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## Original article

# Periodontal tactile sensation and occlusal loading condition of autotransplanted teeth: A retrospective pilot study

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## ABSTRACT

**Purpose:** The objectives of this retrospective pilot study were: (1) to examine the occlusal properties (periodontal tactile sensation, occlusal force support ability, dynamic tooth mobility, occlusal force, contact area, preferred chewing side and main occluding area) of autotransplanted teeth with no clinical complications after transplantation (postoperative periods from 1 to 7 years).

**Methods:** Three groups were formed from 20 subjects (23 teeth in each group): autotransplanted teeth (ATP group), teeth contralateral to the recipient site (control group A), and teeth contralateral to the donor site (control group B).

**Results:** The tactile detection threshold of the ATP group was higher than both the control groups, and the individual occlusal force was significantly lower than control group A. The occlusal force ratio and the occlusal contact area ratio were significantly lower in the ATP group than in both control groups, while the mobility was similar in all groups. Eight out of 20 subjects chose the autotransplanted teeth side as the preferred chewing side. Especially when the recipient site was the first molar, the ATP of these subjects were included in the main occluding area. The pocket depth of the three groups was within the normal range.

**Conclusions:** These results demonstrate that teeth autotransplantation can achieve a mastication efficiency and periodontal condition similar to normal teeth; however, without proper healing, the periodontal sensation of autotransplanted teeth may be inferior to that of normal teeth (<250).

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## 1. Introduction

Tooth autotransplantation has been accepted as a viable method to replace a missing tooth. When compared with prosthetic or implant treatment, autotransplantation offers potential benefits such as bone induction and the re-establishment of a normal alveolar process, and regeneration of periodontal tissue including the periodontal ligament, nerves and alveolar bone [1]. Although several side effects have been reported in the literature, such as infection-related root resorption (inflammatory resorption) and ankylosis (replacement resorption), many other

studies have reported a high success rate in teeth both with incompletely formed roots or completely formed roots under medium- or long-term observation [2–5]. The success of autotransplantation has usually been evaluated through radiographic, clinical or histological examination. However, the criteria for success described in previous studies are not comprehensive enough to evaluate the periodontal condition and the masticatory function and, most importantly, histological evaluation is impossible in clinical cases [6,7]. Additionally, the tactile sensation of teeth, which plays an important role in the recovery of the periodontal receptors, occlusal contacts, and mastication type, is reported to be an important factor influencing oral function [6].

The aim of this retrospective pilot study was to investigate the properties of the periodontal and occlusal function in autotransplanted teeth with no clinical complications (postoperative periods from 1 to 7 years). The parameters for examining periodontal and occlusal function were: periodontal tactile sensation, occlusal force support ability, dynamic tooth mobility,

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occlusal force, contact area, preferred chewing side and main occluding area. This information may be important for the treatment planning, restoration design and evaluation of auto-transplanted teeth.

2. Material and methods

2.1. Subjects and test teeth

We recalled 20 patients (4 men and 16 women; mean age 40.27 ± 12.54 years) with teeth that had been autotransplanted and restored with a single crown at least 1 year earlier at Tohoku University Hospital. Twenty-three autotransplanted teeth were examined in this study. The patients regularly visited the periodontal or prosthodontic clinic for maintenance of the remaining teeth. The mean postoperative period was 6 years (range, 1–7 years) (Table 1). All transplantations were basically performed according to the procedure described by Andreasen et al. [8], and the extraction and autotransplantation took place on the same day. After 3–7 months, each autotransplanted tooth was restored with a single crown. All autotransplanted teeth progressed favorably without any clinical complications. Autotransplanted teeth (ATP group) were compared with teeth at the contralateral recipient site (control group A) (CTR\_A), and with contralateral donor teeth (control group B) (CTR\_B) (Fig. 1). All the teeth were restored with crowns (to imitate the shape and the function of the missing tooth), and there were no clinical or radiographic signs of failure. Subjects who had autotransplantation combined with bridge restorations or connected crowns were not included in this study. The research protocol was reviewed and approved by the Research Ethics Committee of the Tohoku University Graduate School of Dentistry.

