

# CASE REPORT

## Autotransplantation of a Permanent Maxillary Incisor

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**T**his report documents an autotransplantation used to restore the space left by an inverted and impacted permanent maxillary incisor in an adolescent patient.

### Diagnosis and Treatment Planning

A 12-year-old female presented with a severe Class II malocclusion with open bite, excessive overjet, and upper crowding that left no space for the eruption of the left cuspid (Fig. 1). The radiograph showed the left permanent incisor inverted 180° on its long axis. A supernumerary tooth was also observed adjacent to the inverted incisor.

An accidental traumatic injury to the deciduous maxillary

central incisor had occurred about eight years earlier. Her parents reported that she had suffered an intrusion of the deciduous tooth, which might have caused some damage to the permanent tooth germ.

A pediatric dentist extracted the supernumerary tooth and a resorbed deciduous incisor (Fig. 2). The main goal of orthodontic treatment was to maintain the alveolar bone for future

restorations and to preserve the central incisor during the patient's adolescence, since she had no other alternative for tooth replacement at that time. The parents were informed of the risk that this treatment could fail.

### Surgical Procedure

The inverted incisor was extracted under local anesthesia. A full-thickness flap was laid,



**Fig. 1** 12-year-old female with severe Class II malocclusion, inverted permanent left maxillary incisor, and adjacent supernumerary tooth.



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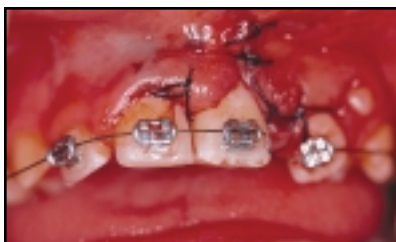
**Fig. 2** Extraction of supernumerary tooth and resorbed deciduous incisor.

with vertical incisions at the level of the distally adjacent teeth. The gingival periodontal fibers were incised with a scalpel. The alveolar vestibular bone was lifted and left attached to the base of the flap (Fig. 3). After the incisor was properly repositioned, the flap was closed over the alveolar bone and sutured with simple Ethicon 4-0\* stitches.

The tooth was extracted in a labial direction because its long axis was facing the apex of the adjacent teeth, and extracting it through the alveolus might have damaged the periodontal fibers. Particular care was also taken to minimize periodontal ligament damage, which can be caused by



**Fig. 3** Surgical autotransplantation procedure.



**Fig. 4** Stabilization of transplant with fixed appliances.

excessive compressive forces or prolonged extra-alveolar exposure.

The incisor socket did not need to be modified because of the recent extraction of the supernumerary tooth. Although the root apex of the incisor was complete, which was a clear disadvantage, we decided to assume that risk.

Stabilization was achieved with a  $2 \times 4$  appliance consisting of .018" standard edgewise brackets and bands\*\* and a passive .014" stainless steel archwire (Fig. 4).

Three weeks later, the non-vital pulp of the transplanted tooth was extirpated, and the canal was dressed with non-setting calcium hydroxide paste<sup>1</sup> (Fig. 5). This was changed monthly until seven months later, when final endodontic treatment was performed.<sup>2</sup>

### Results

Some orthodontic tooth movement was carried out after three months of stabilization, but the complete orthodontic treatment plan was declined by the patient due to financial problems. Fixed appliances were removed four months after the surgery, and the patient continued to report for follow-up of the autotransplantation procedure.

