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Original research

Evaluation of quality of life and masticatory function in patients treated with mandibular reconstruction followed by occlusal rehabilitation with dental implants: A preliminary report

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ABSTRACT

Objective: The objective of this study was to evaluate the clinical outcomes of prosthetic rehabilitation using dental implants in patients with mandibular reconstruction after mandible tumor ablation based on QOL and masticatory function.

Materials and methods: This study included 12 patients who had undergone mandibular reconstruction and occlusal rehabilitation with dental implants. Five cases had hemi mandibular defects, 7 cases had segmental mandibular defects, and 1 case had marginal resection. A total of 45 implants were placed in the mandible (27 implants placed in reconstructed bone and 18 implants placed in residual bone).

Results: The implant survival rates of implants placed in reconstructed bone and residual bone were 92.6% and 100%, respectively with an average follow-up of 46.08 ± 15.03 months. Four patients received an implant-retained bridge, and 8 patients received removable implant-supported dentures. Postoperative quality of life (QOL) was evaluated by the OHIP-14 and masticatory function questionnaires. In nonmalignant cases, there were significant improvement in the domain of functional limitation. And functional limitation, psychological discomfort, physical disability and psychological disability were significantly improved in malignant cases. Masticatory function scores were significantly higher after dental implant prosthetic rehabilitation in malignant cases (before 17.50 ± 16.05 , after 60.83 ± 19.08 , $p < 0.01$).

Conclusion: Mandibular reconstruction and dental implant prosthetic rehabilitation have contributed to improving patients' oral function and postoperative QOL.

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1. Introduction

Patients with mandibular tumors often undergo tumor resection, including the jaw bone. Even minor bone defects, loss of soft tissue, and teeth defects may lead to significant problems, with functional disturbances of mastication, swallowing, and speech, and in aesthetic appearance. This in turn causes psychological prob-

lems and reduced postoperative quality of life (QOL). During the past 3 decades, reconstruction of mandibular defects has greatly improved [1–4]. Free vascularized osteocutaneous flaps such as the free fibula flap (FFF) and the iliac crest flap have become the most commonly used flaps for mandibular reconstruction. The iliac particulate cancellous bone and marrow (PCBM) graft with a titanium mesh tray (Ti-MT) is also a reliable technique for mandibular reconstruction [5]. Furthermore, in patients requiring mandibular reconstruction, a comprehensive treatment strategy that considers not only facial contours but also masticatory function using dental implants is indispensable for improving QOL [6].

However, there have been very few reports of the subjective and objective benefits of mandibular reconstruction and prosthetic rehabilitation for patients to justify this additional effort. The objective of this study was to evaluate the clinical outcomes of prosthetic

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rehabilitation using dental implants in patients with mandibular reconstruction after mandible tumor ablation based on QOL and masticatory function.

2. Materials and methods

2.1. Patients

The present study included 12 patients who underwent mandibular tumor resection, mandibular reconstruction, and dental implant surgery in the Department of Dentistry, Oral and Maxillofacial Surgery, Yamagata University Hospital from 2009 to 2014. A retrospective review was conducted based on patient age, sex, histological type of tumor, type of mandibular defect, and implant prosthetic rehabilitation.

The longitudinal differences in patient satisfaction and masticatory function were also compared between before and after completion of dental implant prosthetic rehabilitation. Masticatory function and oral health-related QOL were evaluated before and after 12 months of dental implant prosthetic rehabilitation. The occlusal condition before implant prosthetic rehabilitation was evaluated using Eichner's classification [7], which is based on the presence or absence of occlusal contact in four supporting areas; the right and left premolar and molar regions.

2.2. Implant placement and prosthetic procedure

After completion of mandibular reconstruction, fabrication of a mandibular prosthesis supported by dental implants was planned. After osseointegration of the dental implants was obtained, second-stage surgery was performed. If necessary, corrective preimplant surgery (vestibular extension, thinning of the skin paddle, and creation of a buccal and lingual sulcus) was performed before exposure of the implants. Complete rehabilitation was defined as occurring when the patient was fitted with an implant-retained bridge or removable implant-supported denture. The implant survival time was measured from implant placement to either the failure (removal) or the last follow up, and the implant survival rate was determined from the number of implants that still remained at the last follow-up.

2.3. Quality of life and functional assessment

The QOL was evaluated with the use of the OHIP-14 [8], which consists of seven categories: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. For each of the seven categories, the mean value is calculated from the values attributed to the two related questions: the higher the score, the poorer the patient's state of health. Patients were asked to complete the OHIP-14 questionnaire before and after they achieved dental rehabilitation with dental implants. After completion of the questionnaire, their individual total scores were calculated.

Masticatory function was evaluated using a modification of the masticatory evaluation sheet established by Sato et al. [9]. The sheet consists of 20 foods and the masticatory function score of each patient ranges from 0 to 100. The mean scores, before and after the patients completed dental implant prosthetic rehabilitation, were calculated.

2.4. Statistical analysis

The mean age was compared between patients with nonmalignant disease and patients with malignant disease using the unpaired *t*-test. The average values for the OHIP-14 and the masti-

Table 1
Patients' characteristics.

	No. of patients
Age (years)	
<40	3
40–60	4
>60	5
Sex	
Male	10
Female	2
Pathology	
Malignant disease	
Squamous cell carcinoma	5
Osteosarcoma	1
Nonmalignant disease	
Ameloblastoma	3
Keratocystic Odontogenic tumor	1
Odontogenic myxoma	1
Radicular cyst	1

catory function scores were evaluated using the paired *t*-test, and data were considered significant when $p < 0.05$.

3. Results

3.1. Patients

The patients were 10 men and 2 women with a mean age of 55.9 ± 19.3 years (range 26–83 years). The mean age differed significantly between patients with a benign tumor and those with a malignant tumor: 41.8 ± 15.8 years (range 26–71 years) and 70.0 ± 9.52 years (range 58–83 years) ($p < 0.01$), respectively. Of 12 patients, 6 patients had a benign tumor or cyst and 6 had a malignant tumor of the mandible. The most common histology of the tumor was squamous cell carcinoma (5 cases), followed by ameloblastoma (3 cases). One patient (Case 11) received postoperative radiation therapy (44 Gy) (Table 1).

3.2. Type of mandibular defect

Hemi mandibular resection was performed in 5 patients, segmental mandibular resection was performed in 6 patients, and marginal resection was performed in 1 patient.

3.3. Mandibular reconstruction

In nonmalignant cases, 5 of 6 cases underwent immediate reconstruction using reconstruction plate (RP) and secondary reconstruction (PCBM+Ti-MT±FFF), and one case underwent immediate reconstruction using PCBM+Ti-MT. In the malignant cases, 3 of 6 cases underwent bony reconstruction (i.e., PCBM and/or FFF), and 2 cases were reconstructed using RP±myocutaneous flap. In case 7, which underwent marginal mandibular resection, reconstruction was performed using a myocutaneous flap. Occlusal support zones before completion of dental implant prosthetic rehabilitation are also shown in Tables 2 and 3. The number of remaining mandibular teeth after mandibular tumor resection ranged from 0 to 12.

3.4. Dental implant

A total of 45 Brånemark Mk III implants or Nobel active implants (Nobel Biocare, Switzerland) were placed in the mandibles (2–6 implants/patient). The diameters of the implants varied from 3.3 to 4.3 mm, and their lengths varied from 7.0 to 15 mm. The time interval between final reconstruction and implant placement ranged 0–24 months in nonmalignant cases and 0–28 months in malignant cases. The second surgical phase was carried out 6 months after implant placement. In this study, 27 implants

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