

## RESEARCH ARTICLE

# Dental Autotransplantation: The Natural Alternative to Dental Implants

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### Abstract

Most traumatic dental injuries occur in the preteen males, with the maxillary central incisor being the most commonly avulsed tooth.<sup>1,2</sup> When an incisor is lost, its ability to induce growth of the surrounding alveolar bone and gingival tissues is also lost. Therefore, in the maxillary anterior region of a young and growing patient, it is advantageous to replace a missing tooth with a natural tooth that can continue the process of bone induction as the patient continues growing through their teen years. There are currently two techniques to achieve this goal:

- 1) Orthodontic substitution
- 2) Auto transplantation. The methodology and necessary considerations pertaining to autotransplantation are the subject of this publication, and pertinent literature suggests that:
  - a) Ideal donor teeth should be single-rooted, such as a mandibular premolar.
  - b) Donor teeth should be ideally harvested when there is 2/3 to 3/4 root development.
  - c) Surgical technique to avoid damaging the periodontal ligament of the donor tooth is absolutely critical.
  - d) Newly autotransplanted teeth should be stabilized for 6-12 weeks with a light orthodontic wire allowing physiologic movement. If the aforementioned protocols are followed, then a success rate of 90% or more can be expected.

## **1: Definition and rationale**

Autogenous tooth transplantation, or dental autotransplantation, is the extraction of a donor tooth from its original erupted or impacted site to a prepared recipient site or extraction socket in the same individual. One of the most successful and common applications of autotransplantation is the replacement of a missing maxillary incisor with a premolar.<sup>3-7</sup> Most traumatic dental injuries occur in the preteen years, with the central incisor being the most commonly avulsed tooth<sup>1,2</sup>.

### **1.1: Bone induction**

Unlike an implant, a successful autotransplantation of one's own tooth with an intact periodontal ligament will induce growth of alveolar bone and surrounding tissues and will re-establish a normal maxillary alveolar process as the patient continues to grow and mature.

### **1.2: Timing**

If autotransplantation is chosen, orthodontic treatment will need to be timed such that the recipient site will have adequate mesio-distal space to accommodate the donor tooth when the donor tooth has two-thirds to three-fourths root development.<sup>5,7-9</sup>

Fortunately, this stage of root development usually occurs between the ages of 9 and 13, which is the same age as many traumatic dental injuries resulting in loss of an anterior tooth.

### **1.3 Donor tooth selection**

Donor tooth selection starts with measuring the crown size of the contralateral incisor. A mandibular second premolar, owing to its crown size, root shape, and root diameter, is often the best donor tooth to replace a missing central incisor. Although it is ideal when the extraction of a lower premolar will aid in the overall orthodontic treatment plan, this isn't always the case. In this circumstance the space from the donor site can either be closed orthodontically, or the an implant can be placed.

### **1.4 Orthodontic site preparation**

If dental autotransplantation does not occur immediately after tooth loss, there will be dental drifting of the adjacent teeth into the extraction space (Fig 1,2). Therefore, orthodontic site preparation will be necessary to provide adequate space for the donor tooth once it reaches the prime stage of  $2/3$  to  $3/4$  root development.<sup>3-10</sup> (Fig 3).

**Fig 1** Maxillary right central incisor of a 9-year-old boy was traumatically avulsed, and adjacent teeth drifted into the extraction space.



**Fig 2** Panoramic radiograph demonstrating physiologic drifting of adjacent teeth into the space of traumatically avulsed right central incisor.