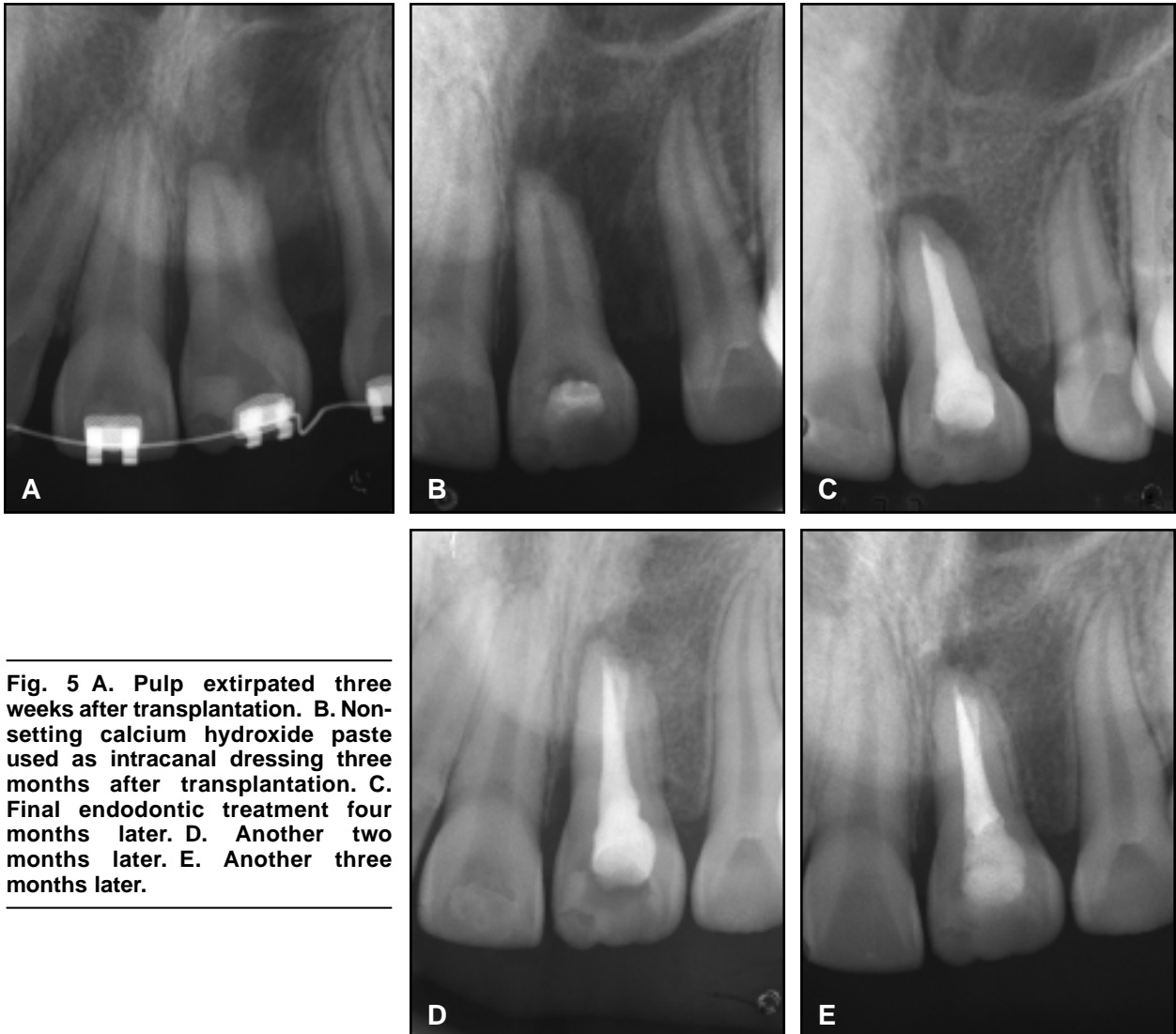
Periodic checkups showed integrity of the periodontal tissues, with no mobility, inflammation, bleeding, or pockets (Fig. 6). Radiographically, there was no evidence of external root resorption, and progressive healing of the periapical lesion was observed (Fig. 5).

### Discussion

Allotransplantation, refer-

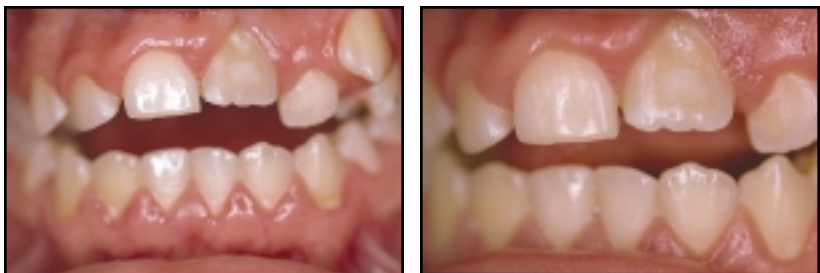
\*Ethicon Products, P.O. Box 151, Somerville, NJ 08876.

