

Long-term follow-up and evaluation of transplantation of fully developed teeth

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Transplantation of fully developed third molars to second or first molar sites, with long-term follow-up and evaluation up to 13 years postoperatively, will be described in this article. Two of the cases involve transplantation of maxillary third molars to maxillary first molar sites, and two involve transplantation of mandibular third molars to mandibular first molar sites; one of these mandibular third molars was transplanted to the first molar site on the opposite side of the mandible. In one of the cases a mandibular third molar was transplanted to the mandibular second molar site.

Four cases of autogenous dental transplants have been reported¹ in which three of the molars were fully developed (cases 2 and 4). The patient in case 4 in this group was seen 4 years postoperatively, and in one of the transplants there was demonstrated deposition of secondary calcification in the root canals and pulp chamber and there was no evidence of resorption.

A case of transplantation of a mandibular third molar into an edentulous mandibular first molar site has been reported.² The third molar was not quite fully developed. When this patient was seen 6 years postoperatively, the radiograph made at that time showed deposition of secondary calcification in the root canals and pulp chamber. Also, there was demonstrated completion of the development of the roots of the tooth and growth of a new attachment, with lamina dura and periodontal membrane space, as shown in the postoperative radiograph made at the 6-year follow-up visit.

Early experimental work in the transplantation of teeth included the research of Glasstone,³ Hahn,⁴ Shapiro and MacLean,⁵ and Agnew and Fong.⁶ A symposium on the transplantation and repositioning of teeth⁷ was published in 1956.

Massler,⁸ in his study of pulpal reactions to dental caries, made the following statement: "In all cases, except when the pulp is actually invaded by instrumentation or micro-organisms, the response of the pulp is productive and not degenerative. Sclerosis of the underlying dentine and reparative dentine formation is the rule not the exception." Massler⁸ also stated that "the healing potential of the dentine-pulp organ is much higher than implied in the past."

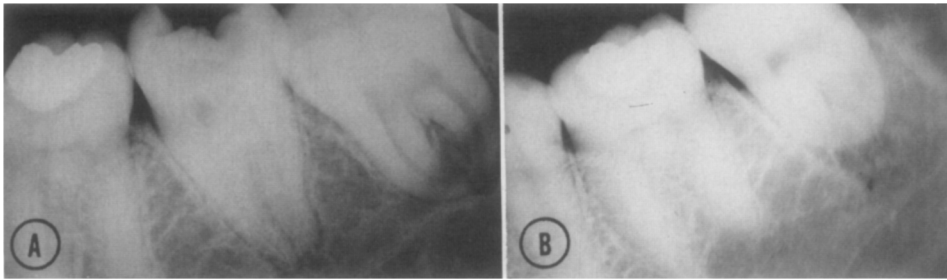


Fig. 1. Case 1. **A**, Radiograph made preoperatively showing mandibular second molar to be removed and third molar to be transplanted. **B**, Radiograph made postoperatively at time of surgical procedure.

Scheinin, Pohto, and Luostarinen⁹ studied the repair following the experimental traumatization of the pulp, especially as it deals with vascular reactions. They stated that repair in the pulp is demonstrated by a wide range of calcifications, from crude calcified deposits to fully mineralized secondary dentin, and that the structure of these formations depends largely on the conditions of the circulation in the dental pulp.

Weinreb, Sharav, and Ickowicz,¹⁰ in studying the recuperative capacity of the pulp, stated that the purpose of their investigation was "to show that pulpal tissue is endowed with enormous recuperative capacities, far beyond those normally described in histological investigations of clinical procedures. Any possible limitations in the healing capacity of pulps in situ are due to their anatomic location rather than to any inherent deficiency in the tissue itself."

Fisher¹¹ made a study of the posttraumatic formation of hard tissue in the pulp chamber.

CASE REPORTS

The five case reports that follow describe successful transplantation of fully developed third molars in patients in whom it was possible to evaluate results on long-term follow-up visits from 10 to 13 years postoperatively.

