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Prosthodontic management of a bilateral total maxillary defect patient with chemoradiotherapy-related progressive osteonecrosis: A case report

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Abstract

This case history report describes the prosthodontic management of an elderly patient who was diagnosed with adenoid cystic carcinoma in the maxilla followed by progressive bone necrosis after chemoradiotherapy. The patient's satisfaction was increased significantly by using a complete open-type obturator prosthesis in heat-cured polymerized acrylic resin with processed record base technique. The patient's oral function and health-related quality of life was improved during the rehabilitation process.

Keywords

bilateral total maxillary defect; prosthodontic management; osteonecrosis

Introduction

Adenoid cystic carcinoma is a relatively uncommon malignancy that occurs most often in minor salivary glands of the hard palate [1]. The optional treatment for these patients is surgery and adjuvant radiotherapy. Unfortunately, in many situation, complications of radiation therapy often present the occurrence of osteonecrosis, and even may result in oroantral/oronasal communication in elderly patients. Total or subtotal absence of the maxilla creates a challenging problem in rehabilitation because of little or no residual maxillary structures for support, retention, and stability of prostheses [2]. The quality of life of these patients are also reduced resulting from difficulty of mastication, air and fluid leakage into the nasal cavity, and speech problem.

Extensive large maxillary defects, such as bilateral maxillary defects, can be rehabilitated with free vascularized osteocutaneous flaps and osseointegrated implants [3]. However, it could only be considered after the patient is proven to be free of disease. In conventional prosthodontics, the movement of the prosthesis depends on the amount and contour of remaining palate, contour and lining mucosa of the defect, the availability of undercuts and the support areas that can be engaged peripheral to the defect area in edentulous bilateral maxillary defect patients. It is necessary to fabricate an obturator prosthesis with an acceptable occlusion on a stable base. The conventional record base is difficult to achieve accurate records, because gross errors in tooth position cannot be recognized until the final prosthesis is inserted,

such as an improper plane of orientation with poor anterior esthetics, improper lip support, and improper buccolingual placement of posterior teeth [4]. The processed record base has been reported in the maxillofacial literature [4,5]. It could offer improved stability and retention over conventional record bases and reduce minimizing errors in occlusion and esthetics in final prosthesis [4].

This case history report describes the prosthodontic management of the elderly patient who was diagnosed with adenoid cystic carcinoma in the maxilla followed by progressive bone necrosis after chemoradiotherapy. A variation of processed record base technique is described to fabricate an open type obturator prosthesis in clear-color heat-cured polymerized acrylic resin. Patient's oral function and health-related quality of Life (QoL) were evaluated during the rehabilitation process.

Case Report

A 66-year-old male patient presented with histopathology confirmed adenoid cystic carcinoma (T4aN0M0) in the hard palate. The patient underwent radiotherapy in combination with chemotherapy three times due to local recurrence, and a custom-made temporary obturator was fabricated in local hospital. With a chief complaint of chewing and swallowing difficulty, he was referred to the clinic of maxillofacial prosthetics of Tokyo Medical and Dental University Dental Hospital. The obturator was carefully adjusted to aid retention and stability by engaging the undercut portion of the maxillary defect at the first visit. Unfortunately, bone necrosis progressively got worsen with time and spread to adjacent, anterior and contralateral maxillary regions as seen in Figure 1. Since the recurrence in the maxilla and lung still existed, surgical reconstruction was impossible.

Processing technique to fabricate open-type obturator

The deep defect area was blocked out with a proper cotton ball before taking the preliminary impression in an irreversible hydrocolloid impression material (Algiace Z; Dentsply Sirona, Tokyo, Japan). A custom impression tray was fabricated and border molded to the defect molding plastic impression compound (ISO functional; GC Corp., Japan) according to the conventional manner. After taking the definitive impression (Fusion II monophase type, GC Corp., Japan), the maxillary clear-color heat-cured polymerized denture base resin (Acron, GC, Japan) was fabricated. After checking the maxillary base for retention, obturation of the defect, and ease of removal and insertion, the modeling paraffin wax was added to the base and shaped in the form of occlusion rim. A maxillomandibular relation record was made by using the processed record base technique [5]. Artificial teeth were arranged and evaluated intraorally. With slight adjustment on right upper part of obturator, the definitive prosthesis, which was held in place, was fitted well to the patient (Figure 2). Oral hygiene instructions were reinforced, and recall appointment were scheduled on a regular basis for examination of oral-related tissue and prosthesis modification. There was no complication for prosthetic treatment during 12 months following the insertion of the new prosthesis.

