Prosthodontic Rehabilitation in a Maxillectomy Patient with an Implant-supported Overdenture: A Clinical Report

Na Li, DDS, MDS¹, Takafumi Otomaru, DDS, PhD²* Mohamed Moustafa Said, BDS, MPhil¹, Motohiro Munakata, DDS, PhD³, Noriko Tachikawa, DDS, PhD⁴, Shohei Kasugai, DDS, PhD⁴ and Hisashi Taniguchi, DDS, PhD⁵

¹Graduate Student, Department of Maxillofacial Prosthetics, Graduate School, Tokyo Medical and Dental University (TMDU), Tokyo, Japan
²Assistant Professor, Department of Maxillofacial Prosthetics, Graduate School, Tokyo Medical and Dental University (TMDU), Tokyo, Japan
³Oral Implant Center, Department of Prosthodontic Dentistry for Function of TMJ and Occlusion, Kanagawa Dental University, Kanagawa, Japan
⁴Department of Oral Implantology and Regenerative Dental Medicine, Tokyo Medical and Dental University, Tokyo, Japan
⁵Professor & Head of Department of Maxillofacial Prosthetics, Graduate School, Tokyo Medical and Dental University (TMDU), Tokyo, Japan

*Corresponding Author: Takafumi Otomaru, Department of Maxillofacial Prosthetics, Graduate School, Tokyo Medical and Dental University (TMDU), 1-5-45 Yushima, Bunkyo-ku, Tokyo 113-8549, Japan; Tel/Fax: +81-3-5803-5556; E-mail: otomaru.mfp@tmd.ac.jp


Abstract

A 65-year-old male patient with a status of right maxillectomy with preoperative chemoradiotherapy is presented, in whom the defect was reconstructed with rectus abdominis flap. Following loss of abutment teeth due to poor periodontal condition, the previous maxillary overdenture retained O-ring attachments (OP anchor attachment) unfortunately failed. Dental adhesive was unable to provide satisfactory denture stability and adequate prosthesis retention. Therefore, the patient was offered treatment of dental implant with Locator attachment-retained overdenture in the remaining maxilla. Masticatory efficiency by using subjective and objective measurements was evaluated with the previous overdenture, with the implant-supported overdenture, and with two years follow-up. Although an implant was suddenly left after 1 year functioning, the patient wore implant-supported overdenture with Locator attachments masticatory functions still showed markedly improvement. There was no complication during the second year follow-up period. The results suggest that the application of implant-supported overdenture with Locator attachments is useful for oral rehabilitation in patients with resected edentulous maxilla.

Keywords: Head and neck cancer; Implant-supported overdenture; Perceived chewing ability; Masticatory performance.
Introduction

Prosthetic rehabilitation after resection of the maxilla is effective, and surgical reconstruction is usually not indicated in patients with maxillary cancer [1]. Fabricating a maxillary obturator is relatively easy through making use of the remaining teeth in dentate patients or extending to the anatomical undercut, such as in case of the existence of the communication from oral to nasal cavity. However, it can be challenging in edentulous patients with no anatomical undercuts.

Dental implants can help cancer patients by improving denture retention and stability, decrease the load on the vulnerable mucosa, improve function, increase comfort, and improve the patient’s quality of life [2]. The use of free tissue transfer and implant-supported prostheses of maxillary have been studied in the literature [4-8], but reports of masticatory functions of their combined use for maxillary reconstruction in oral cancer patients remains limited [3, 13].

The purpose of this clinical report was to describe the prosthodontic approach in reconstruction of right infrastructure maxillectomy defect patient, and to evaluate the masticatory function by using subjective and objective measurement with the previous overdenture, with the implant-supported overdenture, and 2-year follow-up.