None of the five patients was interested in root canal therapy for the involved molar, but each patient was interested in hearing about the possibility of transplanting the third molar into the site where the first or second molar was to be removed.

In all five of these patients the surgery was performed in the office using local anesthesia, and the patients were seen on numerous occasions postoperatively for follow-up and evaluation.

The surgical approach for these cases was from the buccal aspect of the maxilla or mandible. The mesial incision was an angular incision, starting at the interproximal area between the first and second premolars and angling mesially toward the mucobuccal fold. The distal incision was made distally from the second molar and extending into the ramus or tuberosity regions. The transplants were positioned into the recipient sites in occlusion with the opposing molar when possible, or, as in the case of the patient in Case 4, the third molar transplant, which was considerably smaller than the recipient site between the crowns of the second molar and the second premolar, was placed superiorly in the site approximately 2 mm. out of occlusion. The transplants were all placed in a normal position buccolingually in the recipient site in relation to the adjacent teeth and the form of the arch. Occlusion of the transplants in the recipient sites was checked and adjustment was made for any occlusal traumatism. The transplants were stabilized by suturing the tissues tightly about the



Fig. 2. Case 1. Radiograph made at the 13-year postoperative visit showing deposition of secondary calcification in root canals and pulp chamber, regeneration of supporting structures of transplant, and filling-in of bone in lateral and periapical areas. Lamina dura and periodontal membrane space are shown.

transplants. One suture was placed between the second premolar and the transplant buccolingually, one suture was placed in the interproximal area buccolingually between the transplant and the second molar, and one suture was placed buccolingually over the occlusal surface of the transplant in the region of the buccal groove. In the case of the mandibular molar transplants from third to first molar sites and in one case of transplantation of a maxillary third molar to a first molar site, there was good fit of the transplant between the second premolar and the second molar when the transplants were placed in normal occlusion and in a normal position buccolingually in relation to the arch. In the case of the patient in whom a tooth was transplanted into the mandibular second molar site, the transplant was placed in a normal position in approximate occlusion and in normal arch relationship, and the transplant was stabilized by suturing of the tissues over the buccal cusps of the transplant and by suturing in the interproximal region between the transplant and the first molar. Sutures in these cases were removed after about 10 days. Patients were checked periodically for occlusal traumatism, and adjustments were made if trauma were detected.

CASE 1

A woman, 20 years of age, was referred to the office because of pain in the left posterior region of the mandible. A radiograph (Fig. 1, *A*) demonstrated a deeply carious mandibular left second molar which was responsible for the pain. This radiograph also demonstrated a vertically impacted mandibular left third molar which would serve as a donor for transplantation into the site where the second molar was to be removed. The second molar was removed and the second molar site was prepared. The third molar then was prepared for removal and transplanted directly into the prepared second molar site (Fig. 1, *B*), and the tissues were sutured. At the 13-year postoperative visit, the radiograph (Fig. 2) shows considerable deposition of secondary calcification in the root canals and pulp chamber. The periodontal tissues were in excellent condition. There had been growth of new attachment, with lamina dura and periodontal membrane space demonstrated in the radiograph (Fig. 2) made at this long-term follow-up visit, and there had been regeneration of periapical and lateral bone. A restoration had been acquired in the transplant, but the patient had no complaints related to the transplanted tooth at this long-term follow-up visit.

CASE 2

A 17-year-old boy came to the office because of pain in the right posterior region of the mandible. The cause of the pain was deep dental caries involving the pulp in the right mandibular first molar (Fig. 3, *A*). The radiograph (Fig. 3, *A*) also demonstrated a third molar impacted in the

