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# Managing Maxillofacial Defects with Hollow Closed Bulb Obturator Prosthesis

Sanaa Rimaoui, Soukaina Oujdad, and Samira Bellemkhannate

***ABSTRACT***

**Maxillary resection surgery in response to tumour processes often results in loss of substance, leading to bucco-nasal or bucco-naso-sinus communication. The resulting consequences are significant, including difficulties with eating, with food and fluids leaking out, phonetic problems resulting in a nasal voice and incomprehensible speech. These problems are compounded by aesthetic problems such as sagging skin, asymmetry and facial disfigurement, particularly in cases where the facial tissues are affected.**

**This article describes the case of a patient with maxillary bone loss associated with a deficit of jugal covering tissues. We decided to fabricate a cast metal partial denture with a hollow obturator, and we will detail the steps involved in its fabrication and describe the impression techniques used. Given the absence of a mandibular prosthetic corridor, we will also describe our approach to rehabilitating the mandibular arch to prevent food and fluid spillage through the jugal gap. In this context, our main objective was to ensure a watertight seal to guarantee optimal function.**

**Keywords:** Closed bulb obturator, Hollow obturator, Malignant maxillofacial defects, Prosthesis.

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## I. Introduction

Maxillofacial prosthesis is defined as the science of artificially reconstructing different structures of the face. It is indicated in cases of congenital or acquired maxillofacial defects, due to oncological, infectious or traumatic causes [1].

In cases involving a substantial maxillary defect, the maxillofacial obturator prosthetic is typically composed of two separate parts [2]:

- A palatal plate, facing the intraoral cavity and restoring the palate's surface and outlines. It also encloses the dental part.

- An obturator, to fill the maxillary defect, positioned on the upper surface of the palatal plate, within the maxillary bone.

Following the conventional removable prosthesis principles, maxillofacial prosthesis must respond to Housset's triad (support - retention - stabilization), adding to these, it must respond to the objective of peripheral sealing. In conclusion we can establish a « Maxillofacial prosthetic tetrad" (Housset's triad completed by the objective of sealing) [3].

In response to this prosthetic tetrad, several techniques and therapeutic choices have been reported [4], but with common objectives: to enable the patient to regain optimal mastication, phonation and swallowing, while ensuring a seal between the oral and nasal cavities and an acceptable aesthetic result [5].

The obturator can be flexible and made of silicone elastomer. It's generally hollow, removable, and secured to the prosthesis by an interlocking system or magnetic attachments [4,6]. It has the advantage of lightness and comfort. A number of factors can limit its indication, we cite its fragility, the impossibility of carrying out a rebasing if needed, and the fact that it requires periodic changes every two years [7].

The rigid obturator on the other hand, made of acrylic resin and fixed to the palatal plate, is more frequently used due to its low cost, its rigidity and non-porous texture, and its rebasable character [8].

Despite its advantages, the clinical application of a rigid obturator prosthesis can be challenging. Achieving a stable and retentive prosthesis with this type of obturator iscomplicated by the inherent weight. To overcome these problems, the use of a hollow obturator is employed, offering two techniques: Open or closed bulb [9].

The open bulb obturator is comparatively easier to manufacture and fit, but has the disadvantage of collecting nasal secretions, requiring frequent and thorough cleaning. On the other hand, the closed bulb obturator facilitates oral hygiene, is lighter, and provides maximum coverage, but is more complex to fabricate.

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## II. CASE REPORT

A 60-year-old female patient in apparent good health consulted the Surgical Dentistry Department at CCTD for radiating pain in the hard palate. The patient had no history of tobacco or alcohol use. Clinical examination revealed mild facial asymmetry. Intraoral examination showed the presence of a budding, vegetating, exophytic lesion raised above the adjacent mucosa and bleeding upon contact. The lesion was painful and bled upon touch. Induration was also noted in the corresponding cheek.

Histological examination concluded a squamous cell carcinoma of the hard palate. After a multidisciplinary consultation meeting, the therapeutic strategy consisted in a large safety margin excision of the left side of the maxilla including homonym palate and sinus and preserving the orbital floor. A radical neck dissection was performed simultaneously, under general anesthesia. Afterward, the patient received external transcutaneous adjuvant radiotherapy with a total dose of 70 grays.

One month later, the patient was referred to the department of removable prosthetic of the consultation and treatment center of Casablanca to start the prosthetic treatment.

