

## Case Report

# Application of Palatal Augmentation Prostheses for a Patient with Partial Glossectomy

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## Abstract

*The swallowing and chewing of patients who undergo a partial glossectomy to treat oral cancer or for other reasons are affected according to the size of the excision. Damage inflicted upon the lingual nerves by the procedure is also a factor. The use of palatal augmentation prostheses (PAPs) can help patients to improve the functions of phonation and food consumption by increasing contact between the tongue and the palatal surface of the prostheses during swallowing. This clinical report details the treatment provided to a patient who received a partial glossectomy due to squamous cell carcinoma (SCC). The intraoral status of the patient was defined by a fully edentulous ridge with limited tongue movement. After the palatal augmentation prosthesis was delivered, the patient adapted well to it and his chewing function was improved. The 2-year follow-up showed no obvious complications.*

**Key words:** glossectomy, palatal augmentation prostheses

## Introduction

The palatal augmentation prosthesis (PAP) was first reported in the literature by Cantor et al.<sup>1</sup> Prostheses of this type benefit people whose tongue is totally or partially resected, resulting in problems with dysarthria and dysphagia. In normal people, functional contacts occur between the tongue and palate allow them to complete the swallowing process.

Swallowing can be separated into 3 phases, namely, the oral, pharyngeal, and esophageal phases<sup>2</sup>. Factors affecting any of those phases can result in dysphagia. Relatedly, the surgical excision of oral pathological lesions will influence the oral phase of swallowing. Following a glossectomy, bolus transportation from the oral cavity to the pharynx becomes weak and the tongue base pressure decreases. A PAP is a prosthesis that helps people with tongue dysfunction by reshaping the hard palate to improve the contact between the tongue and palate<sup>3</sup>. The palatal vault will become lower within a PAP so that the tongue to palate distance is decreased, benefiting people whose tongue mobility is impaired.

Psychological and sociological adaptation to a PAP is also an important issue<sup>4</sup>. The size of an excision, as well as the extent and location of any defects, affect the degree of impairment of the tongue. In addition, radiation therapy or other ablative procedures are frequently used in combination patients who undergo a partial or total tongue resection. The functions of swallowing and aspiration will be affected

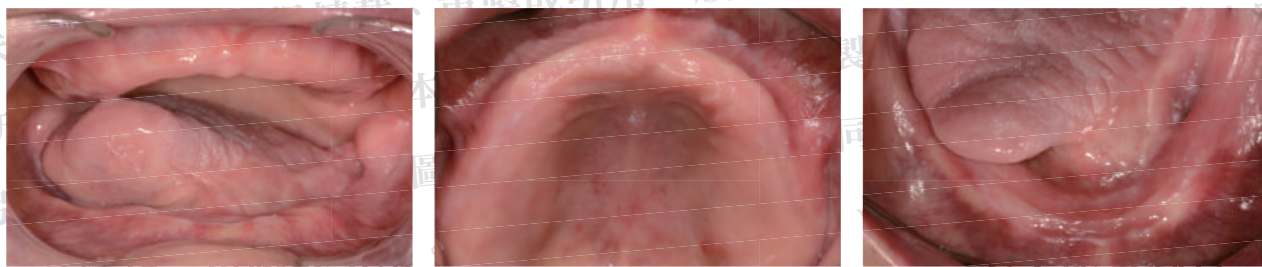


Fig. 1: Patient's maxillary and mandibular edentulous status, frontal and occlusal views

