

Australian Society  
of Orthodontists



THE UNIVERSITY OF  
SYDNEY



## Autotransplantation of Teeth

*Creating Brighter Futures*

# Autotransplantation of Teeth

Autotransplantation of teeth is the surgical movement of a tooth from one location to another in the same mouth.<sup>1</sup> The method for autotransplanting immature teeth was developed 30 years ago by Drs Slagvold and Bjercke and has received increasing attention in recent years.<sup>3,4</sup> Transplanted teeth have the capacity for functional adaptation and preservation of the alveolar ridge,<sup>1</sup> with long-term studies reporting levels of success and survival ranging from 79%–100%.<sup>1,5–10</sup>

The key to a successful procedure is careful case selection and the surgical technique.<sup>11</sup> The morphology of premolars provides a favourable option for autotransplantation and may be indicated as a donor tooth as part of a comprehensive orthodontic/surgical/restorative treatment plan, particularly when removal of premolars is required for orthodontic reasons.

## Factors Affecting Success of Autotransplantation

### Root morphology:

The donor tooth should have a conical, smooth root that will enable an atraumatic extraction. Maxillary first premolars often have two roots and may not be suitable for transplantation.<sup>9</sup> Third molars provide another option for a donor tooth however, these teeth often have complicated root and crown morphology. A localized CBCT may improve the diagnosis and provide valuable information for treatment planning.

### Stage of root development of the donor and apical diameter at the time of transplantation:

It is an important predictor for optimal healing and is recommended to be one-half to two-thirds of the expected final root length root.<sup>5,7,9,12</sup>

### Surgical Skill:

This is a significant factor in the success of the treatment. Meticulous planning and execution of the procedure improves the prognosis.<sup>13,14</sup>

### Recipient site:

Enough space should be provided to accommodate the donor tooth with adequate height and width of the alveolar bone. The donor tooth may be rotated 90 degrees to improve the emergence profile particularly in the anterior maxilla.<sup>12</sup>

### Structured follow-up regimen:

The aim is to monitor periodontal and pulpal complications and a strict follow-up protocol should be established to ensure success of the treatment.<sup>2</sup>

## Treatment Planning

When a tooth is lost after trauma or in a case with multiple missing teeth a multidisciplinary approach is recommended. The first step is to obtain an OPG, in which potential donor teeth, such as canines, premolars and in some cases diminutive third molars, can be identified. When donor teeth are available, the cost-benefit of autotransplantation should be weighed against other treatment solutions such as orthodontic space closure, fixed or removable prosthetic replacement or implants. Preferably a donor tooth should be selected from another dental arch quadrant other than the one with the missing tooth.<sup>1,2</sup>

Other indications for transplantation include agenesis of premolars or lateral incisors where space closure is not indicated.

It is generally the case that the transplant will be part of an ongoing orthodontic treatment plan. It is vital to have a surgeon with the necessary understanding and experience in the procedure to protect the periodontal ligament during transplantation. The best age group are those between 10 and 13 years of age.<sup>1,8</sup> At this stage alveolar bone growth is not yet complete, which contraindicates implant placement and fixed prosthetics.<sup>15,16</sup>

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## Tooth Selection

The primary goals in selecting an appropriate tooth are to ensure optimal periodontal healing and pulp survival, which in turn ensures optimal root development after transplantation. The ideal donor tooth is one with simple root form, one that is at the optimal stage of root development, an easy extraction and of an appropriate size that matches the recipient site.<sup>7-10</sup>

### Premolar to Premolar transplantation

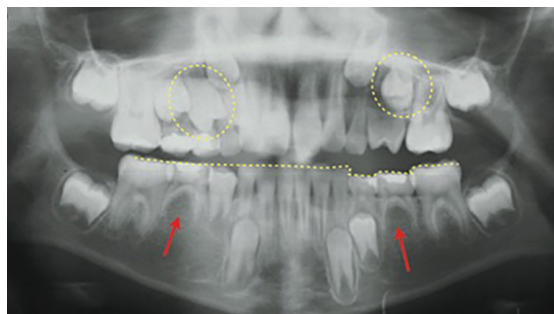


Figure 2: OPG of Patient missing lower second premolars and planned transplantation of Maxillary second premolars

### Premolar to anterior maxilla transplantation:

The case below demonstrates loss of anterior tooth viability due to a history of dental-alveolar trauma. In these cases active inflammation or ankylosis with restricted development of the alveolar bone may be present.