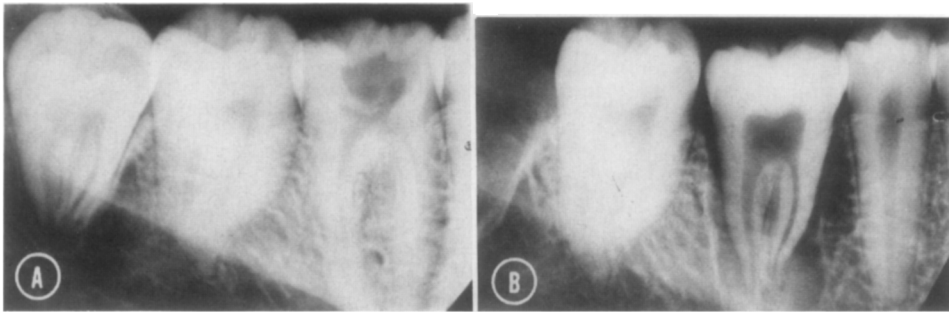


Fig. 3. Case 2. **A**, Radiograph made preoperatively showing mandibular first molar to be removed and third molar to be transplanted. **B**, Radiograph made postoperatively at time of surgery.

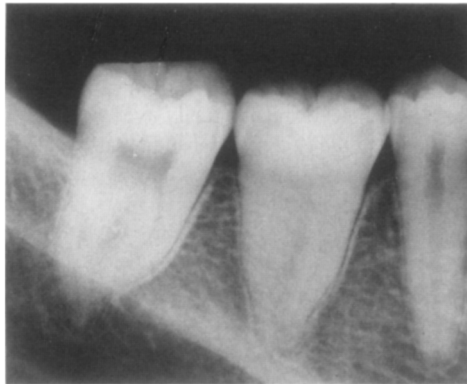


Fig. 4. Case 2. Radiograph made 13 years postoperatively showing deposition of secondary calcification in root canals and pulp chamber, filling-in of bone in lateral and periapical areas, and regeneration of supporting structures of tooth as demonstrated by lamina dura and periodontal membrane space. There is no evidence of resorption.

right side of the mandible which was suitable as a donor for transplantation into the first molar site. The first molar was removed and the site then was prepared for receiving the third molar. The third molar then was prepared for removal and transplanted directly into the first molar site (Fig. 3, *B*), and the tissues were sutured. At the 2-year postoperative visit, the region of the buccal plate of the transplant was exposed surgically, and there was evidence of regeneration of the bone of the buccal plate. At the 13-year postoperative visit, the patient had no complaints related to the transplant. A radiograph made at this visit (Fig. 4) shows growth of new attachment as demonstrated by lamina dura and periodontal membrane space. Deposition of considerable secondary calcification in the pulp chamber and root canals is shown in this radiograph (Fig. 4), and there was no evidence of resorption.

CASE 3

A woman, 23 years of age, was referred to the office because of pain in the left maxillary molar region. A radiograph (Fig. 5, *A*) demonstrated deep dental caries in the left maxillary first molar, which was the cause of the pain, and the radiograph also showed a left maxillary third molar that would be suitable as a donor for transplantation into the first molar site. The first molar was removed

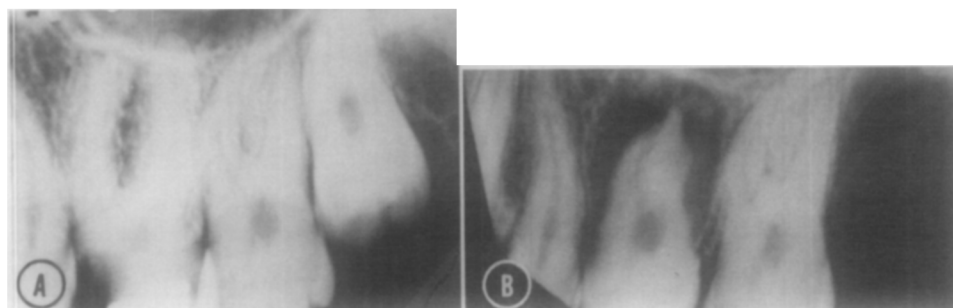


Fig. 5. Case 3. **A**, Radiograph made preoperatively showing maxillary first molar to be removed and third molar to be transplanted. **B**, Radiograph made postoperatively at time of surgical procedure.