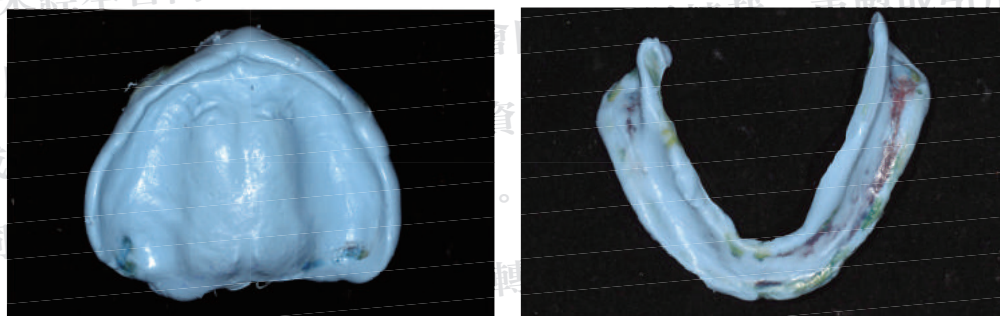


Fig. 2: Maxillary and mandibular impression

by these treatments and the risk of aspiration pneumonia therefore increases<sup>5</sup>. The use of a PAP can assist patients in swallowing safely and efficiently.

The present clinical report focuses on the method of PAP fabrication utilized for a patient who underwent a partial glossectomy.

### Case report

A 70-year-old male patient came to the prosthodontic department of VGHTC with the chief complaint that his old complete dentures were severely worn and he could not consume food well. The medical history of the patient included a partial glossectomy 16 years earlier due to squamous cell carcinoma (SCC) over the left tongue border. He also underwent concomitant chemo-radio-therapy.

The intraoral examination revealed that the maxillary edentulous ridge was of good quality but the mandibular ridge was moderately resorbed (Fig. 1). A hyperkeratinized left tongue border was also noted. Moreover, the movement of the patient's tongue was limited, and he experienced difficulty with swallowing.

Due to financial problems, the patient could not afford an implant; therefore, a definitive treatment plan consisting of application of a maxillary PAP and mandibular complete denture was suggested and agreed to by the patient.

The preliminary impressions were taken and

custom resin trays were fabricated for final impressions. Green stick compound (PERI COMPOUND, GC Corporation, Japan) was used to conduct the border molding procedures in the same way as conventional complete dentures are fabricated. The final impression was taken with polyvinyl siloxane material (Exadenture tube, GC, Japan) (Fig. 2). After beading and boxing, the master casts were poured.

Trial denture bases and occlusion rims were fabricated on the master casts. The vertical dimension was determined using the same general procedures applied to normal patients, including physiological methods such as testing of the swallowing threshold and phonetics. In addition, centric relation registration was also taken. The master casts were mounted on a semi-adjustable articulator (Artex® CT, Austria) with three remounting indices on each cast. Resin artificial teeth (Bioblend IPN denture teeth, Dentsply, USA) were then arranged as necessary to achieve balanced occlusion.

The trial dentures were fitted and the facial profile was checked with patient. The vertical dimension and centric relation position were confirmed additionally. The dentures were processed with heat-cured resin (Lucitone 199, Dentsply, USA). After the laboratory remounting procedure, the occlusion was adjusted again. A clinical remounting jig was made with the adjusted maxillary denture. The dentures



Fig. 3: The processed maxillary and mandibular dentures



Fig. 4-1: No contact of tongue and palatal surface of maxillary denture was noted when patient swallowed

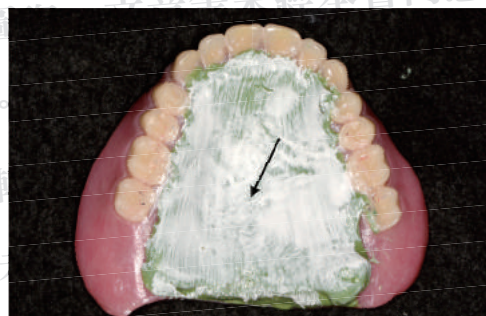


Fig. 4-2: Impression compound application and checking tongue contact with PIP



Fig. 4-3: Impression wax application



Fig. 4-4: Checking with PIP

were removed from the master casts and then the procedures of finishing and polishing were completed.