2.2. Tactile detection threshold

The tactile detection threshold (TDT) of each tooth was measured using von Frey hairs (Touch-Test<sup>®</sup>, North Coast Medical, CA, USA) with 20 different diameters corresponding to 20 target forces (0.008–300 g) [9]. Tactile stimulation was applied perpendicularly to the tooth axis on the lingual surface. The sequence of tested teeth was randomized. The TDT was determined by the

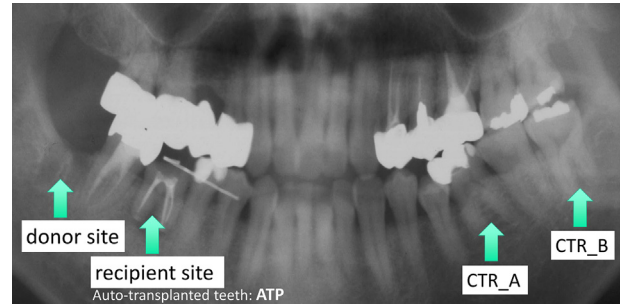


Fig. 1. Example of a panoramic radiograph of the donor site, the recipient (autotransplantation) site and the control site. Teeth contralateral to the recipient site are in control group A (CTR\_A), and teeth contralateral to the donor site are in control group B (CTR\_B).

psychophysical method (methods of limits). After three alternating ascending and descending series of tests, the mean value of the detected thresholds was considered to be the TDT of the tested tooth. TDT measurement was performed by two calibrated examiners.

2.3. Individual occlusal force

The individual occlusal force (IOF) was measured using a digital occlusal force meter (GM10, Nagano Keiki, Tokyo, Japan). This digital intra-oral instrument has an 8.6 mm-thick bite element with a disposable plastic cap on each tooth. The opposite dentition was covered by a splint made of a hard resin to avoid the influence of the condition of the opposing tooth. Subjects were instructed to bite as hard as possible without dental pain or discomfort. The test was performed three times, and the mean value was calculated.

2.4. Tooth mobility

The mobility of the teeth was assessed using Periotest (Gulden-Medizintechnik, Bensheim, Germany) [10], which consists of a scale ranging from –8 to +50. The lower the Periotest value, the higher the stability or damping effect of the tested teeth. The measurements were taken three times, and the average values were used. Probing depth was recorded at six sites with a

Table 1  
Characteristics of subjects and autotransplanted teeth.

Subjects No.	Gender	Age	Donor teeth	Recipient site	Postoperative period	Prosthesis
1	F	34	28	36	3 years	FMC
2	F	65	38	26	6 years 8 months	RJC
3	F	36	18	47	1 year	PFM
4	M	36	18	36	3 years	FMC
5	F	29	18	16	2 years 3 months	FMC
6	F	30	18	16	3 years	PFM
7	M	32	38	36	6 years	FMC
8	F	41	34	35	2 years	FMC
9	F	30	28	36	2 years 6 months	RJC
10	F	29	18	47	1 year 4 months	FMC
11	M	29	44	21	6 years	RJC
12	M	56	48	46	3 years	FMC
13	F	55	35	44	2 years 8 months	FMC
			31	35	2 years 6 months	FMC
			24	37		
14	F	48	31	35	2 years 6 months	FMC
15	F	37	24	37	2 years 4 months	FMC
16	F	27	28	46	1 year	RJC
17	F	33	38	37	4 years 10 months	FMC
18	F	62	38	47	3 years 5 months	FMC
			38	26	5 years	FMC
19	F	56	48	46	1 years 10 months	RFM
20	F	44	38	47	1 years 4 months	RFM

FMC: full metal crown, RJC: resin jacket crown, RFM: resin facing metal crown, PFM: porcelain fused-to-metal crown.

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