Quality of life evaluation

UWQOL questionnaire, which is composed of 15 domains: 12 disease-specific items (pain, appearance, activity, recreation, swallowing, chewing, speech, shoulder, taste, saliva, mood and anxiety) and 3 global questions, was used to evaluate the quality of life during the use of the obturator [6]. Sleep quality data were obtained using the self-reported Pittsburgh Sleep Quality Index (PSQI) which is a

comprehensive sleep-specific questionnaire and can characterize sleep quality [7,8]. A global score of 5 differentiate good sleepers from bad sleepers. The results showed that the patient presented with a reasonable improvement in all items of UWQOL. Chewing was considered to be the most important issue, followed by pain and taste. In addition, there was a poor sleep quality (PSQI global score was 8) at the time of evaluation.

Masticatory evaluation

The thirty-five food item list was performed 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); "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 denture" were given 0 point. With the first obturator, the patient could not chew almost any food on any side. With the second prosthesis, MS reached 37% and patient was able to chew on both sides.

Speech evaluation

In the acoustic analysis, the formant frequency (F2 range) with and without prosthesis was recorded as reported previously [10]. Speech analysis displayed a significantly wider F2 range compare to without prosthesis. The F2 range without the prosthesis was 459 Hz, and that with it was 1171 Hz (Figure 3).

Discussion

This present case reported the entire processing and optimal treatment in bilateral total maxillary defect patient with radiochemotherapy-related progressive osteonecrosis. In the early stage, favorable abutment teeth and reasonable amount of tissue surrounding defect area allowed the construction of a solid obturator prosthesis to gain enough retention. Unfortunately, resulting from multiple radiation treatment, bone necrosis occurred progressively in the maxillary regions. The late situation resulted in a bilateral maxillary defect with edentulous state. Taken extensive large defect and lack of favorable tissue undercuts into consideration, it was difficult to achieve good retention of the prosthesis with conventional record base method in such situation. The processing technique to fabricate the open type prosthesis is a variation to the conventional technique. The additional retention has been gained by extending the prosthesis along the lateral, anterior and posterior borders of defect, such as the nasal surface of the soft palate, to improve the stability.

Another remarkable finding was that the lowest score of UWQOL in chewing domain. This is because of extensive large defect with edentulous state, thus weakening the chewing function. Although reconstruction surgery in combination with osseointegrated implant can resolve this problem, it was impossible in this case because of local recurrence in lung and maxillary region.

The first obturator was too thick and bulky to replace extensive maxillary defect. The patient's masticatory score became even close to zero. Through using processed record base technique, stability and retention of the prosthesis was remarkably improved for recording the jaw relation. After definitive obturator insertion, the patient was able to chew soft or slightly hard food on both sides. As for speech evaluation, digital acoustic analysis was performed for this patient's vowels sound. In maxillectomy patients, /i/ and /e/ of Japanese five vowels specifically become disorder and F2 range showed a

significantly narrower than the normal controls was discussed in the previous study [9]. In this case, after the delivery of the obturator, the shape of pentagon of the 5 vowels became wider F2, which indicated 5 vowels would become clear for better speech. The restoration of speech and mastication significantly enhanced the patient's confidence in coping with normal activities reasonably well. The obturator prosthesis had not leaked when checked after 12 months of use with this patient which indicate a satisfactory seal.

In addition, the patient reported a significant poor sleep quality and had a habit that wears the prosthesis during sleep because of drooling and slight pain. Our previous study demonstrated a high prevalence of poor sleep quality in long-term head and neck cancer survivors, and elaborated that extensive neck dissection, mental health status and poor oral-related health quality of life may contribute to poor sleep quality [7]. Careful maintenance and systematic approach to improving QoL in elderly patients should be considered for better sleep quality.

Although there are several treatment modalities for patients with maxillary defect, patients with bone necrosis or tumor recurrence, conventional rehabilitation may be a good option. This report reveals an available approach of prosthetic rehabilitation of bilateral total maxillary defect patient with chemoradiotherapy-related progressive osteonecrosis.

Acknowledgement

The authors declare that they have no conflicts of interests related to this study.