The tumor excision gave way to an important facial defect on the left cheek resulting in a pronounced aesthetic damage (Fig.1). The endobuccal defect included the left side of the hard palate, presenting a large oro-nasal fistula (Fig. 2).

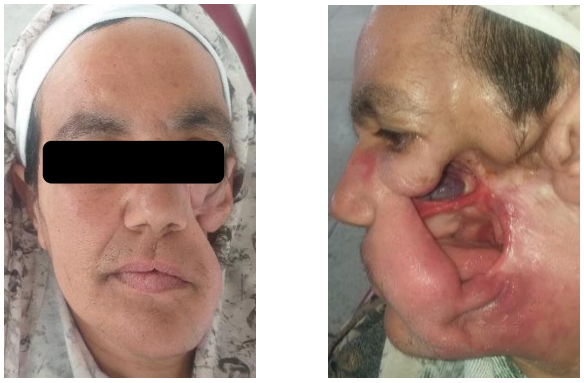

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Fig. 1. Maxillary and jugal defect after hemi-maxillectomy of the hard palate (squamous cell carcinoma of the hard palate): a: frontal view; b: side view.

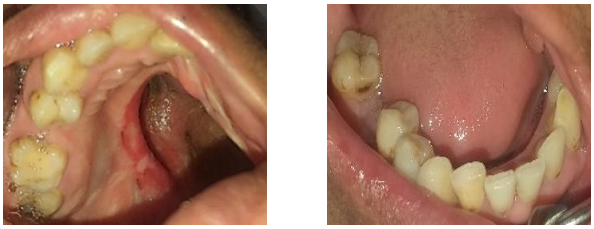

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Fig. 2. Endobuccal view: a: maxillary arch; b: mandibular arch.

Teeth loss is presented as a Kennedy's class II modification 1 in the maxillary arch, and class II modification in the mandibular arch.

Eating disfunction and phonation disturbance were very accented by the absence of oral and facial continuance and food and liquid leakage.

We decided on a partially removable prosthetic with a closed hollow bulb obturator. We describe the different steps of elaboration.

A Palatal plate made of transparent resin and rebased with a tissue conditioner, was worn by the patient on a temporary basis during the making of the definitive appliance.

A provisional palatal plate was made to prevent contamination of the surgical site during tissue healing. By reproducing the palatal contours and sealing the patient was able to regain phonation and masticatory function.

We proceeded as follows: the most creased areas of the defect were filled with a few fragments of Vaselined gauzes. An alginate impression was taken using a standard plastic impression tray cut and adjusted to match the defect.

The resulting dental cast (named N1) will be used to make the palatal plate, and for the elaboration of an individual impression tray.

The palatal plate was then fitted. The plate was then filled with tissue conditioner to form the temporary obturator. (Fig. 3).

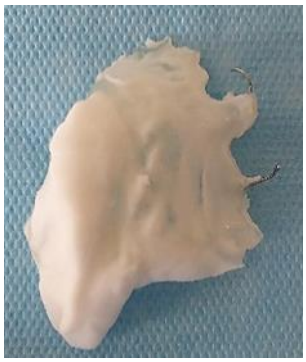

Fig. 3. Palatal plate rebased with tissue conditioner.

Using the individual tray prepared on cast N1, we proceeded with the secondary impression. The tray is first adjusted, ensuring its borders are positioned 1.5 to 2 mm from the mucosal reflection line and frenulum insertions. A rebordering procedure with a suitable material for irradiated tissue, such as polysulfide, is applied in the area corresponding to the healthy hemi-arch. Prior to taking the central impression, preparation of the clasps' housings is performed according to the pre-established framework of the removable partial denture. Due to significant cantilevering of the obturator, the clasps will need to engage nearly all the teeth of the healthy hemi-arch. It should be noted that the prepared plate will extend closely to the defect area by a retentive grid that will be embedded in the obturator.

The central impression was taken using a medium-viscosity polysulfide material (Permlastic Regular®) in two steps:

- First step: With the previously adjusted tray, an impression was taken using polysulfide material of the healthy part of the arch, ensuring to seal any undercuts with small pieces of vaselined gauzes (Fig. 4a).
- Second step: The same material is prepared and injected using a syringe directly through the buccal defect to record the defect. (Fig. 4b).

