

Prosthodontic rehabilitation of a mandibulectomy patient with an implant-retained overdenture: A clinical report

Yesiboli Yeerken, DDS; Takafumi Otomaru, DDS, PhD^{*}; Kamarul Hisham Kamarudin, BDS, MFDS, MClintDent; Yuka Sumita, DDS, PhD; Mohamed Said, BDS, MPhil; Motohiro Munakata, DDS, PhD; Shohei Kasugai, DDS, PhD; Hisashi Taniguchi, DDS, PhD

***Takafumi Otomaru, DDS, PhD**

Maxillofacial Prosthetics, Tokyo Medical and Dental University, 1-5-45 Yushima Bunkyo-Ku, Tokyo 113-8549, Japan

Abstract

A 63-year-old female patient had undergone marginal mandibulectomy for squamous cell carcinoma and reconstruction with a radial forearm flap in the year 2000. In 2013, the overdenture became unstable, because the increased mobility of the first premolar of the three O-ring attachments, lateral incisor with an O-ring attachment was taken off due to caries. We planned to extract the lateral and first premolar and to place dental implants in the right mandibular molar site (non-defective side). The patient agreed to the proposed treatment plan and 2 implants were placed. Also, an implant-retained overdenture was fabricated with stud attachments. To compare the conditions before and after implant treatment, the patient's perceived chewing ability and oral health-related quality of life (OHRQOL) were evaluated. Patient's perceived chewing ability was rated using a food intake questionnaire and Masticatory Score (MS) was obtained. OHRQOL was measured using the Geriatric Oral Health Assessment Index (GOHAI). MS was increased from 43% to 61%. GOHAI score was improved from 36 to 51. Within 3 years after the implant surgery, no issues were noted with the implant bodies, abutments or the overdenture. Perceived chewing ability and OHRQOL might be improved in mandibulectomy patients with the use of dental implants with stud attachments.

Keywords

Mandibulectomy; implant-retained overdenture; masticatory function; perceived chewing ability; oral health-related quality of life

Introduction

Surgical resection of head and neck cancer often results in altered anatomical condition in the oral cavity, which may severely hamper oral functions. Masticatory, speech and swallowing namely would be impaired. Masticatory impairment is regarded as one of the most serious oral health problems in patients who had undergone mandibulectomy for head and neck lesions [1]. The chewing ability is not only an important dimension of oral health, but is increasingly recognized as being associated with general health status, because the ability to chew food may affect dietary choices and nutritional intake [2,3], and may, therefore, have consequences for general health and oral health-related quality of life [4,5]. Factors affecting oral health-related quality of life (OHRQOL) were reported such as the number of teeth,

occluding pairs of teeth and presence of restorations in the elderly [6,7,8]. Degree of rehabilitation was recently evaluated using various methods such as food intake and OHRQOL questionnaires [9,10]. For instance, perceived chewing ability showed a significant relationship with OHRQOL in partially dentate patients [11] and removable partial denturewearer [12]. A free flap combined with implant-retained prostheses not only maintains the aesthetic profile but also aids the functional rehabilitation, such as impaired mastication, speech [13,14] and significantly reduce bone resorption. It was also found that patients after surgical resection of head and neck cancer were treated with dento-maxillary prosthesis, however, edentulous cases were more challenging for getting the stability of the prosthesis [15]. The introduction of the osseointegration concept has allowed maxillofacial prosthodontists to fabricate prosthesis with better retention and stability. This article describes prosthetic rehabilitation in a mandibulectomy patient and a comparison between masticatory function and OHRQOL before and after implant-prosthetic treatment [16,17].

