

CASE REPORT

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Dental Auto-transplantation to Premolar Mandibullary Sites: Case report

Premolar Alt Çene Bölgelerine Dişin Oto-transplantasyonu: Vaka raporu

ABSTRACT

This study aims to present the success rate, advantages, and factors influencing the success, along with potential complications associated with autotransplantation to the mandibular premolar region. Autotransplantation involves the extraction of a suitable impacted, semi-erupted, or erupted tooth from an individual, followed by surgical transplantation into areas of tooth loss within the same individual. This procedure is particularly significant in addressing tooth loss, especially among young patients, with its success dependent on the careful selection of appropriate cases. Indications for autotransplantation include premature tooth loss resulting from various causes such as irreparable teeth, periodontal diseases, root fractures, dental agenesis, early tooth loss due to trauma, and impacted or ectopic teeth. The primary criteria for evaluating the success of autotransplantation involve normal periapical healing and sustained root development, without inflammatory pulpal changes or root resorption. The tooth designated for autotransplantation underwent initial treatment with a root canal, followed by complete filling with MTA to prevent root resorption. Subsequently, it was positioned and secured in the designated transplant area. The patient was called for periodic check-ups after the treatment was completed. Despite its limited practical applications, autotransplantation serves as a valid alternative to implant and prosthetic treatments due to its cost-effectiveness, relative simplicity, and ability to provide satisfactory aesthetics and functional results. Additionally, it preserves the quality and quantity of alveolar bone. In this study a 5-year follow-up of the patient revealed no criteria indicating failure in the transplanted tooth.

Key Words

Autotransplantation, Ectopic tooth, Root resorption

ÖZ

Bu çalışma mandibular premolar bölgeye ototransplantasyonun başarı oranını, avantajlarını ve başarıyı etkileyen faktörleri ve bununla birlikte olası komplikasyonları sunmayı amaçlamaktadır. Ototransplantasyon, bir kişiden uygun bir gömülü, yarı sürmüş veya sürmüş dişin çekilmesini ve ardından aynı kişinin diş kaybı olan bölgelerine cerrahi olarak transplantasyonu içerir. Bu prosedürün başarısı uygun vakaların dikkatli seçimine bağlı olduğundan, özellikle genç hastalarda diş kaybının giderilmesinde önemlidir. Ototransplantasyon endikasyonları; tedavi edilemeyen dişler, periodontal hastalıklar, kök kırıkları, diş agenezisi, travmaya bağlı erken diş kayıpları, gömülü veya ektojik dişler gibi çeşitli nedenlerden kaynaklanan erken diş kayıplarıdır. Ototransplantasyonun başarısını değerlendirmenin birincil kriterleri, inflamatuvar pulpal değişiklikler veya kök rezorpsiyonu olmaksızın normal periapikal iyileşmeyi ve sürekli kök gelişimini içerir. Bu vakada ototransplantasyon yapılacak dişe kök kanal tedavinin ardından kökün rezorpsiyonunu önlemek için kanal tamamen MTA ile dolduruldu. Daha sonra belirlenen alana transplante edilip sabitlendirildi. Tedavi tamamlandıktan sonra hasta periyodik kontrollere çağırıldı. Ototransplantasyon sınırlı pratik uygulamalarına rağmen maliyet etkinliği, göreceli basitliği ve tatmin edici estetik ve fonksiyonel sonuçlar sağlaması nedeniyle implant ve protetik tedavilere geçerli bir alternatif olarak sunulmaktadır. Ayrıca, alveol kemiğinin kalitesini ve miktarını korur. Bu çalışmada hastanın 5 yıllık takibinde, nakledilen dişte başarısızlığa işaret eden herhangi bir kritere rastlanmadı.

Anahtar Sözcükler

Ototransplantasyon, Ektojik diş, Kök rezorpsiyonu

INTRODUCTION

Autogenous tooth transplantation, also known as autotransplantation, refers to the relocation of an impacted or erupted tooth from its original location in the same individual to a surgically prepared socket or extraction space in the recipient area (1-6). The first case reports of successful autotransplantation were published in the 1950s (1,4,7). However, in 1956, Hale became the first author to describe autotransplantation in detail (8). Since then, many authors have described various techniques with differing success rates.

Cardiovascular problems, poor oral hygiene, and low patient motivation are the main contraindications for autotransplantation (2,3).