The denture delivery procedures were arranged with the patient (Fig. 3). The tissue surface and border extension were checked first and occlusion was adjusted with clinical remounting procedures. After that, the fabrication of the PAP was begun. According to the marks on the pressure indicating paste (PIP, National Keystone, USA), no contact between the tongue and palatal area of the denture during swallowing was noticed (Fig. 4-1). At the beginning, the Green stick compound (PERI COMPOUND, GC Corporation, Japan) was applied to the polished surface of the maxillary denture, and the patient was

instructed to swallow several times. A check with PIP was then conducted again in order to confirm contact between the tongue and the polished surface of the maxillary denture when the patient swallowed (Fig. 4-2).

Next, impression wax (Adaptol, Jelenko, USA) was used to do the former movement. The patient was asked to phonate several specific sounds. Anterior dental-alveolar sounds (that is, "T" and "D") and palatal-lingual sounds (that is, "Ger" and "Ker") were phonated by the patient alternately. These movements were repeated several times and then checked with PIP (Figs. 4-3, 4-4). The maxillary denture was then processed again for the modified palatal area.



Fig. 5-1: Occlusal view



Fig. 5-2: Lateral view

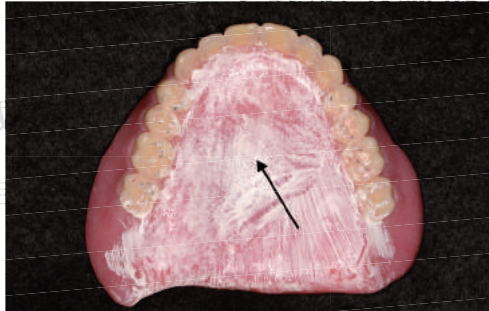


Fig. 5-3: Contact of swallowing

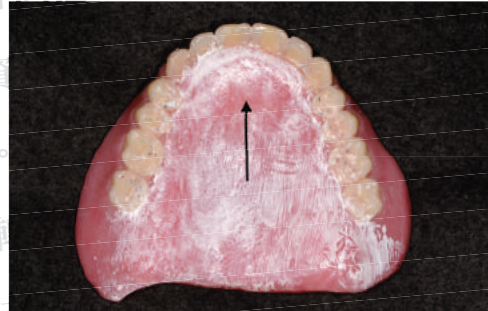


Fig. 5-4: Phonations of "T," "D," and "La"

Fig. 5: Definitive maxillary denture after palatal augmentation



Fig. 6: Intraoral view of dentures

The dentures were prepared for delivery (Figs. 5-1, 5-2). The inspection of the tissue surface and border extension were conducted first; the contact between the tongue and the palatal polished surface of the maxillary denture was checked thereafter (Figs. 5-3, 5-4). Balanced occlusion was achieved and the dentures were delivered to the patient (Fig. 6). The patient was instructed to remove the dentures at night and clean them after meals and before sleeping.

A one-day follow-up visit was arranged with the patient; inspection at that time indicated that his adaptation to the dentures and PAP was acceptable. A small ulcer was noted, however, over the lower left lingual ridge, and the lingual flange of the mandibular denture was adjusted.

After several appointments for adjustment, an examination at the two-year follow-up visit showed that the patient's adaptation was good and his chewing function was substantially improved (Fig. 7).



Fig. 7: Extraoral view of patient (at 2-year follow-up visit)

## Discussion

In Taiwan, 95% of oral cancers consist of oral SCC; betel nut chewing and cigarette smoking are the major causes of such SCC and there is a high risk group of 2.5 million people in Taiwan with these habits<sup>6</sup>. Cases of tongue cancer account for about 25-30% of all cases of oropharyngeal cancer<sup>7</sup>. Ablative surgery such as glossectomy is a standard treatment option for tongue cancer patients; however, such forms of surgery always compromise these patients' quality of life.