Case Report

Case outline

A 63-year-old female patient had undergone marginal mandibulectomy for squamous cell carcinoma and reconstruction with a radial forearm flap in 2000. The patient was referred to the Clinic of Maxillofacial Prosthetics of Tokyo Medical and Dental University Dental Hospital. Because of caries and root fracture, the right mandibular second molar was extracted and O-ring attachments (OP-anchor attachment No.1, HAKUHO, JAPAN) were placed onto the right mandibular first molar, canine, and lateral incisor and a resin based overdenture was fabricated in 2011. After several adjustments, the patient's perceived chewing ability and OHRQOL were evaluated (Fig.1). In 2013, the prosthesis became unstable, because the increased mobility of the first premolar of the three O-ring attachments. In addition, lateral incisor with an O-ring attachment was taken off due to caries. We planned to extract the lateral and first premolar and to place dental implants in the right mandibular molar site (non-defective side). Meanwhile, should the prognosis of the lateral become compromise in the future, it would also be replaced with an implant but only after osseointegration of the predecessors were achieved. The patient agreed to the treatment plan, and two units of 3.75× 10mm implants (TiUnite Mk III, Nobel Biocare, Göteborg Sweden) were placed in the molar site of the right side. Between the first and second operation, the old overdenture was relieved at the site of the implant placement and the retention was achieved with 1 residual canine O-ring attachment (Fig.2A). The second operation was performed 6 months after the first operation, and 2 stud attachments (Locator, NobelBiocare, Göteborg Sweden) were delivered and a new implant-retained overdenture was fabricated with 2 Locators (Fig.2B). After several adjustments, 1 residual canine O-ring attachment became stable and it just needed to be replaced because of the presence of margin caries. The prosthesis had stabilized and the patient was satisfied with the fitting, so the patient's perceived chewing ability and OHRQOL were evaluated. During monthly maintenance visits, we assessed oral hygiene by checking for plaque control around the abutments, stability of the prosthesis including the occlusion, and any recurrence of carcinoma. Up to 3 years after the implant surgery, no issues were noted with the implant bodies, abutments, or the prosthesis (Fig.3).

Evaluation of masticatory function and oral health-related quality of life

Patients' perception of chewing ability was rated using a food intake questionnaire consisting of

35 food items classified into 5 grades based on food hardness. The participants rated their ability to chew each of the 35 food items using the following scale: 0, cannot eat; 1, can eat with difficulty; and 2, can eat easily. An additional 2 categories of "do not eat because of aversion" and "have not eaten since starting to wear dentures" were scored as 0 which comprises 12 items reflecting 3 dimensions of the impact of oral disease: physical function (e.g. eating, swallowing, biting, and chewing); psychosocial function (e.g., satisfaction with appearance, worries or concerns about oral health, and inhibition of social contacts as a result of such concerns); and pain or discomfort (either with eating or with sensitivity to hot, cold, or sweetness). The questions referred to how often the patients had experienced difficulties (e.g., limitations and problems) in the preceding 3 months. Responses to the GOHAI questionnaire are scored on a 5-point scale (1 = always, 5 = never), with the cumulative score from the 12 questions representing the total GOHAI score of 12–60 points. A higher GOHAI score indicates less impaired OHRQOL. Patient perception of chewing ability with a food intake questionnaire increased from 43% to 61% (Table1) [18]. The GOHAI score was improved from 36 to 51 (Table 2) [19].

Discussion

In this case, due to squamous cell carcinoma, the soft and hard tissue of the left side were resected and reconstructed with a radial forearm free flap. If a fixed implant prosthesis was chosen, it was thought that the maintenance around the left side abutments would become difficult for the patient [20]. Even in a normal edentulous mucosa without the presence of grafted tissues, it can be challenging to maintain a clean fixed implant bridge [21]. Thus, removable overdenture type was chosen for this patient. According to mechanical design, the design of implant position should be either triangular or square implant forms, and each of the implants should be connected and a fixed prosthesis delivered. However, we chose the ease of maintenance around the implant abutments and finally decided that 2 dental implants be placed in the molar part of the right mandible. Because canine O-ring attachment was used as retention after the implant surgery, the overdenture could remain stable during the period from implant installation to the delivery of the abutments. In the anterior part of the mandible the patient still has a single O-ring attachment. In case the abutment tooth is extracted, 1 or 2 dental implants will be placed in the anterior part.

The results of masticatory function assessment reflect a remarkable improvement. MS showed a favorable response with an increase from 43% to 61%. Previous research has shown that MS was 71.8 in moderate mandibular bone resorption subjects with complete dentures and 57.7 in those with severe resorption [18]. This provides a reference suggesting that the increase in MS is indicative of the improved masticatory function. GOHAI scores of 38.7, 46.3, and 54.0 have been reported in edentulous patients, partially dentate patients and patients with 20 teeth, respectively [19]. In this case, OHRQOL was also measured using the GOHAI questionnaire and was seen to have improved from 36 to 51 which is relatively similar to patients with 20 teeth. Though we cannot determine the most suitable treatment plan, a 3-year follow-up suggests that masticatory function and OHRQOL might be improved in patients who have had marginal mandibulectomy.

