

Post-hemimaxillectomy rehabilitation as a conservative prosthetic design to enhance functionality: A case report

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ABSTRACT

Background: Oral rehabilitation through prosthetic management after cancer resection is a conservative and effective modality in improving patients' oral health-related quality of life. However, it is challenging to obtain sufficient retention for hemimaxillectomy and edentulous cases without the use of Osseo-integrated implants. **Purpose:** This case aims to explain the oral rehabilitation management of post-hemimaxillectomy for edentulous patients using a hollow bulb obturator and long-term soft liner. **Case:** A 63-year-old female presented to the Universiti Malaya postgraduate dental clinic and complained of a loose obturator during speaking and eating and high resonance during speaking. Seven years ago, she underwent hemimaxillectomy surgery of the left hard palate for the removal of squamous cell carcinoma. Upon examination, she had an edentulous maxillary arch, with a large palatal defect; the lateral border of the defect was lined with a skin graft. The mandibular arch was partially dentate with three teeth remaining (33, 35, 43). **Case Management:** First, elective root canal treatment of the mandibular canines was done to use them as abutments for a mandibular overdenture. Next, a maxillary hollow bulb obturator and a mandibular overdenture were constructed. Then, after evaluating the airspace on the defect site, the lateral and posterior borders of the obturator were modified to be better utilized for retention. **Conclusion:** Oral rehabilitation of hemimaxillectomy cases with a hollow bulb obturator without the use of Osseo-integrated implants can be a viable option for improving patients' mastication, and speech, after assessing the retention factors, including the seal, available undercuts, and occlusion.

Keywords: hemimaxillectomy; maxillary obturator; oral rehabilitation; overdenture attachments

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INTRODUCTION

Maxillary defects are usually divided into congenital and acquired defects. One treatment modality for maxillary tumors is to surgically resect the tumor resulting in an acquired defect that can range in size from small to large. The defect may involve the hard palate, soft palate, and alveolar ridges and may lead to oronasal communication as well as disruption of speech, mastication, and appearance.¹ Obturators are suggested to be advantageous in restoring large maxillary defects.² Surgical reconstruction after hemimaxillectomy can be accepted in cases where the patient is still dentate in the maxillary arch or where there is a combination of both surgical and prosthetic elements and the obturator can be designed to gain retention and support

from the remaining dentition similar to removable partial dentures.^{1,3} However, obturators on the edentulous maxilla depend solely on the remaining hard palate and the defect site for support and tissue undercuts for retention. Although the use of osseo-integrated implants into the remaining bone of the maxilla has been promoted to enhance the retention and support of the obturators,⁴ using the osseo-integrated implants shows a significantly greater failure rate when being used with patients who have received radiotherapy, especially on irradiated maxilla compared with non-irradiated.⁵

Obturators are categorized as surgical, temporary, and definitive; the third is only provided approximately six months after the surgical resection. When a definitive obturator is designed, the size of the defect is of immense

importance, as the larger the size of the defect the more need to provide a bulb to cover it. Several designs have been proposed to create the bulb, open or closed, hollow or solid. The open design is advantageous in terms of weight and allowing air flow, which reduces resonance, yet it imposes a greater disadvantage in terms of the ability to polish the inner surface and accumulation of nasal secretions and is considered the least hygienic. Similarly, the hollow design is lighter in weight than the solid design;⁶ however, it is technique sensitive and more difficult to construct if planned to be hollow and closed at the same time. In addition, if any reduction of the height of the bulb is required, this imposes the possibility of creating a hole in the bulb, which will collect nasal fluids and subvert the cleanability advantage of the closed design.