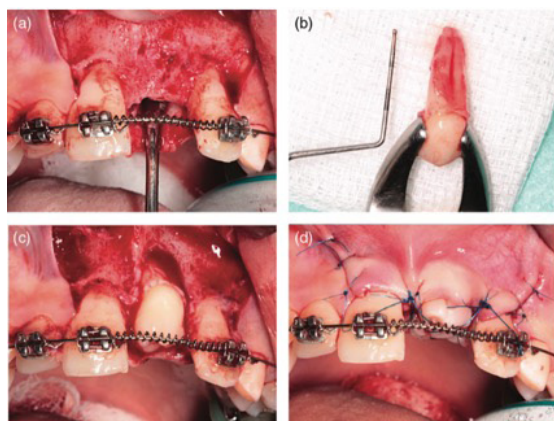


Figure 3: Traumatic loss of the upper left central incisors – at the recipient site the labial cortical bone defect was present after previous avulsion of the upper left central incisors (a). The preparation of the recipient site in the anterior maxilla (the second stage surgery) was performed after initial uncovering of the donor tooth. After elevation, the semi-erupted lower right second premolar was transferred to the prepared recipient site at the gingival level (b). The buccal bone dehiscence resulted from the initial bone defect and surgical preparation of the artificial socket (c). The root of the transplanted premolar and the bone dehiscence were covered with repositioned flap, which was stabilized using sutures (d).<sup>2</sup>

## Follow-Up

Post-operative instructions and follow-up include: appropriate antibiotics, non-steroid anti-inflammatory drugs, ice packs, gentle rinsing with 0.12-0.2% chlorhexidine gluconate, and a soft diet for 7 days. All sutures or stabilising wires should be removed after 10-14 days.<sup>2</sup>

Clinical and radiographic evaluation should be undertaken at four weeks, three months, six months and then annually

if possible to confirm uneventful healing.<sup>2</sup> When healing complications ie. pulpal necrosis or external root resorption are diagnosed, appropriate management should be instituted.

The clinical examination comprises evaluation of the periodontal tissues, which includes measurements of pocket depths, clinical attachment levels, and width of keratinized gingiva, assessment of plaque accumulation and detection of any signs of inflammation and tooth mobility as well as a percussion test for possible ankylosis. The contralateral tooth should serve as a control.<sup>2,5,6</sup>

## Periodontal Healing

Favourable healing of the PDL depends on how many viable cells are preserved on the root.<sup>8</sup> PDL cells can be damaged mechanically during extraction or bio-chemically due to various extra-oral conditions.

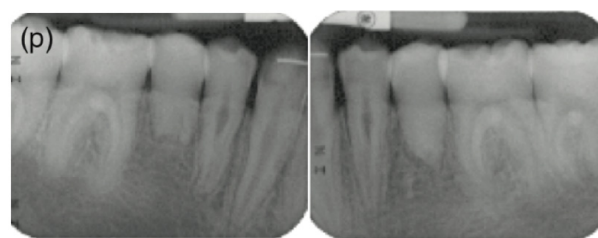
Regeneration is most likely to occur when a donor tooth is implanted into a socket immediately following extraction of another tooth. It will be shown radiographically as a normal continuous lamina-dura. Where there has been damage to the PDL healing will take place by ankylosis (replacement resorption).<sup>9</sup>

## Pulp Healing

In teeth with open apices pulp revascularisation starts shortly after surgery by ingrowth of newly formed blood vessels from the apical part of the root.<sup>17</sup> Radiographically there should be progressive pulp obliteration. This is a common finding after transplantation of developing teeth and should be detected after a few months on the intraoral radiographs. Lack of pulp obliteration might indicate pulp necrosis. If pulp necrosis occurs after transplantation then the transplant requires endodontic treatment.<sup>8</sup>

## Root Growth

Further root growth is to be expected after transplantation of teeth and depends on the initial stage of root development.<sup>10</sup> Usually these teeth develop slightly shorter roots compared to contralateral teeth.<sup>5,12</sup> Final root length of the transplanted tooth is usually reached within two years after surgery.<sup>18</sup> Sometimes root growth does not continue after transplantation, more often noted on teeth that are transplanted at earlier stages of root formation.<sup>10</sup>



## Restoration of Transplanted Teeth

General principles for restoration should apply to transplanted teeth to maintain the health of the pulp and the peridontium.<sup>7-10</sup> The contour and height of the gingival margin should be considered prior to restoring the transplanted tooth and adjunctive periodontal procedure may be indicated.



is published by the Australian Society of Orthodontists (NSW Branch) Inc. in conjunction with the Orthodontic Discipline at the University of Sydney.