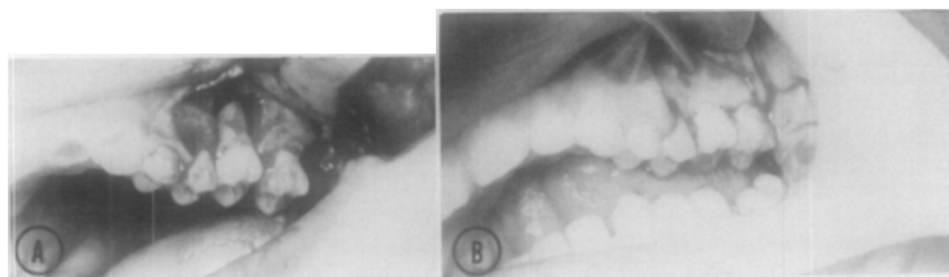


Fig. 6. Case 3. **A**, Photograph showing appearance of region of buccal plate at time of surgical procedure. **B**, Appearance of buccal plate when surgically exposed 1 year postoperatively showing regeneration of bone of the buccal plate as compared with appearance of region of buccal plate at time of surgical procedure.

and the site prepared to receive the third molar. The third molar was prepared for removal and transplanted into the first molar site (Fig. 5, *B*), and the tissues were sutured. At the 1-year postoperative visit, the buccal plate of the transplanted tooth in the first molar site was exposed surgically. The photograph made at that time (Fig. 6, *B*) shows regrowth of the buccal plate as compared with the photograph of the region of the buccal plate (Fig. 6, *A*) at the time of the surgical procedure. At the long-term postoperative visit, 10 years postoperatively, the periodontal tissues were in excellent condition, and the radiograph (Fig. 7) made at that time showed secondary calcification in the root canals and pulp chamber, regeneration of bone in the lateral and periapical areas, growth of new attachment, and very little, if any, resorption of the tooth. A restoration had been acquired, but the patient had no complaints about the transplanted tooth.

CASE 4

A 22-year-old woman was referred to the office because of severe pain in the left posterior region of the maxilla. It was determined that the left maxillary first molar was the cause of the pain. The radiograph (Fig. 8, *A*) made preoperatively shows the first molar to be removed and also shows an impacted third molar which could be used as a donor for transplantation. The first molar was removed and the site prepared to receive the third molar. The third molar then was prepared for removal and transplanted into the first molar site (Fig. 8, *B*). When the patient was seen 10 years postoperatively, tissues were in excellent condition. The transplant, which at the time of transplantation had been positioned about 2 mm. out of occlusion, had erupted into occlusion. There had been regeneration of bone in the periapical and lateral areas, with new attachment demonstrated by

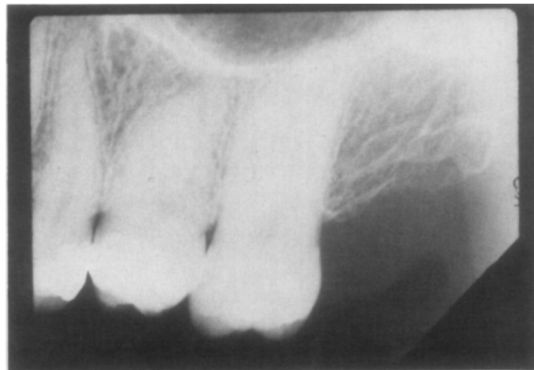


Fig. 7. Case 3. Radiograph made 10 years postoperatively showing deposition of secondary dentine in root canals and pulp chamber, regeneration of bone in lateral and periapical areas, and growth of new attachment.



Fig. 8. Case 4. **A**, Radiograph made preoperatively at time of surgical procedure showing maxillary first molar to be removed and maxillary third molar to be transplanted. **B**, Radiograph made postoperatively at time of surgical procedure.

lamina dura and periodontal membrane space in the radiograph made at that time (Fig. 9). Also, the radiograph demonstrated deposition of secondary calcification in the root canals and pulp chamber, and there was no evidence of resorption. The patient had no complaints related to the transplanted tooth.

