Nutritional assessment in a maxillectomy patient from the preoperative period to definitive obturator insertion: A case report

Mai Murase a, Hiroko Tani a, Yuka I Sumita a,*, Shuichi Ino b, Hisashi Taniguchi a

a Department of Maxillofacial Prosthetics, Graduate School, Tokyo Medical and Dental University, Tokyo, Japan
b Division of Mechanical Engineering, Graduate School of Engineering, Osaka University, Osaka, Japan

Abstract

Patient: A 69-year-old Japanese male with squamous cell carcinoma of the right maxilla (T4M0N0) was referred to our department for a preoperative examination. An immediate surgical obturator was fabricated before surgery. He underwent surgical treatment, which included right subtotal maxillectomy and reconstruction with a split skin graft. One week postoperatively, the immediate surgical obturator was modified to expand the nasal cavity for obturator prosthesis. Oral intake was started 12 days postoperatively with an immediate surgical obturator in situ. The definitive obturator was fabricated after the wound surface had healed 8 months postoperatively. Assessment of the nutritional status included body mass index, serum albumin level, resting energy expenditure (REE) measured using indirect calorimetry, and predicted REE using the Harris-Benedict equation. These assessments were performed several times, from the time of admission until the definitive obturator was applied.

Discussion: Malnutrition occurs frequently in patients with head and neck cancer because this region is vital for swallowing and mastication. Maxillectomy patients require a maxillofacial prosthesis to improve their nutritional status from the preoperative period to recovery. This case report describes maxillofacial prosthetic treatment from the perspective of nutrition. The patient wore the immediate surgical obturator postoperatively, which was followed by marked weight loss after restoration, and then weight gain returned to the normal range when wearing the definitive obturator.

Conclusion: Maxillofacial prosthetic treatments should make efforts to maintain nutritional status and achieve optimal function and quality of life in patients with head and neck cancers.

Keywords: Nutrition assessments, Head and neck cancer, Maxillectomy, Resting energy expenditure

1. Introduction

Patients with head and neck cancers experience difficulties with dietary intake. Couch et al. described the multifactorial etiologies of deterioration in patients with head and neck cancers, patient attributes, cachexia symptoms, and side effects of head and neck cancer treatment, collectively referred to as “head and neck cancer syndrome”[1]. Many patients with head and neck cancer have a history of heavy smoking, alcohol consumption, and poor diet, all of which can lead to malnutrition before cancer treatment[2]. The treatment of cancer in the head and neck area has a significant negative impact on oral intake of nutrition during and after therapy[3]. Nutritional management is a necessary requirement to support surgical treatment, chemotherapy, and radiation treatment[4]. It is also important in the rehabilitation setting[5]. Improving quality of life[6] and compensating for deficits after maxillectomy require intervention through maxillofacial prosthetic treatment. Periodically assessing patient nutritional status is also important for preventing malnutrition[7,8]. Generally, maxillofacial prosthetic treatment includes the standard protocol for immediate surgical obturator, interim obturator, and definitive obturator[9]. In most cases, an immediate surgical obturator is fabricated before surgery based on the provisional surgical site. It is possible to provide an immediate surgical obturator in collaboration not only with oral, head and neck, and plastic surgeons in the same hospital, but also with other hospitals[10]. A notable and useful point is to provide an immediate surgical obturator, reduce contamination of the surgical wound, and enable relatively normal speech[11] and swallowing[12] in the immediate postoperative period. It is also advantageous because wearing an immediate surgical obturator shortens the period of tube feeding and enables early initiation of oral nutrition[13]. In addition, with prosthetic intervention immediately after the operation, the design of the final denture and the morphology of the defect can be appropriately determined, and the final prosthesis can be smoothly transferred. However, the extent to which prosthetic treatment at each time point contributes to patient nutritional status remains unclear. This case report describes
maxillofacial prosthetic treatment from the perspective of nutrition by documenting the clinical course of the patient.

