donor tooth. Atraumatic extraction should be able to maintain as much bone and soft tissue integrity in the recipient socket as possible.^{3,4,7,9} Atraumatic extraction in this case was performed by splitting the tooth longitudinally with bur followed by removal of the root segments one after the other preserving the interdental alveolar crest. The atraumatic donor tooth removal in this case was performed by removing adequate amount of the overlying bone under copious saline irrigation to preserve the periodontal ligament and dental follicle of the donor tooth as much as possible during delivery. Preservation of viable periodontal ligament cells was also applied by always holding the tooth on its crown surface and had it wrapped in moist gauze at all times during socket manipulation procedure and by keeping the extra oral time at minimum time as suggested by several authors.^{3,7}

The success criteria for autogenous tooth transplantation are healing of the periodontal ligament (PDL), healing of gingival tissue and alveolar bone, healing of the pulp and continuation of root development.¹ All the abovementioned parameters for successful result were found in this case evidenced by clinical and radiographic examination. The most important determinant of success in this procedure was the stage of root development and viability of periodontal ligament cells of donor tooth.^{2,10} Root with open apex would facilitate revascularization to the pulp canal which was very critical to the viability of the pulp tissue. Studies showed that following traumatic injuries to the pulp tissue, various growth factors incorporated in blood clot and dentin played important role in the cell proliferation inside

the root canal space.¹¹ With regard to the apical opening, revascularization seems to be more predictable when apical diameter is greater than 1.0 mm and is unlikely to occur in apical opening narrower than 0.3 mm.^{1,12}

Damage to PDL cells may cause bony ankylosis in which case external root resorption was inevitable leading to tooth loss.^{9,10} Failure of autogenous tooth transplantation were usually caused by inflammatory root resorption and replacement root resorption or ankylosis. Inflammatory resorption was resorption of the root dentin caused by injury to the innermost layer of the PDL and cementum eliciting a deep osteoclastic attack on the root surface exposing dentinal tubules. When the tubules communicate with the bacteria from the necrotic pulp, activation of the resorption process further continues.⁴ Replacement resorption or ankylosis is the result of extensive injury to the innermost layer of PDL and cementum in which healing initiated from the adjacent bone hence forming bone ankylosis. Being the integral part of the bone the tooth subsequently undergoes remodelling cycle leading to resorption of the tooth overtime.⁴

Inflammatory resorption usually commenced from four week after transplantation, while ankylosis between root cementum and the adjacent bone usually occurred after 4 months after the procedure.⁵ These two types of root resorption were not found in the reported case until 18 months post operatively. This was most probably due to vitality of the pulp tissue and periodontal ligament cells of the transplanted tooth supported by the radiographic evidence of fully formed lamina dura.

Authors suggested that few parameters can be used to assess the health of transplanted tooth, i.e. free from complaint of pain, tooth mobility, gingivitis, periodontal pocket, and any form of root resorption.⁸ In the case presented here, result of the assessment of all parameters above and the normal pulp vitality indicated that the transplanted tooth was healthy, and therefore it was considered as successful treatment.

The conclusion of this case report was that autogenous tooth transplantation was a potential method to replace an extracted tooth. The success of this treatment depended highly on good case selection and meticulous surgical procedure which should be done according to rigorous criteria.

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