Resonance in speech and hypernasality is a serious problem for these patients, as they suffer difficulty in confining the oral emissions to the oral cavity, but the bulb of the obturator and proper palatal seal are sufficient to counter this issue in specific designs.⁷ When the defect is large, the obturator's efficiency in governing speech decreases significantly.⁸ In such cases, obturator support is gained from the orbital floor; this causes the extended superior border of the bulb to hinder airflow in the defect where the hypernasality problem appears.⁹

Maximum distribution of the occlusal forces on centric and eccentric relations is paramount for prosthesis stability. To obtain it, lateral deflective forces must be reduced and a favorable occlusal plane must be established. In cases where natural dentition is overerupted, occlusal adjustments of deflective contacts must be ensured. This certainly can cause hypersensitivity or even pulp exposure in severe cases. Elective root canal treatment can be considered in such cases if the teeth have no signs or symptoms of pulpitis.¹⁰ The purpose of this case report is to explain the prosthetic oral rehabilitation management of post-hemimaxillectomy for edentulous patients using a hollow bulb obturator and long-term soft liner utilizing the available tissue undercuts for retention and establishing sufficient support without distressing speech quality through comprehensive analysis of the defect and surrounding tissues as well as establishing favorable occlusion.

CASE

A 63-year-old Malay female presented to the Universiti Malaya postgraduate dental clinic and complained of a loose obturator that inversely affected speaking and eating functionality as well as of a high resonance sound during speaking. She had been using her present maxillary obturator for three years. Seven years ago, she underwent hemimaxillectomy surgery of the left hard palate for the removal of a squamous cell carcinoma tumor. She also claimed to have received postoperative radiotherapy.

Upon examination, she had an edentulous maxillary arch with a large palatal defect on the left side without involvement of the orbital floor, which did not cross the midline (Figure 1a). The mandibular arch was partially dentate with only three remaining teeth: 33, 35, and 43 (Figure 1b). The patient's existing obturator's intaglio surface (Figure 2) showed multiple torn layered soft liners as well as full extension of the bulb covering the full depth of the defect when in situ. Accumulated calculus on the polished surface indicated poor denture hygiene and gave a poor aesthetic appearance. When in use, the prosthesis only occluded on teeth 33 and 43 (Figure 3), which caused deflective occlusion, impacting the retention and stability of the obturator. Furthermore, evident hypernasality was detected during speech.

CASE MANAGEMENT

After diagnosis and exploring the treatment options, the patient was informed of the treatment, approved the treatment plan, and signed an informed consent. The first step was to take primary impressions. In preparation for taking the primary maxillary impression, a stock tray was modified with impression compound material (Hoffmann Dental Manufaktur GmbH, Komturststraße, Berlin, Germany) on the defect side to ensure the entire depth of the defect was captured in the impression. Subsequently, gauze with petroleum jelly tied to dental floss was used to block the medial wall of the defect to prevent leaking of the impression material into the nasal cavity. Irreversible

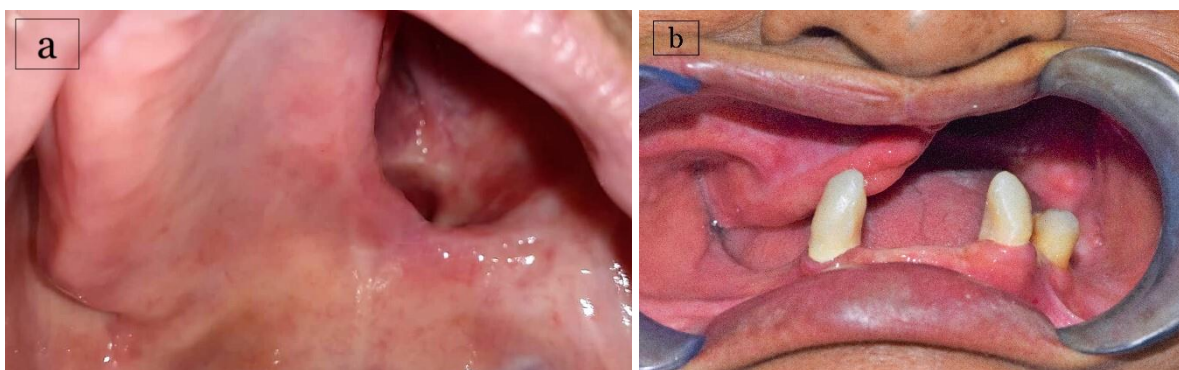


Figure 1. a. Intraoral view of the maxillary arch and the defect of the patient; b. Anterior intraoral view shows the overerupted lower teeth.

hydrocolloid alginate (Aroma fine plus, GCAsia, Singapore) was used to take the primary impressions. Subsequently, a custom tray was fabricated on the primary cast. Next, the medial wall undercut of the defect was blocked again with gauze. Border molding using low fusing compound (green stick) (PERI COMPOUND, GCAsia, Singapore) was done to facilitate capture of the functional depth, and the scar band formed at the skin graft–mucosal junction. Then the final impression was taken in regular body polyvinyl siloxane (PVS) (GC Exaflex, GC America, Alsip, USA). The working maxillary model (Figure 4) was poured using type IV dental stone (Elite stone, Zhermack, Badia Polesine, Italy).