2. Outline of the case

A 69-year-old Japanese male (height, 164 cm; weight, 74.2 kg; body mass index [BMI], 27.5 kg/m²) with squamous cell carcinoma of the right maxilla (T4M0N0) was referred to the authors’ hospital for a preoperative medical examination (Fig. 1a and 1b). During hospitalization, a registered dietitian determined total energy expenditure based on the patient’s preoperative status and the invasiveness of the planned surgery, which was estimated to be 1600 kcal/day. The patient underwent preoperative radiotherapy with a total dose of 40 Gy and oral administration of 100 mg/day of tegafur-gimeracil-oteracil potassium (TS-1) for 2 weeks followed by 1 drug-free week. He underwent surgical treatment, which included right subtotal maxillectomy and reconstruction with a split skin graft. An immediate surgical obturator was fabricated before surgery. The immediate surgical obturator was designed with a stainless-steel wire on the maxillary right canine, left first premolar, and left second molar. The base was made using a self-curing denture acrylic (Palapress VARIO Heraeus Kulzer, Japan). The occlusal supports were maintained, except for the right-side maxillary defect. It is preferable to avoid using artificial teeth for denture design to protect the wound surface. One week postoperatively, the immediate surgical obturator was modified to expand the nasal cavity for obturator prostheses. The condition of the maxilla with and without the immediate surgical obturator at 2 weeks postoperatively is shown in Fig. 1c, 1d, and 1e. Oral intake was started 12 days postoperatively with an immediate surgical obturator. After oral intake was started, cervical lymph node metastasis was detected, and a right-side neck dissection was performed, resulting in a total of 95 days of hospitalization. The definitive obturator was fabricated after the wound surface had healed, 8 months postoperatively (Fig. 2a and 2b). The definitive obturator was designed with a double Akers clasp on the maxillary left first molar and second molar, occlusal rests, and cast circumferential clasps on the maxillary left first premolar and wire clasp on both sides of the maxilla. The denture base was fabricated from heat-cured acrylic resin (ACRON GC Co., Japan). In this case, prosthodontic treatment was performed by the same prosthodontist. The patient attended the clinic once per week or two for adjustments while using an immediate surgical obturator. After the definitive obturator was applied, the
patient visited the hospital approximately once per month and was interviewed about his diet and eating patterns at each visit. Assessment of nutritional status included BMI, resting energy expenditure (REE)[14] measured using indirect calorimetry (Fit-2100; Cosmed, Rome, Italy)[15], and REE was predicted using the Harris-Benedict equation. Energy requirements could be estimated from the REE. It is also important to identify the balance between food intake and energy expenditure for each disease stage in patients with cancer[16]. The Harris-Benedict equation remains the most common method of calculating REE for clinical and research purposes; however, the REE predicted using the Harris-Benedict equation is based only on body weight. In contrast, REE measured using indirect calorimetry is based on breathing excursion at the time of measurement and, is thus, more accurate than the Harris-Benedict equation and is more reflective of the current situation[17].

These assessments were performed at admission, immediately after surgery, at discharge, one month after discharge, 3 months after immediate surgical obturator insertion, and 3 months after definitive obturator insertion. Changes in BMI, serum albumin levels, and food forms are shown in Fig. 3. Two methods of REE were performed three times: preoperatively; 3 months after immediate surgical obturator insertion; and 3 months after definitive obturator insertion. The REE course, as measured by indirect calorimetry and Harris-Benedict equations, are shown in Fig. 4. Written informed consent for the publication of anonymized case details was obtained from the patient.

3. Discussion

According to the Global Leadership Initiative on Malnutrition (GLIM) criteria for the diagnosis of malnutrition, the top five include three phenotypic criteria (weight loss, low BMI, and reduced muscle mass) and two etiological criteria (reduced food intake or assimilation, and inflammation or disease burden)[18]. Our patient fulfilled the requirements for the presence of at least one phenotypic criterion and one etiological criterion for the diagnosis of malnutrition; accordingly, the patient was diagnosed as malnourished. His weight and BMI decreased remarkably when the immediate surgical obturator was inserted and increased after the insertion of the definitive obturator. BMI was interpreted using standard weight status categories for adults ≥ 20 years of age. Current guidelines from the Centers for Disease Control and Prevention and the World Health Organization define normal BMI as 18.5–24.9 kg/m²; accordingly, this patient was preoperatively categorized as obese. Compared with his preoperative weight, weight loss was observed from the time of hospitalization, and no recovery was observed while the patient was wearing the immediate surgical obturator, resulting in a loss of 10 kg. Even if BMI is in the normal range, unintentional weight loss of ≥10% within the past 6 months, or ≥20% beyond 6 months, indicates a risk for malnutrition[19]. In the present case, the length of hospital stay was 95 days, and the prolonged hospital stay may have led to reduced skeletal muscle mass[20]. The patient was unable to eat food per os for 11 days postoperatively due to the use of a nasogastric tube and then experienced anorexia caused by taste disorder and/or numbness for approximately 20 days postoperatively. Nutritional intake was thus reduced by changes in dietary formulation, which led to weight loss (Fig. 3). Serum albumin level is usually used to assess nutritional status, with a concentration <3.5 g/dl indicating possible protein energy malnutrition. A normal albumin range is 3.9 to 4.9 g/dL[21]. Albumin levels continued to decline at admission, with the lowest albumin level at discharge (3.6 g/dL), but returned to a healthy range after discharge.