Clinical Report

A 65-year-old male patient with a status of right maxillectomy with preoperative chemoradiotherapy (total 50 Gy) due to squamous cell carcinoma (T4aN0M0) was referred to the clinic of maxillofacial prosthetics of Tokyo Medical and Dental University Dental Hospital in 2007, in whom the defect was reconstructed with rectus abdominis flap. Subsequently, the left canine was extracted because of severe decay. O-ring attachments (OP anchor attachment No.2. Hakuho, JAPAN) were placed to only both incisors to support the maxillary denture in 2009 (Figure 1). No further recurrence of SCC was observed in following 2 years.
In 2011, two abutment teeth were spontaneously lost. The patient was temporarily provided with denture adhesive to get the support and stability of the previous maxillary overdenture, but the patient stated that it was not effective because of unstableness of the overdenture when the mouth was opened wide, as well as shifted when chewing hard and sticky food.

In 2013, implant-supported overdenture was provided with informed consents. The patient was referred to the clinic of oral implantology for placement of endosseous implants in the residual maxillary bone. Based on computed tomography findings and the conventional prosthesis as a definitive prosthesis, three dental implants (TiUnite Mk III; Nobel Biocare, Göteborg Sweden) were installed, including two 3.75 × 11.5 mm and one 3.75 × 10 mm implants (Figure 2).

About six months later the second operation was undergone and the attachments (Locater, NobelBiocare, Göteborg Sweden) were connected. The prosthetic procedure followed approximately 2 weeks after the abutment connection. A pickup impression was made to generate the master cast for fabrication of a final prosthesis. The resin-based implant-supported overdenture was fabricated in 2014 (Figure 3).

Figure 2
(a) Panoramic X-ray picture for preoperative designs of dental implantation
(b) Panoramic X-ray after placement of the 3 dental implants
Figure 3

(a) Intra-oral view of three implants in position
(b) Intra-oral view of the implant-supported overdenture in position
(c) Mucosal views of the implant-supported overdenture
(d) Frontal view with the implant-supported overdenture in position

After 12-month delivery of the implant-supported overdenture, an implant in right incisor area has been suddenly left. During second year follow-up, no issues were noted with the left implant bodies, abutments, or prosthesis, and the patient’s perceived chewing ability and masticatory performance were evaluated (Figure 4).

Figure 4

(a) Intra-oral view of 2 implants in position
(b) Panoramic X-ray after placement of the 2 dental implants
Evaluation of Perceived Chewing Ability

A thirty-five food item list was applied to evaluate patient’s perceived chewing ability [9]. The patient was asked to assign each food item a mark according to one of five categories. To calculate the masticatory score (MS) indicating the ability of mastication, “easily eaten” was given 2 points, “eaten with difficulty” was given 1 point, “cannot be eaten”, “do not eat because of dislike”, “have not eaten since starting to wear dentures” were given 0 point, respectively. The result showed that MS was increased from 56% with the previous overdenture, to 70%, with the implant-supported overdenture, stable to 62% with second year follow-up (Table 1).

Table 1: Items with Food Intake questionnaire for Patient’s perceived chewing ability with the previous overdenture, with the implant-supported overdenture, and 2-year follow-up.

<table>
<thead>
<tr>
<th>Difficulty Grade</th>
<th>Difficulty Ratio</th>
<th>Total Points</th>
<th>Foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1.00</td>
<td>A</td>
<td>Pudding, bananas, boiled cabbage, boiled carrots, boiled tofu (yam), sliced raw tuna, boiled onions</td>
</tr>
<tr>
<td>II</td>
<td>1.14</td>
<td>B</td>
<td>Strawberries, ham, boiled chicken, boiled fish paste patty, konnyaku (yam jelly), boiled kombu (kelp), raw cucumber</td>
</tr>
<tr>
<td>III</td>
<td>1.30</td>
<td>C</td>
<td>Fried chicken, fried rice crackers, roast chicken, apples, pickled eggplants, boiled beef, raw cabbage</td>
</tr>
<tr>
<td>IV</td>
<td>1.52</td>
<td>D</td>
<td>Roast pork, pickled scallion, pickled radish, rice cakes, peanuts, sliced raw fish cutlet, pork cutlet</td>
</tr>
<tr>
<td>V</td>
<td>3.00</td>
<td>E</td>
<td>Raw carrots, takuan (pickled radish), jellyfish, vinegarad octopus, raw sea cucumber, raw abalone, dried cuttlefish</td>
</tr>
</tbody>
</table>