Tooth-supported overdenture was planned for the mandibular arch, and teeth 33 and 43 were to receive telescopic crowns. First, elective root canal treatment (Figures 5a and 5b) was performed, followed by crown reduction and preparation for overdenture abutments. A double-step technique utilizing regular-body PVS (GC Exaflex, GC America, Alsip, USA) and light-body PVS (3MTM Express™ XT Light Body VPS Impression Material, MN, USA) was used to take the impression to construct the metal copings. Resin cement (RelyX, 3M, USA) was used to cement the metal copings on teeth 33 and 43 (Figure 5c).

A record of the maxillary and mandibular relationship was conducted while keeping the patient's existing occlusal vertical dimension, where the previous obturator was used as a guide, and free space was measured and found to be 3 mm. Teeth shade was selected at this stage, and acrylic teeth (Naperce acrylic resin teeth, Yamahachi Dental MFG, Aichi, Japan) were set up to obtain bilateral balanced occlusion for the try-on stage (Figure 6).

Her obturator was designed with a hollow bulb, where the medial wall of the bulb was only in contact with the tissue in that area for 3–5 mm. The bulb was designed to be short in the middle by adding extra block-out on this side of the defect during processing, but it was superiorly extended on the lateral wall, making sure the resonance and hypernasality were reduced and allowing the air to flow into the defect cavity. After that, a soft liner (reline soft II, GC, USA) (Figure 7) was also placed on the intaglio surface of the obturator to maximize engagement with the lateral and posterior undercuts to improve retention on the day of issuing and maintain the cleanability of the bulb by leaving the slop on the medial wall untouched to prevent any fluid retention.

On the intaglio surface of the mandibular overdenture, metal housing was placed in the location of teeth 33 and 43 to accommodate the telescopic crowns. During the issue stage, the retention gained by the new design was satisfactory during function. Also, an evident reduction of hypernasality was noted. Another advantage obtained by the treatment was that facial tissue support was improved by the intra-defect extinction of the obturator, which increased patient satisfaction and confidence (Figure 8). The treatment was satisfactory and met the patient's expectations.

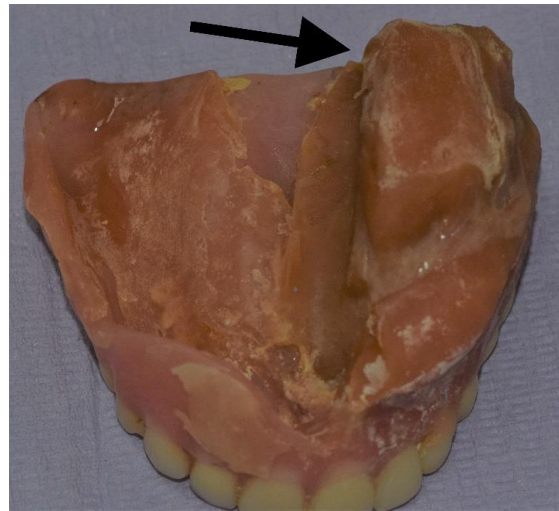


Figure 2. The intaglio surface of the existing denture showing the torn layers of the soft liner. Note the extension of the bulb (arrow).



Figure 3. Intraoral anterior view with the existing denture in situ.