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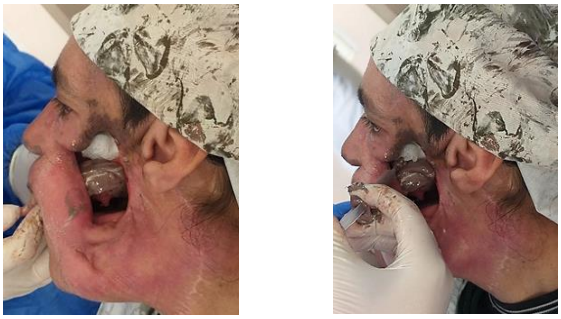

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Fig. 4. Steps of the maxillary secondary impression:
a: Impression of the healthy part of the arch b: Impression of the defect.

The secondary impression (Fig. 5) is poured in hard plaster to create model N2.

Fig. 5. Maxillary secondary impression.

This model is used for the construction of the cast metal framework using a cobalt-chrome alloy, following the conventional technique.

The metal framework was tried on. The clasps and position of the retention grid were inspected and adjusted. (Fig. 6).

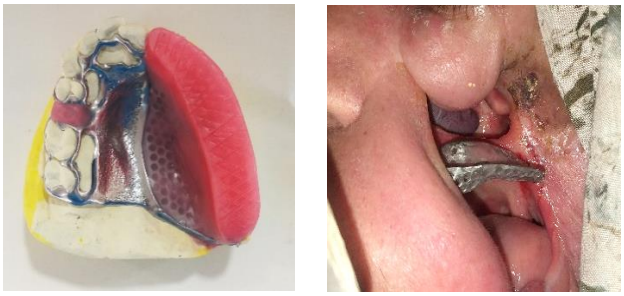

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Fig. 6. Fitting of the metal framework:
a: Stellite on cast N2; b: Exobuccal view.

The impression of the obturator involved three distinct steps, with the first step being the ambulatory impression. After inspecting and adjusting the metallic framework, a large quantity of Fitt resin by Kerr® is prepared and directly injected into the defect area through the buccal defect to form an ambulatory obturator (Fig. 7).

The patient was sent with the ambulatory obturator, which records the condition of the mucosa, the periphery of the defect, and the surrounding structures during physiological functions over the next few days.

The patient was examined periodically to adapt the obturator (addition or subtraction procedures) for a duration of 3 weeks.

The second step in the impression process for the obturator was the corrective impression.

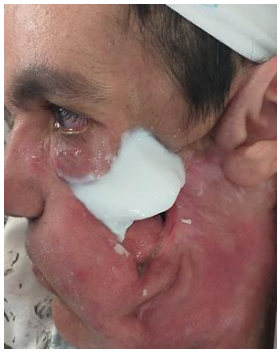

Fig. 7. Ambulatory obturator with tissue conditioner.

After confirming the obturator's fit, we proceeded to rebase the ambulatory obturator using a low-viscosity injectable silicone to enhance the accuracy of the impression (Fig. 8).

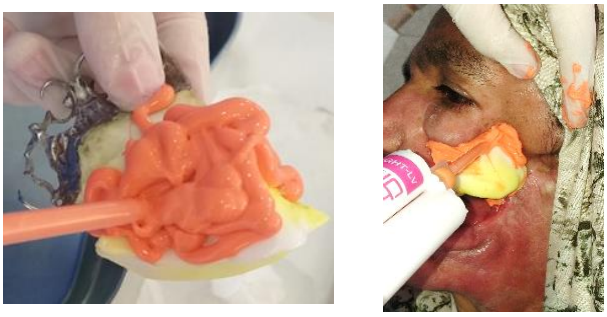

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Fig. 8. Rebasage of the ambulatory obturator using low-viscosity silicone.

The third and final step in the impression process for the obturator was the over-impression with alginate. A stock plastic tray was adjusted to cover the entire arch avoiding any interference with the metallic framework.

An over-impression was taken using alginate, encompassing both the denture base and the obturator.

The casting was done in a dissociated manner to obtain «dental cast N3» on which the hollowed obturator was made:

A self-polymerizing resin was prepared, which was applied to the periphery of the cast representing the negative of the bulb. After solidification, a pink wax was poured to fill the placement of the obturator. A self-polymerizing resin was applied to the stellite corresponding to the defect area. The stellite was then placed back in its correct position on the cast, to let the resin polymerize. Afterwards, the cast was fractured to retrieve the prosthetic.

After the surface finishing of the prosthesis, two holes were made on both sides of the obturator. The prosthesis was then immersed in a bowl of boiling water to melt and remove the wax filling inside the obturator.

Once all of the wax had been evacuated, a small amount of self-polymerizing resin was prepared to close the holes. A final surface finishing was performed using a resin bur and a hard-bristle brush with pumice.