It is necessary to prioritize swallowing over masticatory ability because promoting wound surface healing takes precedence. However, the patient’s body weight returned to normal after the obturator was worn. Thus, the definitive obturator enabled recovery of swallowing, speech, and masticatory function by providing occlusal support. Evaluation was performed using a Nasometer (Nasometer II, model 6400 KayPENTAX, Lincoln Park, NJ, USA) to determine the degree of nasopharyngeal closure dysfunction. The average nasalance score with a definitive obturator was 11%. In this case, nasopharyngeal closure dysfunction was <20%, and no abnormalities were observed[22]. Masticatory performance was evaluated based on the amount of glucose extracted from chewing gummy-jelly (GLUCOLUMN, GC Co. Ltd., Tokyo, Japan). The gummy-jelly test score was 158.2 mg/dL. The glucose elution amount has been reported to be ≥ 100 mg/dL in patients wearing plate dentures who were satisfied with the denture[23]. The masticatory function of the definitive obturator exceeded normal levels and could function sufficiently. However, functional assessment should be avoided during the period of immediate surgical obturator use because the wound surface is not sufficiently stable, which may inhibit wound recovery.

As shown in Fig. 4, the REE predicted using the Harris-Benedict equation did not change significantly, but the REE measured using...
indirect calorimetry increased when wearing the definitive obturator. A negative balance between energy intake and energy expenditure contributes to the development of malnutrition. In cancer patients, it is presumed that an increase or decrease in REE is related to various factors such as cancer type, degree of progression, and cancer site. In our case, the REE predicted using the Harris-Benedict equation was virtually unchanged; however, the REE measured using indirect calorimetry was slightly lower preoperatively and immediately postoperatively, and was higher at the time when oral ingestion was possible using the definitive obturator. The measurement predicted by REE using the Harris-Benedict equation, which is highly dependent on weight[24], and it was believed that it was not as sensitive as a nutritional indicator and the amount of change was small. The increase in activity in the measurement by REE using indirect calorimetry is reflected by increases in daily activity and social activity without delay. The increase in energy requirement may reflect the fact that the patient is able to return to society without problems after the definitive obturator. It has already been recognized that maxillofacial prostheses contribute to improved masticatory function; however, the extent of weight recovery when using a maxillofacial prosthesis remains unclear.

The patient described in the present case report wore the immediate surgical obturator postoperatively, which was followed by marked weight loss after restoration, and then weight gain returning to the normal range when wearing the definitive obturator. Therefore, maxillofacial prosthetic treatment was considered to contribute to shortening the length of hospital stay, promoting oral intake during the perioperative period, and further improving nutrition during the recovery period. This suggests that nutritional evaluation should be continued following changes in the prosthesis to maintain adequate nutritional status. In future studies, it will be necessary to evaluate the dietary diversity required to achieve the REE evaluated in this study.

4. Conclusion

We report a patient who regained body weight after restoration of occlusal support using a definitive obturator. Our findings demonstrate that the use of a maxillofacial prosthesis could contribute to nutritional support during the perioperative period.

Acknowledgements

This work was supported by JSPS KAKENHI Grant Number 17H00755. The authors report no conflicts of interest related to this study. This work was supported by project for Promoting Leading edge Research in Oral Science at Tokyo Medical and Dental University.

Conflicts of interest

The authors report no conflicts of interest related to this study.

References


This is an open-access article distributed under the terms of Creative Commons Attribution-NonCommercial License 4.0 (CC BY-NC 4.0), which allows users to distribute and copy the material in any format as long as credit is given to the Japan Prosthodontic Society. It should be noted however, that the material cannot be used for commercial purposes.