**Fig 3** Orthodontic site preparation to ensure adequate mesio-distal width for donor tooth.

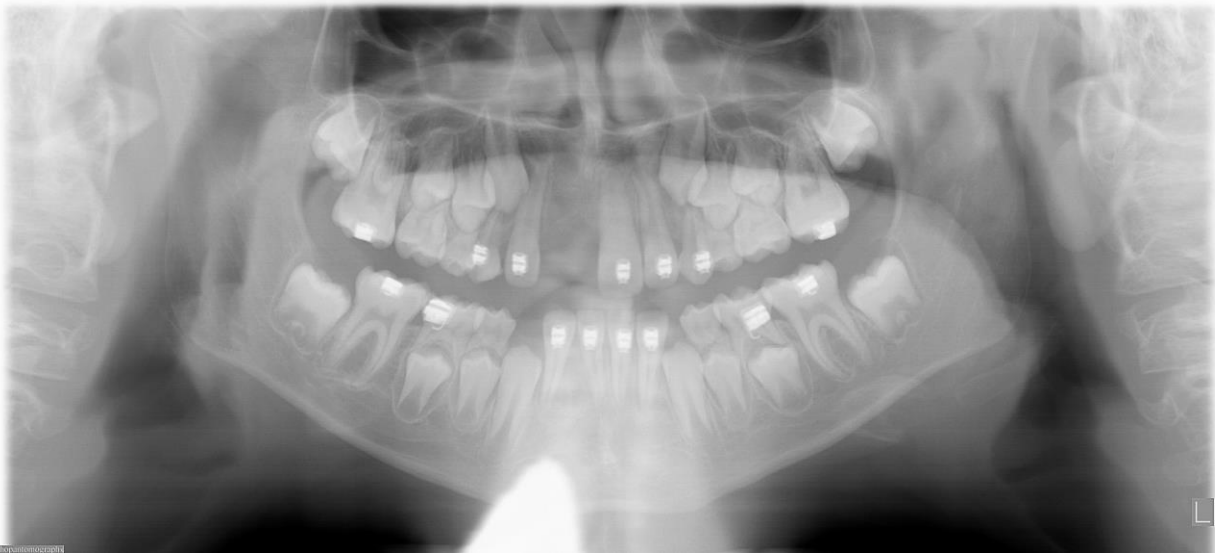
### 1.5 Autotransplantation Procedure

The autotransplantation procedure involves preparation of the recipient site with surgical burs<sup>9</sup>, much like a dental implant site (Fig 5). Next, the donor tooth is carefully harvested, patiently and meticulously, ensuring that the entire dental follicle is intact and undamaged during the extraction process. This is the most critical step of the autotransplantation process. The donor tooth is then placed in the recipient site, insuring that there is no binding, impinging, or compression of the periodontal ligament. Additionally, the tooth should be out of occlusal contact with the opposing dentition. The donor tooth is then sutured into place (Fig 6,7) and stabilized with a light wire splint to allow only physiological movement (Fig 8). Ideally, the recipient site should be slightly wider than the donor tooth, and the remaining

proximal space should be distributed such that one-third of the space lies mesially and two-thirds of the space lies distally (Fig 6). The facial surface of the donor tooth should also be placed approximately 0.5-1.0 mm lingual to the facial surfaces of the adjacent teeth to allow space for a composite or porcelain restoration (Fig 7). The patient is placed on an antimicrobial rinse and soft diet for 6 weeks as a precautionary measure to minimize the function on the donor tooth. Additionally, the patient is instructed to gently clean the area with a cotton swab rather than a toothbrush. While it is the position of some authors to recommend healing for 3-4 months before restoration or application of orthodontic forces, the composite build-up and application of extremely light orthodontic forces can be successfully begun as early as 6 weeks if necessary (Figs 9-11).