(*) Total points = Sum of the points in each grade
MS = (A×1.14+B×1.30+C×1.52+D×3.00)/11.4× 100%

Evaluation of Masticatory Performance

The masticatory performance was evaluated in a series of chewing tests by measuring glucose extracted from gummy jelly[10]. The patient was instructed to masticate a gummy jelly for 20 seconds on his habitual chewing side and rinsed his mouths with 10 ml distilled water. Chewed particles were then gathered as thoroughly as possible in a cup containing filter paper. The concentrations of the dissolved glucose were measured by a blood glucose meter (Gluco sensor GS-1; GC, Tokyo, JAPAN). Measurements display 98 mg/dl with the previous overdenture, 156 mg/dl with the implant-supported overdenture, and 146 mg/dl with second year follow-up.
Discussion

Considering only left two incisor teeth in poor condition after surgical reconstruction, the first proposal was settled by using O-ring system to improve the ratio of the root and the crown, and the prosthesis could be kept stable for 2 years. Following loss of abutment teeth, the complaint from poor fitness and unstable of the overdenture had a serious influence on masticatory function, thereby resulting in initial failure of prosthesis design. Therefore, treatment of dental implant with Locator attachment-retained overdenture in the remaining maxilla was provided. The results of the masticatory function reflect a remarkable improvement in the subjective and objective evaluation. From the 35 items questionnaire given to assess perceived chewing, masticatory score gave a favorable response, increased from 56% to 70%. Even through an implant was left, the masticatory function to date still showed remarkably improved (62%) compared to those of the previous overdenture. Previous research has shown that masticatory score in the moderate mandibular bone resorption subjects with complete dentures was 71.8 and 57.7 in those with severe resorption and in complete denture wearers, respectively [11]. It provides a reference suggesting that the increase of masticatory score meant the improvement of the masticatory function. On the other hand, our results found that masticatory performance of objective evaluation was increased from 98 to 156 mg/dl. There is the previous evidence that masticatory performance in subjects with a full complement of teeth was 97 mg/dl (10 s chewing), 134 mg/dl (15 s chewing), and 185 mg/dl (20 s chewing) [12]. Through comparing these data, it suggests that implant-supported overdenture could be provided superior helps in masticatory performance. Furthermore, follow-up data (to the second year, follow-up was 146 mg/dl) indicates that the left two implant still contribute to strong support during daily chewing.

No more than three implants were designed and installed in the residual maxillary bone due to limited residual maxilla and the position of the designed stent in this case. Considering the patient’s preference and economic issue, the type of abutment and prosthesis was selected referring to Japanese insurance system. Regarding an implant failure in the anterior area, it was thought that one of the reasons was the overload. It is important note that the implant-supported overdenture still provides a satisfactory support attached to two remaining implants.

Conclusion

This case report described and provided a considering prosthodontic approach in reconstruction of right infrastructure maxillectomy defect patient. The masticatory function of a maxillectomy edentulous patient with microvascular free flap was effectively improved by the placement of an implant-supported overdenture with Locator attachments.

Acknowledgment

This work was supported by a JSPS Grand-in-Aid for Young Scientists (B) (25861828).

This research was approved by Ethical Committee at Tokyo Medical and Dental University (Approval No. 865).

Presented at the 16th International College of Prosthodontics Meeting, Seoul, Korea, 17-20 September 2015.

References


Please Submit your Manuscript to Cresco Online Publishing
http://crescopublications.org/submitmanuscript.php