

## Primary canine auto-transplantation: a new surgical technique

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**Objective.** The aim of this study was to investigate whether the growth of soft tissue and bone in children with traumatic tooth loss or agenesis of teeth can be developed reliably, using a new technique of autogenous primary canine transplant.

**Study Design.** A total of 10 patients (age range, 7-13 years) were treated either for trauma or for agenesis (n = 14 primary canine transplants). In addition to the clinical examination, patients were subjected to radiologic examinations with regard to root resorption, bone height, and soft tissue level.

**Results.** With an average survival rate of 87%, the average survival time of the transplants using the Kaplan-Meier estimator was 5.2 years. In all cases, soft tissue and bone growth was effectively developed.

**Conclusions.** Autogenous primary canine transplant is a reliable surgical method for rehabilitating children in the early mixed dentition after traumatic tooth loss, enabling adequate soft tissue and bone growth. (Oral Surg Oral Med Oral Pathol Oral Radiol 2014;■:e1-e12)

The lack of a permanent upper incisor, either due to traumatic loss in the early mixed dentition (ages 6 to 10 years) or due to congenital tooth agenesis, always presents the dentist with the difficult task of satisfactorily rehabilitating the affected patients in terms of both aesthetics and function. Epidemiologic studies have found that in Europe, every second child experiences a tooth trauma before the age of 16 years<sup>1,2</sup>; 8% to 10% of all dental injuries are injuries with loss of permanent teeth.<sup>3</sup> In contrast to traumatic tooth loss, multiple aplasia of teeth is rather rare in the maxillary anterior region. Nevertheless, it presents the dentist with a difficult task, as natural bite raising with alveolar process growth does not occur, owing to the absence of tooth development. The incidence of aplasia in adolescent dentition is found to be approximately 8%.<sup>4</sup> The loss of a permanent tooth in adolescent dentition, and also agenesis of the corresponding tooth, is always accompanied by an inhibition of the vertical and horizontal alveolar process growth.<sup>5</sup> Especially between the ages of 6 and 10 (in the so-called early mixed dentition), a fixed restoration of existing primary or traumatically incurred tooth gaps is not possible because during this time, neither orthodontic gap closure nor endosseous implantation are available as treatment options. Endosseous implants placed before the completion

of jaw growth lead to growth inhibition in the respective region.<sup>6-8</sup>

The therapeutic concepts for the treatment of traumatic anterior gaps or tooth agenesis in this aesthetically and functionally important region can be performed by various treatment methods; the favorite option should be the orthodontic gap closure, which has an important indication for the closing of the tooth gap of the upper lateral incisors. For a central front tooth gap, however, this is not applicable as a therapeutic option for technical reasons. Because this orthodontic treatment is possible only in late mixed dentition with the breakthrough of the upper canine, this form of therapy is ruled out for the primary and early mixed dentition (6 to 10 years). In the absence of alternative fixed therapies, the most commonly used method of gap closure is therefore the prosthetic rehabilitation of children with either fixed or removable prosthetics (e.g., adhesive bridge, child dentures). An additional therapy that has gained little attention so far is autogenous primary canine transplant, which is the only treatment measure that can quickly rehabilitate children both in terms of aesthetics and function.<sup>9</sup> The particular advantage of this method is its potential to induce bone and soft tissue growth and to develop these as is appropriate for the child's age.<sup>1,6,10</sup>

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### Statement of Clinical Relevance

Primary canine autotransplantation is a new therapeutic approach for rehabilitating children with loss of a permanent incisor. The aim is to treat sustainably and quickly the local defect caused by agenesis or trauma while inducing bone and soft tissue growth.

**Table I.** Optimal time windows for autotransplant of primary teeth

Localization	Breakthrough (mo)	End of RF (y)	Circa 50% of RF (y)	Optimal time window for autotransplant (y)
Upper primary incisors	7½-9	1½-2	5¼-6	until 5¼-6
Lower primary incisors	6-7	1½-2	4¾-5	until 4½-5
Upper primary canines	18	¾	9½	until 9½
Lower primary canines	16	¾	8½	until 8½

Generally, it can be said that the root length of the grafts should have a minimum length of 50% of the total root length for autotransplant. *autoTX*, autogenous transplant; *RF*, root formation.

Modified from Logan and Kronfeld (1933)<sup>27</sup> and Nolte et al. (2013).<sup>13</sup>

**Table II.** Number of autotransplanted primary canines sorted by donor and recipient site

Donor site			Recipient site					Sum	%
			Maxilla						
			Right upper quadrant		Left upper quadrant				
			Incisors		Incisors		Premolar		
			Lateral	Central	Central	Lateral	First		
Maxilla (n = 4)	Primary canine	Right upper quadrant	-	-	-	-	-	0	0
		Left upper quadrant	-	2	-	1	1	4	29
Mandible (n = 11)	Primary canine	Right upper quadrant	-	1	2	1	-	4	29
		Left upper quadrant	1	2	1	2	-	6	43
<b>Sum</b>			<b>1</b>	<b>5</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>14</b>	
<b>%</b>			<b>7</b>	<b>36</b>	<b>21</b>	<b>29</b>	<b>7</b>		

In 1 patient with aplasia of 9 teeth, a primary canine was transplanted to the region of a first premolar (n = 10 patients; n = 14 transplants).

In contrast to the only article previously published on this topic,<sup>9</sup> we are presenting a new technique of autogenous primary tooth transplant, in which endodontic treatment of primary teeth is consciously avoided. The primary objective of this technique is not only to achieve satisfactory aesthetics but especially to have a positive effect on the expected growth of the edentulous jaw section. The method must be understood as a temporary measure taking advantage of the natural resorption (exfoliation) of primary teeth for the codevelopment of the affected jaw section. The decision to use this method should therefore be made in the time window during which primary canines with sufficient root length are still available for transplant (Table I).

## MATERIALS AND METHODS

### Patients

In the period from 2005 to 2013, 10 patients (6 girls, 4 boys) between the ages of 7 and 13 years (mean age, 9.0 years) with tooth agenesis or lost teeth in the maxillary anterior region were treated with a total of 14 primary canine transplants. Of these transplants, 10 replaced trauma-related losses and 4 corrected tooth agenesis in the anterior maxilla. Table II summarizes the distribution of transplants according to removal and recipient regions. The follow-up of patients took place in 2013 and at least 6 months postoperatively. For this

retrospective clinical study, clinical data were collected anonymously for all examinations by an experienced examiner. Informed consent was obtained from all of the patients. The guidelines of this study have followed the Declaration of Helsinki. The study was approved by the ethics committee of the Bavarian Medical Association of Munich, No. 13116/2013.

### Data collection

Data collection was performed according to the given surgical protocol for tooth transplant (Table III). The data were collected before surgery; on the first postoperative day; on the seventh postoperative day; at 3 weeks postoperatively; at 3, 6, and 12 months postoperatively; and at yearly intervals thereafter. The radiographic controls were performed before surgery, directly after surgery, and at the aforementioned times from the third month after surgery.

At these times, approved dental parameters in terms of oral hygiene, periodontal status, and tooth sensitivity were collected as described in a previous study from our group.<sup>11</sup> The clinical follow-up examinations included an assessment of the patient's oral hygiene, cavities, and Periodontal Screening Index (PSI) values based on the Community Periodontal Index for Treatment Needs (CPITN) for evaluating the periodontal condition. Regarding the transplanted tooth, pocket probing depth was determined at 6 sites from the

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