\*\*American Orthodontics, 1714 Cambridge Ave., Sheboygan, WI 53082.



**Fig. 5** A. Pulp extirpated three weeks after transplantation. B. Non-setting calcium hydroxide paste used as intracanal dressing three months after transplantation. C. Final endodontic treatment four months later. D. Another two months later. E. Another three months later.

ring to the movement of a tooth from one individual to another, dates from ancient Egypt, where slaves used to “donate” their teeth to the pharaohs. This process continued for centuries, but lost favor in the 18th century after its implication in the transmission of infectious diseases. Recent reports of allotransplan-



**Fig. 6** One year after autotransplantation, with no mobility, inflammation, bleeding, or periodontal pockets.

tation demonstrate a low success rate, probably due to histoincompatibility.<sup>3,4</sup>

Autotransplantation, involving the movement of a tooth from one area of the mouth to another in the same individual, has been widely reported over the past 40 years.<sup>5,6</sup> Despite its long history, however, tooth transplantation has not been a conventional treatment method for children or adolescents with absent or inverted maxillary incisors. The problem of missing anterior teeth has traditionally been solved through orthodontic space closure and/or prosthetic restoration.<sup>2</sup>

In many cases, the lateral incisor can be moved into the edentulous space and restored to simulate a central incisor. A good esthetic result may be difficult to achieve, however, because of the narrow cervix of the lateral incisor. An osseointegrated implant would be contraindicated during a child's growth because of possible failure in situations such as ankylosis.<sup>3</sup> Autotransplantation will preserve alveolar bone, even if the transplant fails at some point, thus facilitating the placement of an osseointegrated implant once the child's growth has been completed.

Donor teeth and the recipient alveolus should be carefully assessed before electing transplantation. A donor tooth with half to three-quarters of its full

root development offers the most favorable prognosis because less force is required to remove the tooth, so that less damage to the periodontal ligament will occur.<sup>7</sup> Kugelberg and colleagues showed that in the majority of immature donors, root development continued without complication.<sup>8</sup> An open apex is said to increase the chance of revascularization and re-innervation of the dental pulp, but the latter may not be evident for as long as one year after transplantation.<sup>3</sup>

A tooth that exhibits near or fully complete root development is not necessarily ruled out as a donor tooth. Revitalization of teeth with closed apices has been documented.<sup>1-7</sup> Andreasen and colleagues found, however, that the incidence of pulp necrosis and root resorption was greater in mature premolar transplants because of their closed apices.<sup>3</sup> If the root apex is near closure or closed, pulp extirpation should be carried out seven to 14 days after transplantation. Retrograde endodontic treatment of the donor tooth during the extra-alveolar period should be avoided, because this may damage the periodontal ligament cells and lead to ankylosis. If a donor tooth with incomplete root formation shows evidence of irregular root development or external root resorption, endodontic treatment should be performed to induce apical closure and reduce the possibility of pro-

gressive external resorption.

A careful surgical technique that preserves the periodontal ligament and the marginal gingiva is critical. The recipient alveolar bone area must be cut 1-2mm larger and deeper than the dimensions of the donor root. This will allow the periodontal ligament to induce new bone formation, just as cells in the fibrocartilage can be activated with proper biomechanics.<sup>9</sup> A new alveolar socket will form in one to two months.<sup>10,11</sup>

Orthodontic movement of the transplant may be initiated three to nine months after surgery without interfering with normal periodontal and pulpal healing.<sup>12-14</sup> While surface root resorption of the transplanted tooth should be expected,<sup>15,16</sup> any apical root resorption is usually minor.

In the present case, the donor tooth showed greater than three-quarter root formation, and we expected its removal from the alveolus to render the pulp nonvital. Endodontic treatment was not begun immediately. The pulp was extirpated three weeks after transplantation, and the intracanal dressing was changed monthly to promote apical closure and to allow access if apical resorption or periapical inflammation occurred.<sup>2</sup> Final endodontic treatment was performed seven months later.

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