Previous studies have shown that PAPs can improve the function of the tongue during food consumption<sup>3</sup>. There are, however, some aspects of PAP use that are of concern in patients who have undergone a tongue surgery. Aspiration frequently occurs in patients who have undergone glossectomy, and this complication needs to be reduced or eliminated due to the high risk of death it entails. In a previous study by Davis<sup>8</sup>, the patient was reported to have had 20% aspiration initially but then no aspiration after PAPs were inserted.

Articulation is also another issue, because unclear pronunciation is always distressing for patients. In related previous studies, the speech measurements of patients given PAPs were evaluated. Robbins et al.<sup>9</sup> evaluated 10 patients who received PAPs after glossectomy to reduce the space between the palate and tongue to permit better oral deglutition. Voice recordings of these patients were made and evaluated on a scaled score ranging from 0 to 10 points. The average long-term improvement of the patients' articulation scores was 2.2 points.

Several studies have evaluated oral and pharyn-

geal transit times. In normal people, both times are approximately one second. In Marunick's review study<sup>5</sup>, with PAPs inserted, the oral transit time was improved in 11 of 12 subjects, while 6 of 9 subjects had decreased pharyngeal transit time. However, the texture and consistency of the food specimens used in those studies were not reported.

A 2008 study by Okayama et al.<sup>10</sup> revealed that wearing PAPs can reduce not only the duration of contact with the palate but also the total duration of lingual movement. The mean durations of lingual-palatal contact and lingual movement in patients without PAPs were  $805.4 \pm 306.0$  ms and  $1612.2 \pm 478.3$  ms, respectively; in those with PAPs, the times were  $621.8 \pm 364.9$  ms and  $1245.6 \pm 272.5$  ms, respectively. Both times thus showed statistically significant decreases in those with PAPs ( $P=0.03$ ).

The clinical procedures of this report have discussed the fabrication method utilized in making a PAP. Most of the steps used were similar to those used to make conventional complete dentures. The difference was in the application of impression materials to the polished surface of the maxillary denture. Without dentures, the edentulous patient could swallow smoothly due to the lack of vertical dimension and because the tongue could touch the palatal side easily. When the dentures were inserted, the vertical dimension was increased and the patient could not perform the former movement well due to impaired tongue movement. The impression compound was thus used at the beginning to create a lower level palate. And when the patient phonated, the teeth of the opposing arch separated, resulting in an increased vertical dimension. Therefore, the contact between the tongue and the palatal polished surface of the maxillary denture became uncertain. Hence, impression wax was used to mold the movement of phonation. A final check was then done with PIP to confirm actual contact between the tongue and the palatal polished surface of the maxillary denture.

Patients following glossectomy are compromised with prosthetic therapies. Surgical treatment involving the oral cavity often changes anatomical features, resulting in effects such as impaired function of the tongue, compromised condition of the alveolar ridge, reduced load-bearing area, and the reduction of salivary secretions. Therefore, it may be very difficult to restore the oral functions to their presurgical levels. The use of dental implants for such patients may offer some advantages, such as improving the stability and retention of prostheses<sup>11</sup>.

Although the patient described in this report could not afford implant placement, his adaptation to dentures was still acceptable. A patient's ability to adapt to new dentures is of substantial importance,

as are the methods used for denture fabrication. Patient satisfaction with dentures is associated with age, the number of previous dentures, level of education, period of edentulousness, and self-perceptions regarding one's life<sup>12</sup>. The denture bearing area is also another key factor.

The occlusal scheme in this case was arranged to achieve balanced occlusion with denture stability. The maxillary denture was thicker than a normal complete denture, but the retention was acceptable, perhaps due to a sufficient weight-bearing area. If the increased thickness of a denture is excessive, hollowing out of the denture might be considered to decrease the weight of the denture.

The use of PAPs can have positive effects for patients who have undergone a glossectomy. The acceptable final results seen in this case may be attributed to the obedience to a step-by-step treatment protocol and high patient tolerance.

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