Within scholarly publications, the long-term success rate of autotransplantation has been reported to range from 74% to 100% (9). Many pre- and post-operative factors affect the success of autotransplantation, such as the age of the patient, the type and root development level of the tooth to be transplanted, the compatibility between the tooth and the recipient site, an atraumatic operation, post-operative stability, and the vertical height of the transplanted tooth (1-5,9-14).

It has been indicated that neither gender nor age significantly influence the success of autotransplantation (3,5,9,15). However, in young individuals, immature teeth surrounded by thick follicles or periodontal ligaments facilitate the extraction of the transplanted tooth with minimal force. This enhances the success of the transplantation and reduces the likelihood of ligament damage (3,16).

In autotransplantation, premolars, canines, incisors, and third molars are frequently used (6).

According to many authors (4,5,10,11,17,18), the most important factor affecting the success of transplantation is the level of root development of the tooth. The first study showing the relationship between the root development level of the tooth to be transplanted and the success of autotransplantation was conducted by Slagsvold and Bjercke in 1974 (19). Subsequently, Schwartz et al. (20) reported that the transplantation of teeth with open apices was more successful than teeth with closed apices.

The American Association of Endodontists has recommended that the pulp be extirpated within 7-14 days after transplantation in teeth with a closed apex. Otherwise, they reported that necrotic pulp and developing infection will cause inflammatory root resorption (2,3,5).

According to some authors, the appropriate adaptation between the bone wall of the recipient site and the root surface of the tooth to be transplanted greatly affects the success of autotransplantation (1,3,5,10,21). Another factor to consider when deciding on autotransplantation is the width of the alveolar bone in the recipient field (3,4,22).

Atraumatic extraction of the tooth to be transplanted, with minimal damage to the periodontal ligament and cementum, is among the important factors affecting the success of autotransplantation (3-5,13). Therefore, contact with the root surface should be avoided when extracting the tooth to be transplanted (4). Manual contact with the tooth to be transplanted should be minimal to protect the periodontal ligament and pulpal tissues (3,4). Otherwise, root development may be inhibited, and attachment loss, root resorption, or ankylosis may occur (3,15).

The length of time the transplanted tooth remains outside the mouth during transplantation is another important factor affecting the success of autotransplantation (1,3,5,21).

In addition to semi-rigid stabilization with sutures, more rigid fixation methods such as orthodontic brackets, ligature wires, and composite resin have been defined for the post-operative stabilization of the transplanted tooth (1,9,23-25). Various literatures state that the splinting duration should be between 1 week and 4-6 weeks (5,18,26-31). However, it is also known that rigid splinting or prolonged fixation time has a negative effect on healing (3,4,16,25). Experimental studies have shown that a prolonged fixation period prevents periodontal regeneration, thus increasing the possibility of inflammatory root resorption or ankylosis, while rigid fixation negatively

affects the revascularization of the pulp (3,25). For this reason, many authors recommend applying semi-rigid splints for 7-10 days. According to research, periodontal ligament cell activity and bone repair are stimulated by allowing functional movements of the transplanted tooth (3-5,25,32).

Inflammatory root resorption and dentoalveolar ankylosis are the most common complications after autotransplantation (2-4,10,18,21,33).

We can classify the parameters for evaluating the success of autotransplantation as follows: (1) The transplanted tooth is immobile in the socket without any problems, (2) Chewing is functional and painless, (3) Lack of mobility in the tooth, (4) No pathological condition observed on radiography, (5) Normal appearance of lamina dura on radiography, (6) The sulcus depth is within normal limits, (7) Gum contour and color are normal (34).

The follow-up process for patients undergoing dental autotransplantation is scheduled at 1-, 3-, and 6-month after the operation, followed by subsequent appointments every 6-month for a duration of 5-year (4,21).

CASE REPORT

According to the institution's guidelines, ethics committee approval is not required for individual case disclosure. Written consent was obtained from the patients for the use of their medical information and imaging.