The newsletter is intended to help keep the dental profession updated about contemporary orthodontics, and also to help foster co-operation within the dental team.

Without the generous support of Henry Schein Halas and Colgate, who are an integral part of the dental team, this publication would not be possible.

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Correspondence is welcome and should be sent to:

Department of Orthodontics  
University of Sydney  
Sydney Dental Hospital  
2 Chalmers Street,  
Surry Hills NSW 2010

## AUTHOR & EDITORS

Dr Vanessa Hawkins  
PRINCIPAL AUTHOR

Dr Ross Adams  
Dr Chrys Antoniou  
Dr Susan Cartwright  
Prof M Ali Darendeliler  
Dr Ted Peel  
Dr Vas Srinivasan  
Dr Dan Vickers

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## Composite restoration:

This type of restoration can be performed relatively soon after transplantation and can be a temporary measure prior to the definitive restoration. Usually this provisional composite build-up is performed no earlier than 6 months after transplantation with minimal or no grinding of the enamel surface.

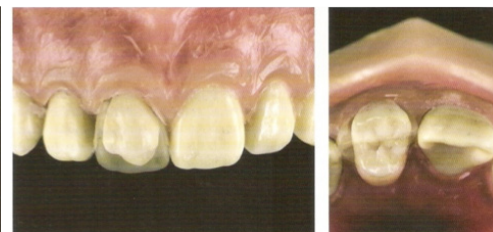
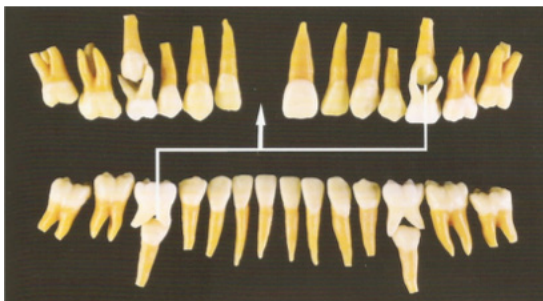


Figure 8. Transplantation of a second premolar into Maxillary central incisor position.

## Ceramic laminate veneers:

The conservative preparation of veneer restoration makes this suitable for restoring aesthetics to the anterior region following premolar transplantation. Although the crown height in younger individuals is very likely to undergo change, the gingival margin of cemented ceramic veneers is aesthetically acceptable despite its eventual visibility.<sup>19</sup> Porcelain veneers also have the best periodontal compatibility with the natural enamel.

Generally, complications after transplantation are seen during the first year post surgery.<sup>8,10</sup> It is therefore recommended that ceramic restorations be postponed until after this time.

Often orthodontic adjustment of the transplant is necessary prior to definitive restoration. In these cases the period of retention must be complete before preparation for veneers otherwise there is a risk of tooth migration.

The overjet, overbite and incisor protrusion need to be evaluated to determine the extent of tooth reduction required to ensure occlusal stability. A bulky palatal cusp can result in lingual pressure and instability of the restoration.

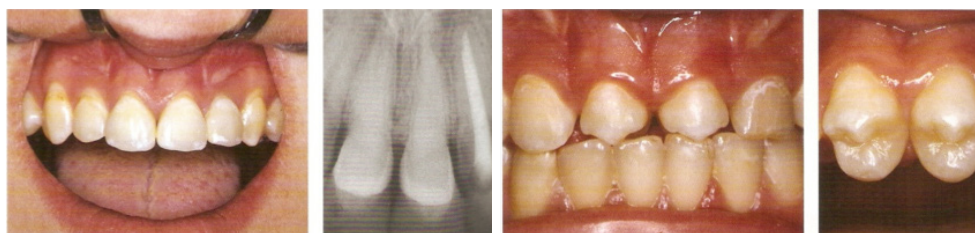


Figure 9: Autotransplanted premolar restored with porcelain laminates

## Conclusion

Tooth auto-transplantation can be considered as an alternative approach in oral rehabilitation for some clinical situations, especially in young patients. It allows bone preservation and re-establishment of a normal alveolar process and soft tissue architecture that will grow and mature as the patient ages. Transplantation of developing premolars in children may have successful outcomes decades later. It requires careful case selection, professional skill, and patient and parent cooperation. This treatment option may also be a temporary measure in young patients in order to preserve bone and provide an aesthetic solution prior to an implant in later years.

## References available upon request

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