Figures

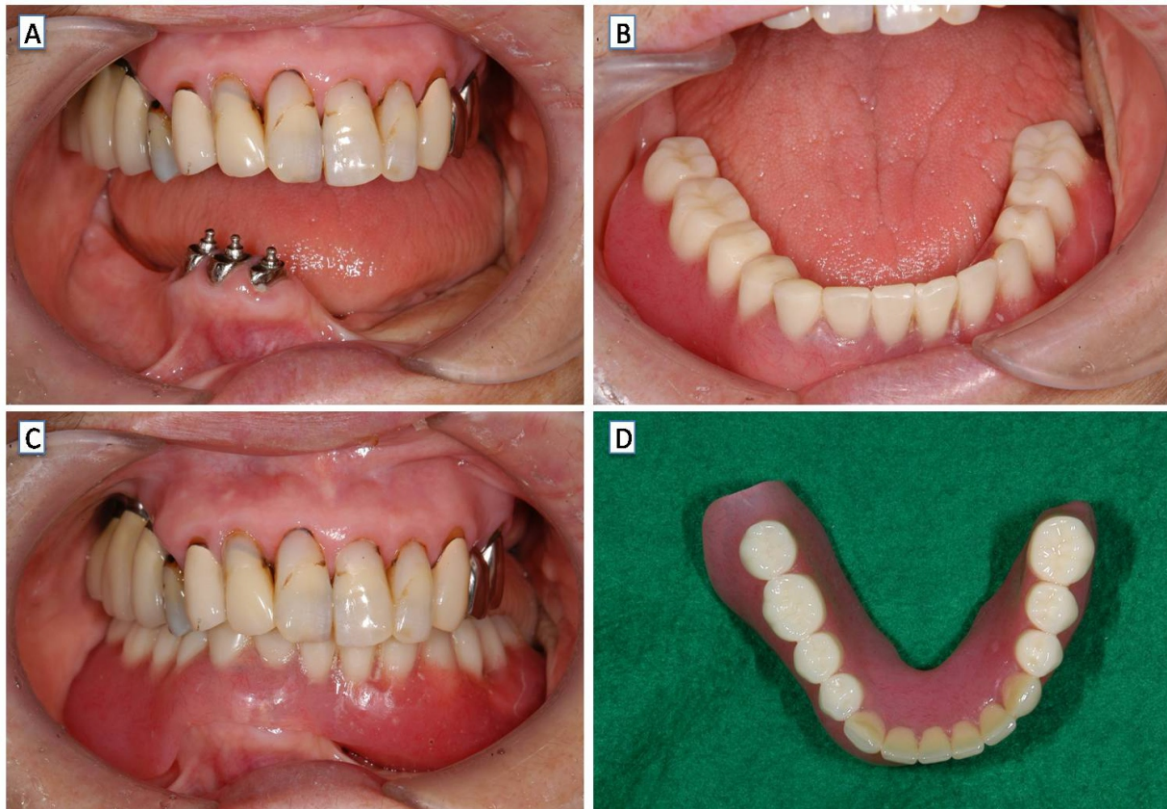


Figure 1: (a) Frontal view without prosthesis; (b) Occlusal view of the prosthesis in position; (c) Frontal view of the prosthesis in position; (d) Occlusal view of conventional overdenture