Figures

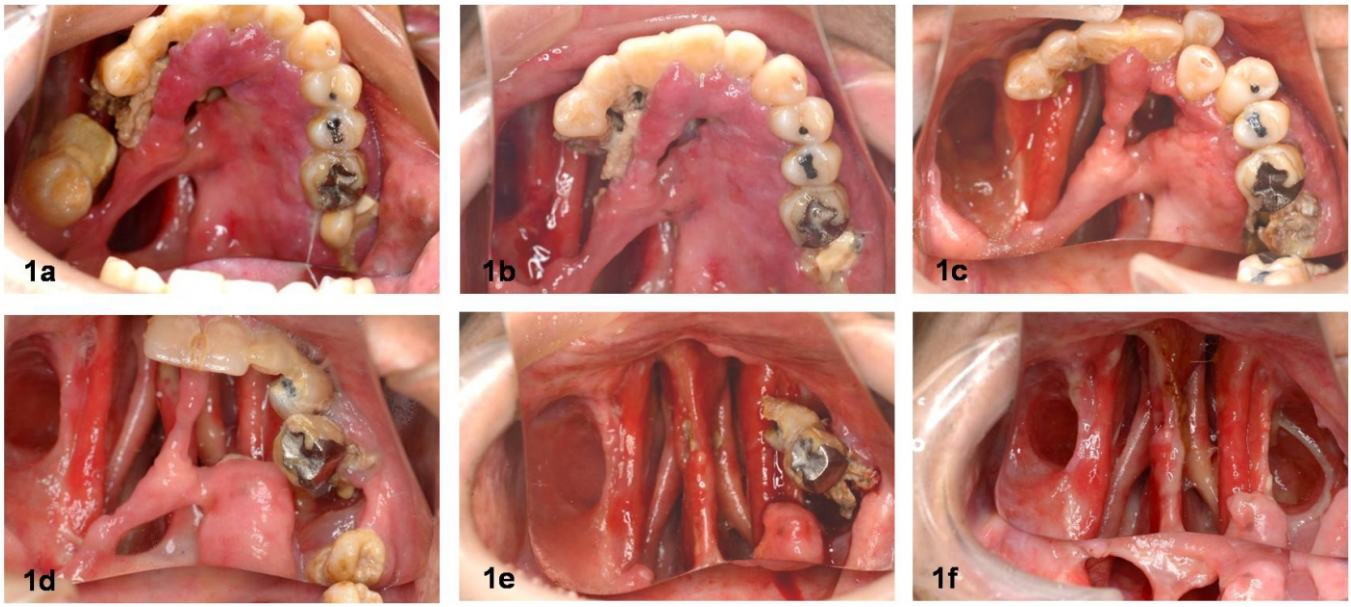

Figure 1: Changes of maxillary defect regions over time.

1a. 6 months after first visit. **1b.** 8 months after first visit **1c**. 14 months after first visit **1d**. 28 months after first visit **1e.** 39 months after first visit **1f**. 42 months after first visit