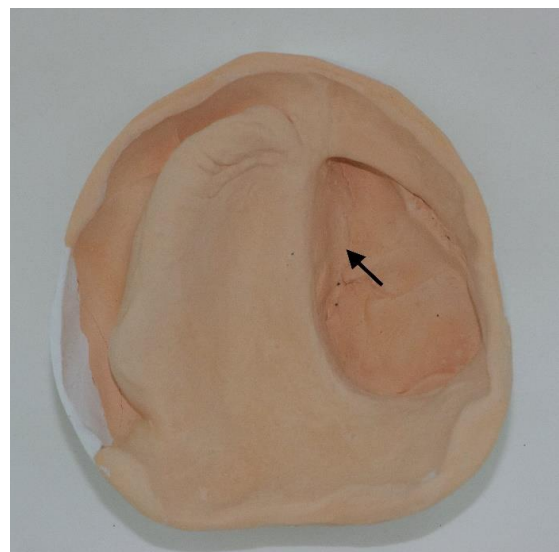


Figure 4. Working maxillary model. Note that the medial undercut was not fully captured (arrow) due to the block-out during impression taking.

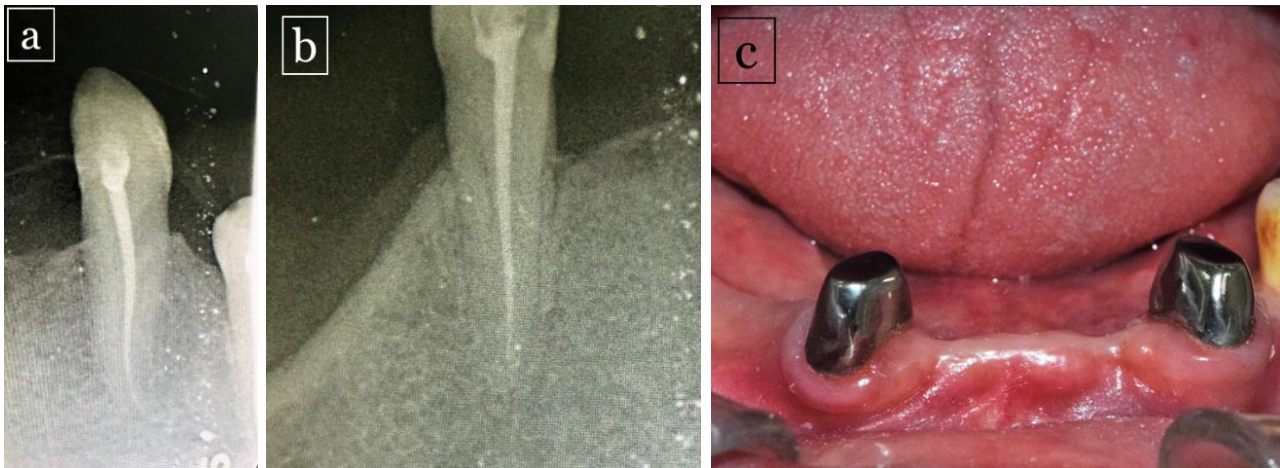


Figure 5. a. Periapical radiograph for tooth 33 after the elective root canal treatment was performed; b. Periapical radiograph for tooth 43 after the elective root canal treatment was performed; c. Intraoral anterior view of the metal copings on teeth 33 and 43.



Figure 6. Anterior intraoral view for the wax-up and teeth setting during the try-on stage. Note the occlusal plane established at this stage.

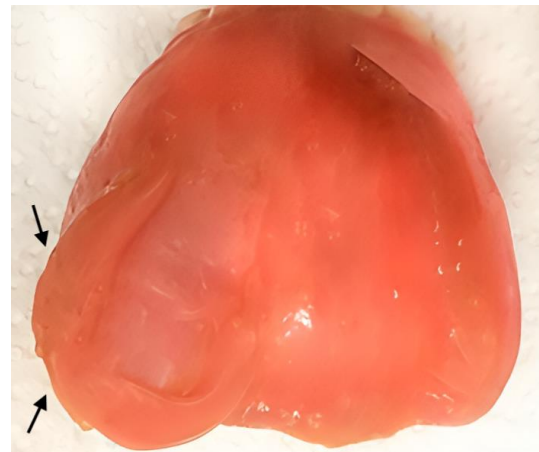


Figure 7. Occlusal view of the intaglio surface shows soft liner placed (arrows) on the lateral and posterior border of the bulb without affecting the medial border.



Figure 8. Extraoral anterior view. a. before the treatment; b. after the treatment. Note the effect of the bulb enhancing support on the cheeks on the defect area (arrows).