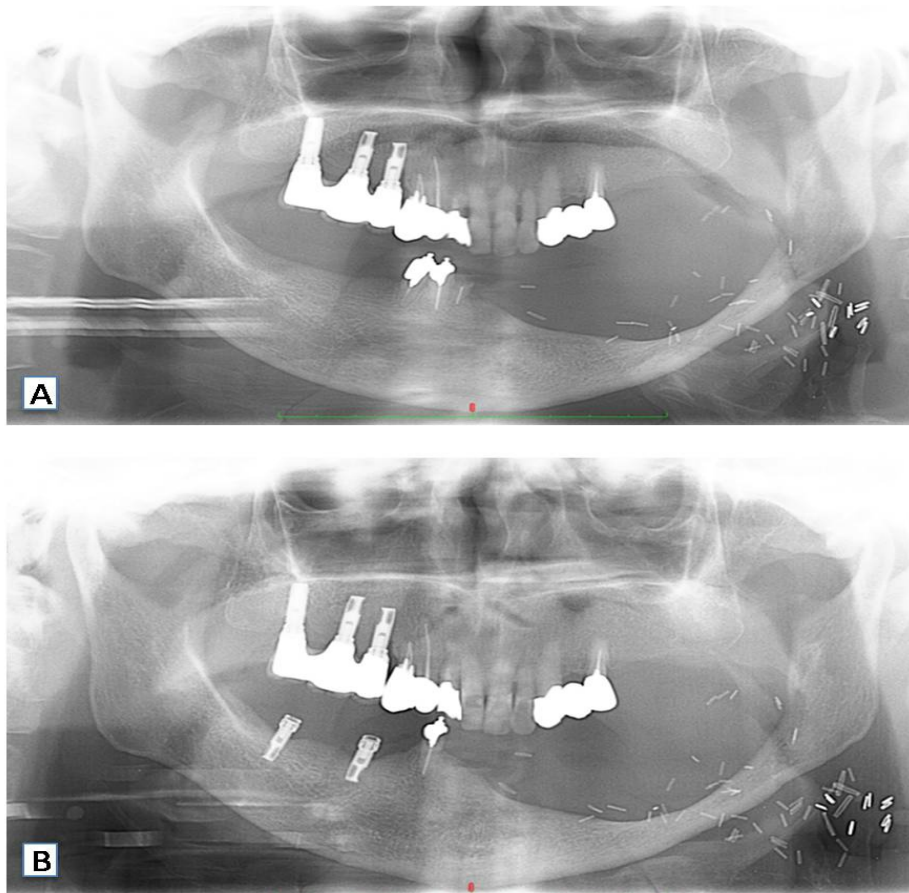


Figure 2: (a) Panoramic radiograph showing the preoperative condition before implant placement; (b) Panoramic radiograph after placement of the 2 dental implants

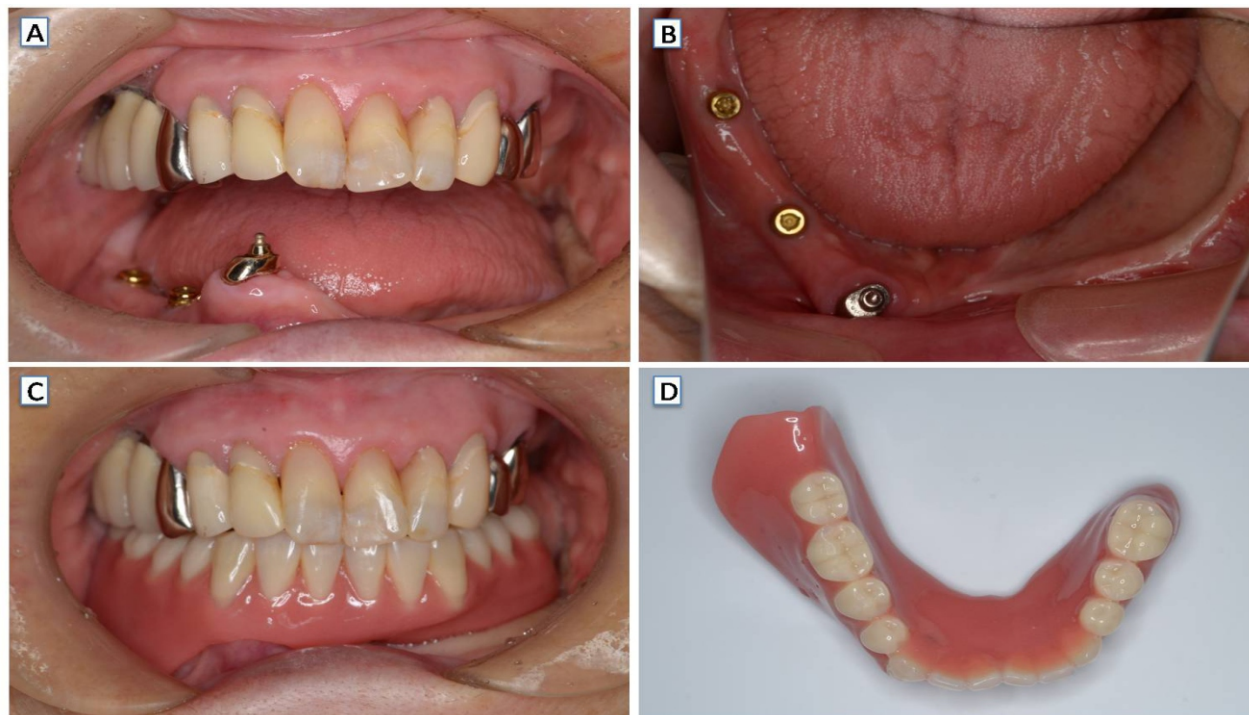


Figure 3: (a) Intra-oral view of 2 implants in position; (b) Occlusal view of 2 implants in position; (c) Frontal view of the implant-retained overdenture in position; (d) Occlusal view of the implant-retained overdenture

Conclusion

The use of the Locator abutment with stud attachments system improved the masticatory function and OHRQOL of this mandibulectomy patient. This might also improve other mandibulectomy patients with few remaining teeth but it requires further studies.