A 35-year-old patient presented to our clinic with a toothache. Clinical and radiological examinations revealed a composite filling and a deep fracture in the mandibular right first premolar. Additionally, the crown of the mandibular right second premolar was malposed near the floor of the mouth in that area. The patient's medical history showed no evidence of systemic disease or regular medication use. Radiologic assessment indicated that root canal treatment had already been performed on the mandibular right first premolar. After evaluations, it was determined that extraction of the first premolar tooth was necessary due to the deep fracture. Prosthetic and implant treatment options were discussed with the patient. However, due to financial constraints, the patient declined prosthetic and implant treatments and instead opted for autotransplantation. They were thoroughly briefed on the procedure's implementation at our clinic, its potential complications, and provided consent by completing an information and consent form. Root canal treatment was performed on the right second premolar using reciprocating preparation systems. The root canals were prepared with Reciproc R50 (VDW, Munich, Germany) reciprocal instruments. A #5 Gates Glidden drill (Mani Inc., Tachigiken, Japan) was used to create a 5 mm-deep coronal reservoir for irrigant placement.

Canals were irrigated with 2.5 mL of 5% NaOCl (Werax, İzmir, Türkiye) using a 27-G syringe needle (Beybi, Anhui, China) during preparation. After instrumentation, the canals were irrigated with 5 mL of 5% NaOCl, followed by 2.5 mL of 17% EDTA (Werax) and 5 ml of distilled water. The root was completely filled with OrthoMTA (BioMTA, Seoul, Korea).

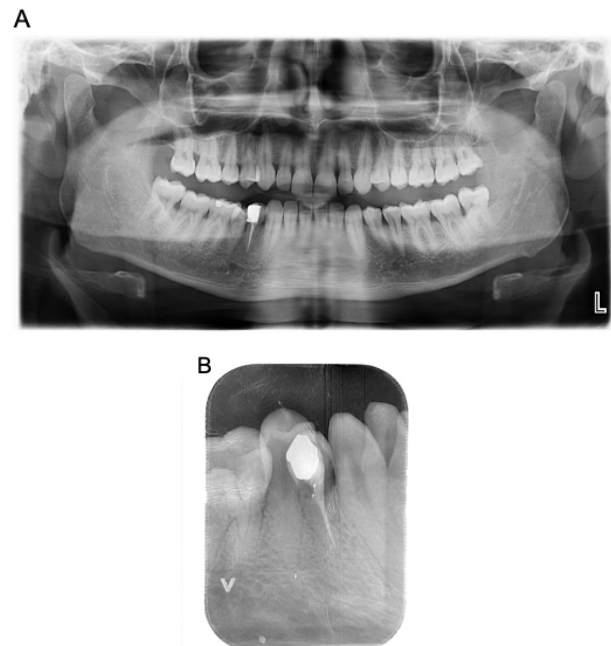


Figure 1. (A) panoramic radiography and (B) periapical radiograph of the patient before starting treatment.

Under local anesthesia, a full-thickness flap was raised, and the malposed mandibular right second premolar was atraumatically extracted. The tooth was kept in a 0.9% isotonic sodium chloride solution to maintain the vitality of the periodontal ligament. Subsequently, the first premolar was extracted, and the recipient socket was prepared for the transplant tooth using surgical burs. Throughout these procedures, the time the tooth remained out of the mouth did not exceed 15 min.

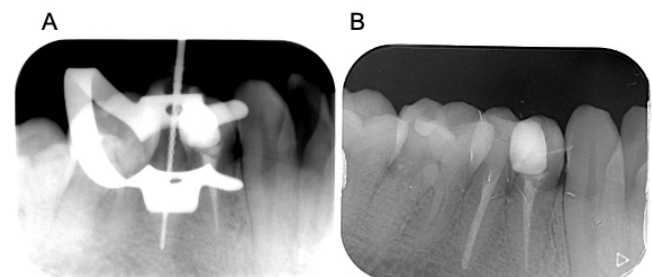


Figure 2. Periapical radiographs taken (A) during root canal treatment of the mandibular second premolar and (B) after root canal treatment.

The transplanted tooth was gently placed into the socket and held in position with finger pressure for 3 min. To stabilize the autotransplanted tooth, the adjacent teeth were splinted with composite resin for a duration of 2-week. The occlusal relationship of the transplanted tooth and the opposing arch was assessed with occlusion papers to ensure that early contact was avoided. One month after splint removal, the patient attended their first follow-up visit. The condition of the transplanted tooth was monitored periodically with X-rays every 6-month for 5-year.

