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## Original article

# Functional outcomes with dental prosthesis following simultaneous mandibulectomy and mandibular bone reconstruction

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## ABSTRACT

**Purpose:** This study sought to ascertain masticatory outcomes in patients who underwent mandibulectomy or hemimandibulectomy together with mandibular bone reconstruction to allow for placement of a removable dental prosthesis.

**Methods:** Perioperative changes in masticatory performance, masticatory ability for solids, and patients' subjective satisfaction were evaluated for 101 patients who had mandibulectomy immediately followed by bone reconstruction. Differences in masticatory performance and masticatory ability for solids after surgery were determined according to occlusal support after surgery and whether the patient was wearing a removable dental prosthesis or not. Occlusal support areas were classified according to Eichner's classification.

**Results:** Preoperative Eichner's class A patients had no experience of wearing a dental prosthesis before surgery and after surgery did not want one. Their masticatory performance was better than that of patients who wanted a dental prosthesis after surgery. Retrospective analysis of postoperative Class B and C patients revealed that masticatory performance was lower in those who wanted a dental prosthesis than in those who did not want one. When patients wore a dental prosthesis after surgery, masticatory performance was markedly improved over not wearing it. All patients' subjective satisfaction was significantly improved after surgery.

**Conclusions:** Increasing the number of occlusal support areas by wearing a removable dental prosthesis after simultaneous mandibulectomy or hemimandibulectomy and mandibular bone reconstruction may improve masticatory functions. Those professional involved in the rehabilitation for the mandibular defect should be mindful that masticatory functions after such surgeries were affected by the masticatory functions before surgery and the number of occlusal support areas after surgery.

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## 1. Introduction

A wide mandibular segmental resection and associated muscle displacement produces mandibular bone discontinuity and loss of muscular and soft tissue attachments [1] that can cause oral dysfunctions and facial deformity [2]. Inadequate bone reconstruction and rehabilitation after mandibulectomy can further contribute to poor functional outcomes, including jaw swing, malocclusion, and an inability to chew solids [3,4], which in turn can result in psychological problems [1,5,6] and reduced quality of life [2,7].

In a study of masticatory performance in segmental mandibulectomy patients, Roumanas et al. [8] found that prosthetic rehabilitation with conventional or implant-supported prostheses improved masticatory performance to presurgical levels. However, there are currently limited data available on the masticatory function of patients following mandibulectomy and bone reconstruction, and the studies that have been conducted examined only a relatively small number of patients [8–10]. This situation would suggest that oral surgeons tend to have limited interest in the functional outcomes of surgery related to postoperative occlusal support and prosthodontic interventions.

In our oral and maxillofacial surgery department, we reconstruct discontinuities of the mandible and soft tissue defects after mandibulectomy and have found that masticatory function is improved by patients wearing dentures after mandibular reconstruction. However, there have been few reports confirming our experience [3,8,9].

As oral maxillofacial surgeons, our aim in this study was to ascertain the perioperative masticatory functions of mandibulectomy patients, based on Eichner's classification of occlusal contact among the remaining teeth, in order to improve postoperative prosthetic rehabilitation for masticatory function and thus also patients' satisfaction and quality of life, and to help prosthodontic specialists and oral maxillofacial surgeons work together to achieve this goal.

## 2. Materials and methods

This longitudinal study targeted patients who underwent mandibular bone reconstruction immediately after mandibulectomy or hemimandibulectomy at the Department of Oral and Maxillofacial Surgery, Tokyo Medical and Dental University Hospital from April 2007 to March 2012. The study complied with the principles laid down in the Declaration of Helsinki and approval for this study was obtained from the institutional research ethics committee.

We evaluated masticatory performance, masticatory ability for solids, occlusal support, denture usage, and patients' subjective satisfaction for eating and chewing 1 day before surgery. Postoperative status for each of these parameters was evaluated at 1 year after delivery of the patient's removable dental prosthesis or at 1 year after surgery for those who chose not to wear the dental prosthesis.

### 2.1. Masticatory performance

Quantitative evaluation of masticatory function was investigated pre- and postoperatively using chewing gum (30 × 20 × 1 mm, 1.0 g; Masticatory Performance Evaluating Gum XYLITOL<sup>®</sup>, Lotte Co., Ltd., Saitama, Japan). Before mastication, the chewing gum has a yellowish-green colour, which changes to red due to acidic conditions as mastication proceeds. The constitution of the chewing gum can be adjusted so it does not adhere to denture materials to allow for easy chewing even by complete denture wearers who have reduced masticatory performance. The patients chewed the gum as much as possible using both sides, without restriction, for 2 min. The chewed gum was collected immediately after chewing and compressed to a thickness of 1.5 mm in a polyethylene film between two glass plates. Then, the  $a^*$  value (CIE- $L^*a^*b^*$  colour space) was measured through the polyethylene film using a colorimeter (CR-13; Konica-Minolta, Tokyo, Japan). The colour readings were performed at five points on a single side and the mean value of the five points was determined. A previous study showed that  $a^*$  value was correlated positively with masticatory performance and was thus suitable for evaluating masticatory performance [15]. We defined the  $a^*$  value determined from the chewed gum as masticatory performance. For patients who wore a removable denture in daily life, gum tests were performed both with and without the denture in place.

The rate of change in postoperative masticatory performance was calculated as follows: Retention index (%) = [the postoperative masticatory performance – the preoperative masticatory performance]/[the preoperative masticatory performance] × 100.

### 2.2. Masticatory ability for solids

Masticatory ability for solid foods was evaluated postoperatively using the modified method established by Yamamoto et al. [16] where foods are arranged from soft (category 1) to hard (category 6) as shown in Table 1. We took the highest category that included more than half of the foods the patient could chew as the score of masticatory ability for solids. For patient who wore a denture in daily life, the masticatory ability for eating solids food was recorded with the denture in place.

### 2.3. Occlusal support

We evaluated perioperative occlusal support using Eichner's classification [13,14], which is based on the number of occlusal support areas present, where an occlusal support area is defined as containing a minimum of one tooth in contact between the upper and lower jaw in the premolar or the molar region on the right and left sides. Antagonist contact in the anterior dentition is not considered to constitute an occlusal support area. We divided patients accordingly into four groups: class B1, 3 occlusal support areas; class B2, 2 areas; class B3, 1 area; and classes B4 and C combined, zero areas. For patients who wore a removable denture in daily life, we recorded occlusal support of natural teeth only, without the removable denture in place.

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