**Fig 4** Panoramic radiograph demonstrating 2/3 root development of mandibular left second premolar.



**Fig 5** Site is prepared using dental implant burs.



**Fig 6** Facial view of donor tooth sutured into place at the recipient site.

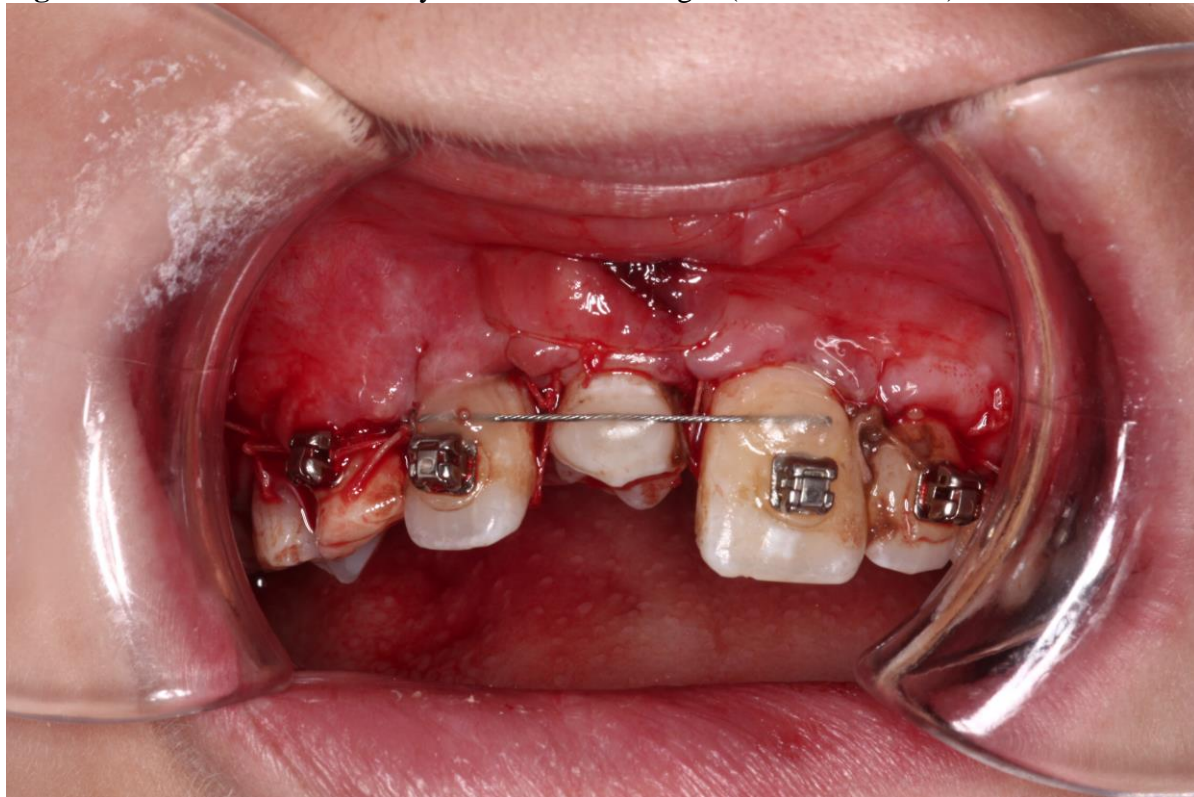


**Fig 7** Occlusal view of donor tooth sutured into place at recipient site





**Fig 8** Donor tooth is immediately stabilized with a light (Nickel Titanium) orthodontic wire.



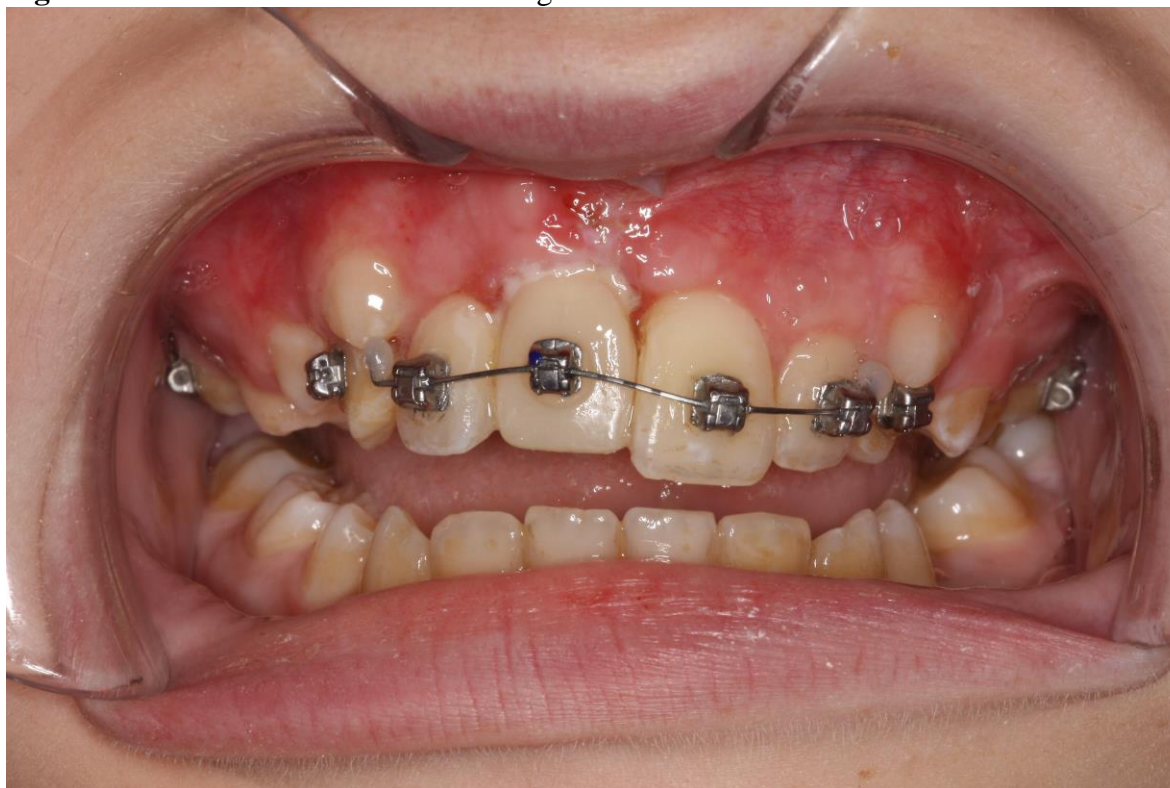
**Fig 9** Stabilization wire removed after 8-12 weeks of healing