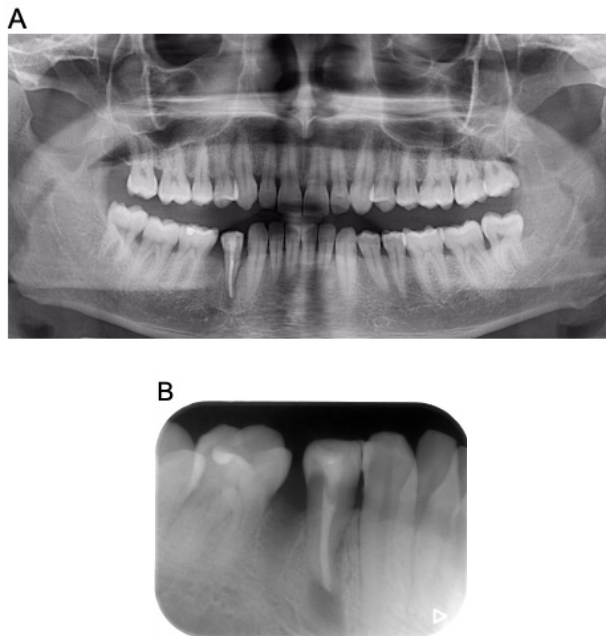


Figure 3. (A) panoramic and (B) periapical radiographs taken from the patient after autotransplantation.

During the follow-up, the patient was examined intraorally, and the root of the tooth was evaluated with X-rays. Throughout the 5-year follow-up period, the patient was able to use the transplanted tooth comfortably, without pain or swelling in the gums. Intraoral examination revealed normal mobility of the tooth without ankylosis, and no color change was observed. Panoramic and periapical X-rays showed no lesions in the periapical region of the tooth.

The patient was not given systemic antibiotics for prophylaxis before or after treatment.

DISCUSSION

Cohen *et al.* (16) highlighted that the optimal age bracket for autotransplantation is between 15- and 19-year old. Additionally, Kim *et al.* (21) identified the primary challenge in autogenous tooth transplantation as obtaining a suitable donor tooth that possesses sufficient root length and volume, ease of extraction, and the absence of periodontal problems.

Various studies have explored the success rates of autotransplantation across different dental groups. Slagsvold *et al.* (19) achieved a 100% success rate in their study

of 34 transplanted premolar teeth, while Tanaka *et al.* (17) reported a similar 100% success rate in their series of 28 premolars over a follow-up period of 4- to 20-year. Kallu *et al.* (10) in their study of 273 teeth with an average follow-up of 3.8-year, reported success rates of 51% for canines, 86.8% for premolars, and 71.1% for molars, highlighting the higher success rate of premolars compared to molars. On the other hand, Akkocaoğlu *et al.* (9) documented the success rates in their series of 96 teeth, including both canines and molars. They reported an 89% success rate in the canine group ($n = 47$) over an average follow-up period of 84 months, and an 84% success rate in the molar group ($n = 49$) over an average follow-up period of 96-month.

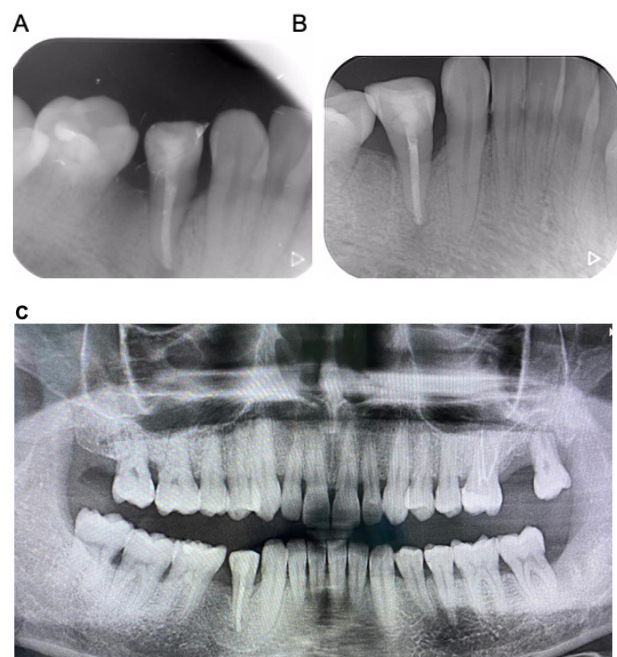


Figure 4. (A) periapical radiograph taken from the patient 3-month follow-up, (B) 6-month follow-up, (C) panoramic radiograph taken from the patient 5-year follow-up.