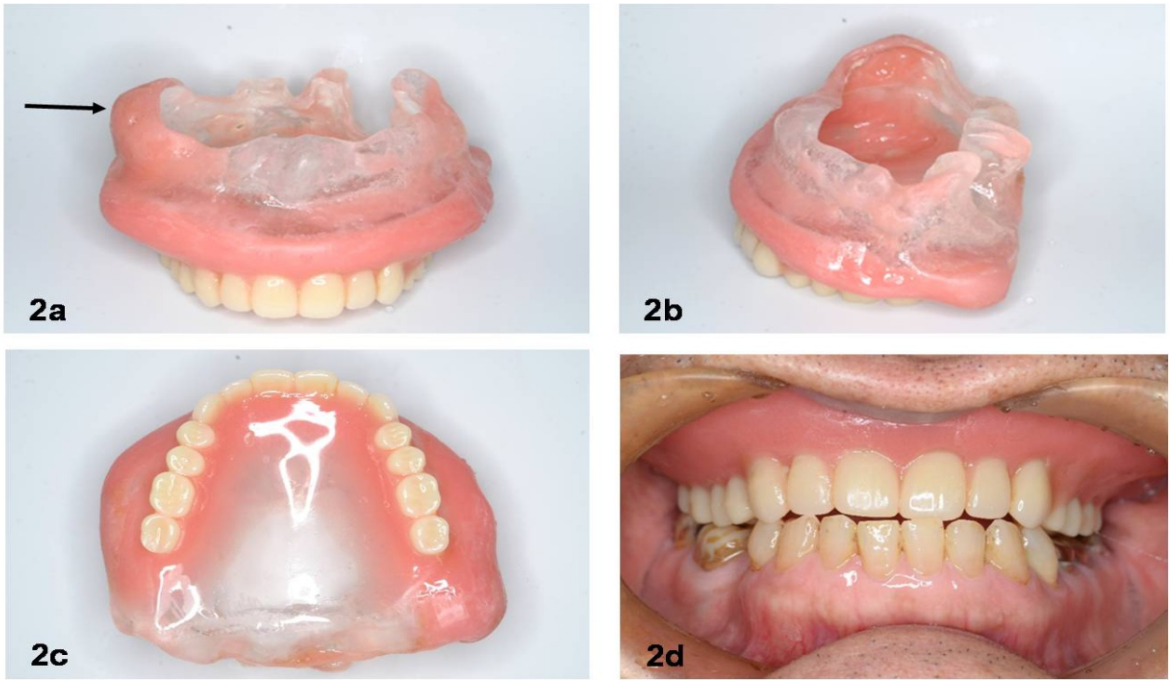

Figure 2: Placement of definitive prosthesis with open-type obturator.

2a. Frontal view of the definitive prosthesis with open-type obturator. The arrow showed a slight relining of obturator prosthesis using Tokuyama Rebase II. **2b.** Lateral view of the definitive prosthesis with open-type obturator. **2c.** Coronal view of the definitive prosthesis. **2d.** Intraoral finding at the insertion of definitive prosthesis.

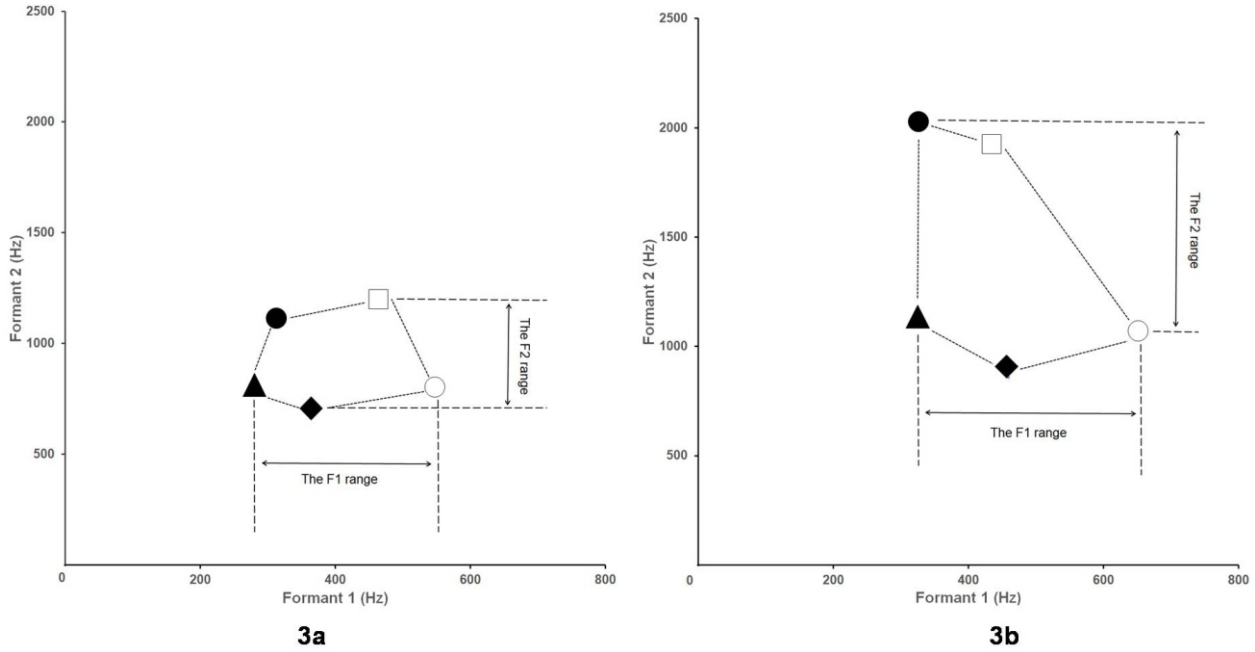

Figure 3: The F1 range and the F2 range in speech analysis

3a. The F1 range and the F2 range without the prosthesis. **3b**. The F1 range and the F2 range the prosthesis.

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