**Fig 10** Composite restoration of donor tooth to simulate avulsed tooth.



**Fig 11** Orthodontic bracket bonded and light orthodontic forces initiated





**Fig 12** Final alignment of maxillary incisors



**Fig 13** Ten-year follow up demonstrating longevity of the procedure



**1.6 Risks**

The risks of autotransplantation include ankylosis and pulpal necrosis with either inflammatory resorption or replacement resorption.<sup>9,10</sup> Most likely, these

complications are a result of damage to the periodontal ligament of the donor tooth during extraction. Even in the event of these untoward outcomes, the donor tooth will have facilitated alveolar bone induction

necessary for an osseointegrated dental implant once the child's growth has been completed.

### **1.7 Discussion**

Historically, patients have had missing maxillary anterior teeth replaced by either a removable partial denture (RPD), fixed partial denture (FPD), or dental implant. An RPD typically is affixed to the entire maxillary arch, much like an orthodontic retainer with a pontic tooth. This can lead to reduction in normal maxillary growth during the teen years due to restriction of the natural maxillary development produced by the intimate contact of the tongue to the maxillary teeth. An RPD can also cause embarrassing situations to the patient, as it is usually removed during meals, revealing a missing tooth in the aesthetic zone. The removal of an RPD during meals also increases its chance of being lost or broken if left in a napkin or stuffed in a clothes pocket. FPD's offer an alternative solution; however, they still do not induce bone at the site of the missing tooth. Furthermore, FPD's have been shown to a) have a higher incidence of plaque and gingivitis and 2) have compromised periodontal health in the area compared to a natural tooth.<sup>11</sup> A dental implant is currently considered the "gold standard" for replacing

a maxillary anterior tooth; however, dental implants cannot be placed in growing children, as the alveolar process has not fully developed and early placement of a dental implant will result in the tooth eventually being in infra-occlusion, much like an ankylosed tooth. During the time when the patient is waiting until growth is complete, the alveolus is constantly resorbing horizontally and vertically. This results in the necessity of a bone graft at the future implant site prior to implant placement, and the predictability of bone grafts, particularly in the vertical dimension, is questionable. Even if an esthetic dental is able to be placed after the teen years, there is evidence demonstrating a 50-60% chance of gingival discoloration at the implant site after 5 years.<sup>12</sup> Furthermore, long-term studies still show an unpredictable amount of infraocclusion in dental implants placed on mature adults.<sup>13</sup> With dental autotransplantations, when fastidious care is taken during the surgical and stabilization procedures, long-term survival rates of 98%-100% have been reported.<sup>7,9,10</sup> With such success rates and predictable esthetic results, autotransplantation of a mandibular premolar should be one of the primary methods used to replace a missing maxillary anterior tooth in a growing patient.

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