Studies (10,35) examining the impact of root development level on success rates have yielded varying results. Kristerson's study (26) of 100 premolars indicated that transplantation of teeth with a root development level between $\frac{1}{2}$ and $\frac{3}{4}$ yielded the best prognosis. Similarly, Kristerson and Lagerström (36) reported success rates of 87% for teeth with incomplete root development and 67% for mature teeth. Lundberg and Isaksson (23) following 278 teeth for an average of 6-year, found success rates of 94% for teeth with open apices and 84% for those with completed root formation.

Additionally, some studies (3,5,37) indicate that the transplantation of teeth with fully developed roots can be notably successful. Mejare *et al.* (37) reported an 81.4% success rate in their study of 50 molars with completed root formation, tracked over a 4-year period. In a separate case report, Teixeira *et al.* (5) highlighted the considerable success achieved through autotransplantation of teeth

with fully developed roots. In the case we managed, high success was achieved despite the absence of an open apex.

As noted by various authors, improved blood flow resulting from proper contact between the transplanted tooth and the alveolar bone enhances the viability of cells nourished by the periodontal ligament (1,5,10). In their study on blood flow, Tronstad *et al.* (38) reported that while tight contact between the recipient site and the tooth is beneficial for blood flow, excessive pressure can cause root resorption due to irreversible damage to the periodontal ligament. OrthoMTA is an innovative orthograde root canal material that is unaffected by moisture or blood. It provides good sealing ability, biocompatibility, good radio-opacity, anti-bacterial effect, has no heavy metal, no expansion, easy handling and retrievability, with a setting time of 3 min (39). In this case, we aimed to create tight contact between the transplanted tooth and the recipient area. Additionally, before starting the procedure, we performed root canal treatment while the tooth was still in the mouth and filled the entire root with MTA to ensure maximum coronal sealing and to prevent root resorption.

Prolonged extra-oral time during transplantation may compromise the viability of healthy periodontal ligament cells, potentially leading to adverse outcomes such as periradicular inflammation or root resorption (1,3-5,13,21). However, some studies have questioned this correlation. For instance, Kim *et al.* (21) in their investigation into the causes of failure in 182 autogenous tooth transplantations, reported a failure rate of 4.5% and found no statistical relationship between the occurrence of external root resorption or ankylosis and extra-oral time exceeding 25 min. During the procedure, while preparing the recipient socket, we touched only the crown part of the tooth to minimize damage to the periodontal ligament cells. The procedure was completed within 15 min.

Other causes of failure have been investigated in different studies. Thomas *et al.* (4) reported that insufficient buccolingual or buccopalatal width at the recipient site may lead to resorption on the alveolar ridge.

Bauss *et al.* (25) in their study investigating the effects of different splinting methods and fixation times on the success of autotransplantation, reported that long-term and rigid fixation negatively affected transplantation success. In our study, after the extraction of the first premolar tooth, it was observed that the alveolar socket was not suitable for the transplantation of the tooth root. Consequently, the recipient socket was prepared using surgical drills, and a rigid splint was applied to reduce tooth mobility within the socket. The splint was removed after 2-week to prevent ankylosis.

In this case report, despite approximately 2 mm of bone loss observed in the interproximal region, follow-ups over 5-year revealed no indications of pain, mobility, ankylosis, or root resorption.

Although autotransplantation is not a frequently used procedure, it remains a viable alternative to implant and prosthetic treatments due to its cost-effectiveness. It offers satisfactory aesthetics and functional outcomes while preserving alveolar bone quality and quantity. However, it is important to acknowledge that predicting treatment outcomes is not always certain, and potential complications that could lead to the loss of the transplanted tooth should be considered. In the presented case, a 5-year follow-up of the patient revealed no criteria indicating failure of the transplanted tooth (Figures 1-4).

Author Contribution Statement:

Case preliminary diagnosis and follow-up, article writing: B.M.; A.J.; N.B; C.Ö.; P.K.

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Conflict of Interest:

None of the authors mentioned in this case report are or there is no conflict of interest with the organization.

Ethics Committee Approval:

Consent was obtained from the patient. Ethics Committee Approval Certificate was not required.

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