The final prosthesis was tried on again, and necessary adjustments were made. Interference of the prosthesis with nasal breathing, and head the movements were also inspected.

Due to the absence of the bony ridge in the left mandibular arch and the absence of the prosthetic corridor, it was not possible to rehabilitate the patient the conventional way. We did not mount prosthetic teeth on the maxillary part; our

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primary goal was to ensure a good seal that would allow the patient to have an acceptable mastication on the healthy sector. We created a resin plate with custom-made clasps that fit perfectly into the remaining jugal gap. The aim of the device was to prevent fluid and food leakage. It also serves as support for the tongue during its functions (Fig. 9).

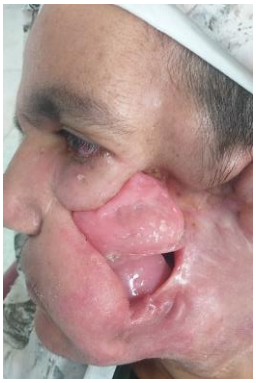

Fig. 9. Maxillary and mandibular prosthetics fitting.

## III. Discussion

Resection surgery often leaves disabling sequelae including eating and swallowing difficulties, speech disorders, aesthetic deficits characterized by skin contours sagging and facial disfigurement in cases facial defects.

The role of the dentist is crucial in the rehabilitation of these defects. Patient should be accompanied throughout the different stages of treatment. Psychological support is a fundamental aspect of ensuring integration and acceptance of the maxillofacial obturator [8], [10].

As mentioned earlier, the obturator prosthesis is often composed of two parts:

- A palatal plate, which can be made of acrylic resin or cobalt-chrome metal, which will include the prosthetic teeth and restore the contours of the bony palate and the alveolar ridge,
- An obturator filling the defect tissue loss and following its contours.

Depending on the extent of the defect, several types of obturators have been described in the literature, including solid obturators, hollow closed bulb obturators, hollow open obturators, and silicone obturators.

The shape and size of the obturator can vary, and it should contribute to prosthetic stability, retention, and sealing. However, in cases of extensive tissue loss, a large extension of the obturator can result in additional weight, leading to prosthesis dislodgement and retention problems.

In cases of extensive maxillary defects, a hollow obturator is recommended, and the choice in such cases is between an open or closed bulb obturator.

The open bulb obturator is lightweight and easy to make because the hollowing process is done on the day of prosthesis insertion, it does not require complex laboratory steps. However, it has the disadvantage of accumulating nasal secretions, which can lead to halitosis, and the increase infection risk.

The closed bulb obturator presents the advantage of lightweightness and superior sealing ability. It perfectly molds the contours of the defects and prevents the accumulation of nasal secretions and mucus.

The complexity lies in choosing a material that will maintain the hollow shape of the obturator during its fabrication and can be evacuated afterwards. In this case, we opted for wax, a material that solidifies after setting and allows us to maintain the desired shape and can be liquefied and evacuated.

Several materials can be used for this purpose:

- Powdered or granulated sugar or granulated [8].
- Ice cream or frozen water [11].
- clay [12].
- Alum stone (known as "el Chab" in Arabic) [13].

Tanaka et al. suggested incorporating polyurethane foam into the defective area of the prosthesis to create the hollow area [14].

Other methods have also been described, involving fabricating the obturator in two parts and sealing the segments with self-polymerizing resin.

The classic technique involves creating a solid closed obturator in the first place, using conventional methods, and then hollowing it out. A wax lid is fabricated, polymerized, and sealed using self-polymerizing resin [8].

In this case, the dimensional changes and properties of the self-polymerizing resin can be one of the main challenges. We have used this technique in the elaboration of hollow obturators, both definitive and temporary, for five patients in the past year at the Dental Consultation and Treatment Center (CCTD) in Casablanca.

These patients were all satisfied with the results and reported an important quality of life improvement.

## IV. Conclusion

Loss of substance in the upper jaw often results in disabling sequelae, both aesthetically and functionally. The importance of early diagnosis means that the patient can be treated with less invasive surgery. Otherwise, loss of maxillary bone substance is often associated with a facial deficit that has a significant impact on the patient's aesthetic appearance.

The prosthetic rehabilitation of these patients requires a great deal of creativity, as the rules of conventional prosthetics do not always apply. A reasoned clinical reflection can guide the treatment by choosing the appropriate techniques and type of prosthesis.

## Conflict of Interest

Authors declare that they do not have any conflict of interest.

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