CASE 5

A 17-year-old girl came into the office because of severe pain in the left posterior region of the mandible. A radiograph (Fig. 10, *B*) made at that time showed deep dental caries involving the pulp of the left mandibular first molar. The mandibular third molar on the same side of the mandible as the tooth to be removed was horizontally impacted (Fig. 10, *B*), and it was determined that this third molar would not be suitable as a donor for transplantation because it appeared that it could not be removed in one piece. However, there was a vertically impacted third molar (Fig. 10, *A*) on the opposite side of the mandible which, it was thought, could be removed successfully in one piece and could serve as a transplant donor for the left mandibular first molar site. The left mandibular first molar was removed and the site prepared to receive the right mandibular third molar. The right mandibular third molar then was prepared for removal and transplanted directly into the left mandibular first molar site (Fig. 11), and the tissues were sutured. At the long-term follow-up visit 13



Fig. 9. Case 4. Radiograph made 10 years postoperatively showing deposition of secondary calcification in root canals and pulp chamber, regrowth of bone in periapical and lateral areas, and growth of new attachment as demonstrated by lamina dura and periodontal membrane space. There is no evidence of resorption.

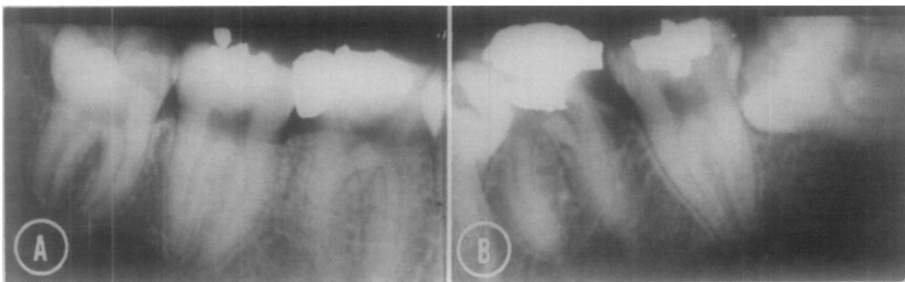


Fig. 10. Case 5. **A,** Radiograph made preoperatively showing mandibular third molar on opposite side of mandible to be transplanted into the first molar site on the left side of the mandible. **B,** Radiograph made preoperatively showing mandibular first molar to be removed.

years postoperatively, the patient had no complaints related to the transplant. She had acquired a restoration in the tooth and had undergone orthodontic treatment in the meantime. The transplant had provided no obstacle to the orthodontic treatment. The periodontal tissues of the transplant were in excellent condition. The radiograph (Fig. 12) made at that time showed deposition of secondary calcification in the root canals and pulp chamber, growth of new attachment with lamina dura and periodontal membrane space demonstrated in this radiograph (Fig. 12), regeneration of bone in the lateral and periapical areas, and no evidence of resorption.

SUMMARY

Five cases of transplantation of fully developed third molars to second or first molar sites have been reported. Three of the transplants were in the mandibular molar region and two were in the maxillary molar region. There has been long-term follow-up and evaluation of the patients in these cases up to 13 years postoperatively.

None of the patients had any complaint about the transplanted tooth at the long-term follow-up visit. In all five cases, at the long-term follow-up visit, the periodontal tissues were in excellent condition and there was growth of new attachment, as demonstrated by lamina dura and periodontal membrane space in the follow-up radiographs, deposition of



Fig. 11. Case 5. Radiograph made postoperatively at time of surgical procedure.



Fig. 12. Case 5. Radiograph made at 10-year postoperative visit showing deposition of secondary dentin in root canals and pulp chamber, growth of new attachment with lamina dura and periodontal membrane space, and regeneration of bone in lateral and periapical areas. There is no evidence of resorption.

secondary calcification of varying amounts within the root canals and pulp chamber, and regeneration of bone in the periapical and lateral areas. There was very little, if any, resorption demonstrated in any of these five cases. The ages of patients ranged from 17 to 23 years at the time of transplantation. Regeneration of the buccal plate was demonstrated by photographs in one of the two cases where there was surgical exposure of the region of the buccal plate at a postoperative follow-up visit.

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