Tables

Table 1: 35-item food intake questionnaire and results

Please fill in the blanks as follows			
[2] easily eaten	[1] eaten with difficulty	[0] cannot be eaten	
[Δ] do not eat because of dislike		[□] have not eaten since starting to wear dentures	
1 [1→2] fried rice cracker	2 [1] rice cake	3 [0→1] raw abalone	4 [1] sliced raw cuttlefish
5 [2] strawberries	6 [2→1] boiled fish paste patty	7 [1→2] raw cabbage	8 [2] boiled beef
9 [2] boiled cabbage	10 [1] raw cucumbers	11 [1] jellyfish	12 [1] konnyaku
13 [2] boiled taro	14 [0] dried cuttlefish	15 [2] boiled chicken	16 [2→1] pickled radish
17 [1] pickled eggplant	18 [0→1] takuwan	19 [0→1] raw carrots	20 [1] fried chicken
21 [2] banana	22 [1] roast chicken	23 [0→1] peanuts	24 [0→1] raw trepan
25 [1] pork cutlets	26 [2] boiled carrots	27 [2] sliced raw tuna	28 [1] harm
29 [1] apples	30 [1→2] roast pork	31 [0→1] vinegared octopus	32 [2] pudding
33 [2] boiled onions	34 [0→1] pickled scallion	35 [1] boiled kombu	

Notice; konnyaku - a paste made from the starch of the devils tongue plant taro - Japanese taro potato ; taku-wan harder to masticate than pickled radish ; kombu tangle weed : trepang cucumber

Table 2: Geriatric Oral Health Assessment Index and results

1. How often did you limit the kinds or amounts of food you eat because of problems with your teeth or dentures?	3→4
2. How often did you have trouble biting or chewing any kinds of food, such as firm meat or apples?	2→3
3. How often were you able to swallow comfortably?	4→4
4. How often have your teeth or dentures prevented you from speaking the way you wanted?	2→3
5. How often were you able to eat anything without feeling discomfort?	3→5
6. How often did you limit contacts with people because of the condition of your teeth and gums, or dentures?	4→5
7. How often were you pleased or happy with the looks of your teeth and gums, or dentures?	2→5
8. How often did you use medication to relieve pain or discomfort from around your mouth?	4→5
9. How often were you worried or concerned about problems with your teeth, gums, or dentures?	3→4
10. How often did you feel nervous or self-conscious because of problems with your teeth, gums, or dentures?	3→5
11. How often did you feel uncomfortable eating in front of people because of problems with your teeth or dentures?	3→4
12. How often were your teeth or gums sensitive to hot, cold, or sweets?	3→5

References

1. Schoen PJ, Raghoobar GM, Bouma J, Reintsema H, Burlage FR, Roodenburg JLN, Vissink A. Prosthodontic rehabilitation of oral function in head–neck cancer patients with dental implants placed simultaneously during ablative tumour surgery: an assessment of treatment outcomes and quality of life. *Int J Oral Maxillofac Surg* 2008;37(1):8-16.
2. Chauncey HH, Muench ME, Kapur KK, Wayler AH. The effect of the loss of teeth on diet and nutrition. *Int Dent J* 1984;34(2):98-104.
3. Joshipura KJ, Willett WC, Douglass CW. The impact of edentulousness on food and nutrient intake. *J Am Dent Assoc* 1996;127(4):459-467.
4. Miura H, Kariyasu M, Yamasaki K, Arai Y, Sumi Y. Relationship between general health status and the change in chewing ability: a longitudinal study of the frail elderly in Japan over a 3-year period. *Gerodontology* 2005;22(4):200-205.
5. Brennan DS, Singh KA. Dietary, self-reported oral health and socio-demographic predictors of general health status among older adults. *J Nutr Health Aging* 2012;16(5):437-441.
6. Agerberg G, Carlsson GE. Chewing ability in relation to dental and general health: analyses of data obtained from a questionnaire. *Acta Odontol Scand* 1981;39(3):147-153.
7. Hildebrandt GH, Dominguez BL, Schork MA, Loesche WJ. Functional units, chewing, swallowing, and food avoidance among the elderly. *J Prosthet Dent* 1997;77(6):588-595.
8. Heath MR. The effect of maximum biting force and bone loss upon masticatory function and dietary selection of the elderly. *Int Dent J* 1982;32(4):345-356.
9. Koshino H, Hirai T, Toyoshita Y, Yokoyama Y, Tanaka M, Iwasaki K, et al. Development of new food intake questionnaire method for evaluating the ability of mastication in complete denture wearers. *Prosthodontic Res Pract* 2008;7(1):12-18.
10. Zenthöfer A, Rammelsberg P, Cabrera T, Schröder J, Hassel AJ. Determinants of oral health-related quality of life of the institutionalized elderly. *Psychogeriatrics* 2014;14(4):247-254.