DISCUSSION

A maxillary obturator is defined as a maxillofacial prosthesis used to close, cover, or maintain the integrity of the oral and nasal compartments resulting from a congenital, acquired, or developmental disease process, such as cancer. Its objectives are to reduce nasal regurgitation and hypernasality in speech and improve articulation, deglutition, and mastication.¹¹ In this case, the patient presented to the clinic with a complaint of a loose obturator during mastication and a high resonance sound during speaking. Hence, the objective of the treatment was to provide the patient with satisfactory rehabilitation for her eating and speaking functionality.

Treatment options for this case could have included prosthetic obturation or surgical tissue reconstruction.¹² However, obturators are suggested to be advantageous in restoring large maxillary defects.² On the other hand, the prosthetic obturator may suffer a loss of retention, which in this case could be attributed to multiple factors. Initially, there was a lack of posterior support by opposing occlusion, which lead to loss of the posterior seal of the obturator, especially with the dentoalveolar compensation and overerupted teeth 33 and 43 due to insufficient occlusal stop. This, in turn, hindered the occlusion and reduced the retention during mastication in addition to the weight of the obturator due to the bulky size of the bulb and the minimal lateral undercut available for retention.¹³

To overcome the first and second factors, mandibular partial overdenture with telescopic crowns was employed for the treatment (abutments on teeth 33, 43) due to the need to reduce the height of the clinical crowns to ensure a suitable vertical dimension and provide balanced occlusion. This choice of treatment has been proven to be a viable and satisfactory option for patients with two or three teeth remaining in the arch, and it shows high survival rates, over 60 months, for the abutment.^{14,15}

The large extension of the bulb on the defect site added additional weight to the patient's prosthesis. Consequently, gravity triggered dislodgement of the obturator whenever there was no occlusal stop. To overcome this challenge, a hollow-bulb obturator was utilized. Using this type of prosthesis significantly reduces the weight of obturators compared with the solid type.^{6,16} Although the use of Osseo-integrated implants in maxillectomy cases has been promoted, and considered especially in cases with large defects,¹⁷ nevertheless, this patient had received radiotherapy, and it has been found that using the Osseo-integrated implants to retain a maxillary obturator for a completely edentulous maxilla may have a compromised success rate for patients who have received radiotherapy.¹⁸ Other means to enhance the retention of the obturator include using the anatomic structures, such as the lateral and posterior undercuts, which have been included in the design; though, the hard acrylic on those areas can be traumatizing due to the increased size of the prosthesis. This required further adjustment, using a soft liner to extend the

prosthesis to engage those undercuts without traumatizing the patient's soft tissue.¹⁷ As this patient's defect had a skin graft, stress was well-tolerated by the skin graft and oral mucosa lining the cheek surface of the defect. Extending the prosthesis superiorly along the lateral margin of the defect successfully improved the retention, stability, and support of the obturator.

In the present case, the patient complained of a high resonance sound during speaking, even though prosthetic treatment is expected to enhance patient speech.¹⁹ It was noted that the current obturator provides a satisfactory seal between the oral and nasal cavities. They are supported by the orbital floor where the extended superior border of the bulb fills the entire defect cavity, reducing airflow in the defect where the hypernasality problem appears. For that reason, the new prosthesis design avoids the medial wall and only utilizes the lateral border. This, in turn, provides adequate space medially for airflow and, at the same time laterally supports the hard tissue stop. For this, a long-term soft liner was adopted to maintain patient comfort during function, as it can be predicted that the use of a soft liner may enhance the masticatory performance as well as oral health-related quality of life.²⁰

This case design combined the advantage of both open- and closed-bulb designs. Simply employing the lateral wall and at the same time utilizing the hollow bulb provided the advantages of space and light weight as in an open design. Furthermore, the advantages of the closed design were obtained by maintaining the cleanability of the bulb by sustaining the slop on the medial wall, preventing any fluid retention. In conclusion, prosthodontic oral rehabilitation of hemimaxillectomy cases with a hollow-bulb obturator without the use of Osseo-integrated implants can be a viable option for improving a patient's mastication and speech after thorough examination and assessment of retention factors, including the peripheral seal, available undercuts, obturator extensions, and occlusion.

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