Lightweight by Design: A Simplified Hollow Bulb Interim Obturator for Maxillary Rehabilitation – A Case Report.

Abstract:

A lightweight closed hollow bulb interim obturator was fabricated for a 74-year-old male following hemi-maxillectomy for squamous cell carcinoma. A customized ice spacer, shaped according to the defect morphology, was used during heat polymerization to create the hollow bulb without requiring spacer retrieval or an access opening. The resulting obturator demonstrated satisfactory retention, stability, and structural integrity, with improved speech, mastication, deglutition, and patient comfort. The customized ice spacer technique is a simple, economical, and practical alternative for fabricating lightweight closed hollow bulb interim obturators during postoperative maxillary rehabilitation.

Keywords: Maxillary defect; Interim obturator; Hollow bulb obturator; Ice spacer; Hemi-maxillectomy; Maxillofacial prosthodontics.

Introduction

The maxilla serves as the cornerstone of midfacial form and oral function. Loss of maxillary tissues following surgical resection creates a complex oronasal communication that compromises speech, mastication, deglutition, facial esthetics, and psychological well-being, making prosthetic rehabilitation an indispensable component of comprehensive patient care[1,2].

An obturator prosthesis is the treatment of choice for restoring the separation between the oral and nasal cavities, thereby improving speech intelligibility, swallowing efficiency, masticatory function, and facial support[2,3]. Depending on the stage of treatment, obturator prostheses are broadly classified into **surgical, interim, and definitive obturators**, each serving a distinct role in the continuum of maxillofacial rehabilitation[1]. Among these, the **interim obturator** is fabricated during the postoperative healing phase to restore oral function, protect the surgical site, support healing tissues, and facilitate the patient's functional and psychological adaptation before definitive prosthetic rehabilitation. As postoperative tissues continue to remodel and contract, the interim obturator also permits periodic adjustments to accommodate these changes[3,4].

The increased weight of a conventional solid obturator, particularly in patients with extensive maxillary defects, may adversely affect retention, stability, and patient comfort[5]. To overcome this limitation, **hollow bulb obturators** have been widely advocated because they reduce the overall weight of the prosthesis while preserving its structural integrity, thereby improving retention, stability, speech, swallowing, and patient comfort[5,6]. Based on the bulb configuration, hollow bulb obturators are classified as **open** or **closed** designs[7]. Although open hollow bulb obturators are relatively simple to fabricate, they are prone to the accumulation of food debris, nasal secretions, and moisture within the bulb, making hygiene maintenance challenging[7]. In contrast, closed hollow bulb obturators provide a sealed hollow cavity that minimizes fluid accumulation, facilitates hygiene maintenance, and further enhances patient comfort and acceptance[6,7]. Various techniques have been described for fabricating closed hollow bulb obturators using different spacer materials and processing methods[8,9]. Despite these advances, there remains a need for fabrication techniques that are practical, predictable, and capable of producing a lightweight interim prosthesis while minimizing laboratory complexity[8,9].

The present case report describes the fabrication of a lightweight **closed hollow bulb interim obturator** for the rehabilitation of an acquired maxillary defect.

The described laboratory technique was aimed at reducing prosthesis weight while restoring speech, mastication, deglutition, and patient comfort during the interim phase of maxillofacial rehabilitation.

Case Report

A 74-year-old male patient reported to the **Department of Prosthodontics , crown & bridge , Dr. R. Ahmed Dental College and Hospital, Kolkata**, with the chief complaints of difficulty in speech, nasal regurgitation during swallowing, impaired mastication, and compromised estheticsfollowing surgical resection of the maxilla.

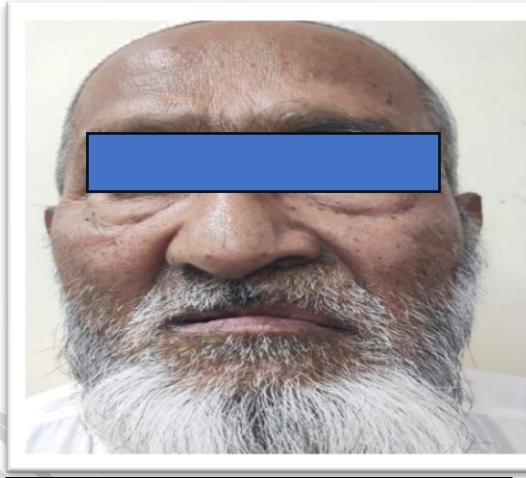


Figure 1A: Extraoral examination

The patient's medical history revealed that he was a known case of diabetes mellitus and was under regular medication with satisfactory glycemic control. The patient had undergone a **hemi-maxillectomy** three months earlier for the management of **squamous cell carcinoma** of the maxilla. A surgical obturator had kbeen delivered immediately following surgery. The patient was subsequently referred to the Department of Prosthodontics ,crown and bridge for interim prosthetic rehabilitation during the postoperative healing phase.

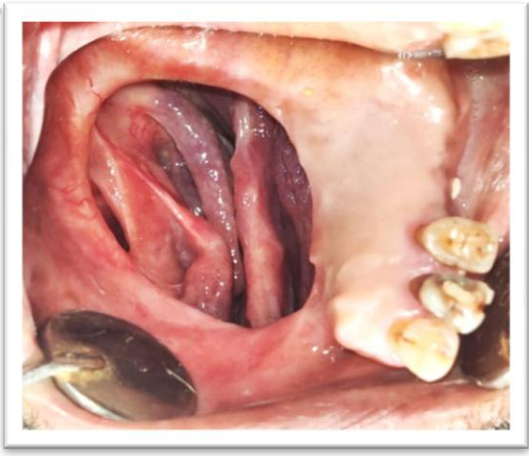


Figure 1B: Intraoral examination maxillary arch

Extraoral examination revealed restricted mouth opening, with no obvious facial asymmetry or extraoral scarring (**Figure 1A**).

Clinical examination revealed an acquired maxillary defect with an oronasal communication and the remaining maxillary dentition (**Figure 1B**). The surgical site was undergoing satisfactory healing; however, complete tissue healing had not yet been achieved. The remaining maxillary dentition comprised teeth **16, 17, and 22–27**, while the remaining mandibular dentition included teeth **35, 44, 45, and 46** (**Figure 1C**). Cervical abrasion and generalized attrition were evident in the remaining teeth, although they exhibited adequate periodontal support for prosthetic rehabilitation. Oral hygiene was considered satisfactory. Based on the clinical examination, the defect was classified as **Aramany Class IV**[2]and **Brown**

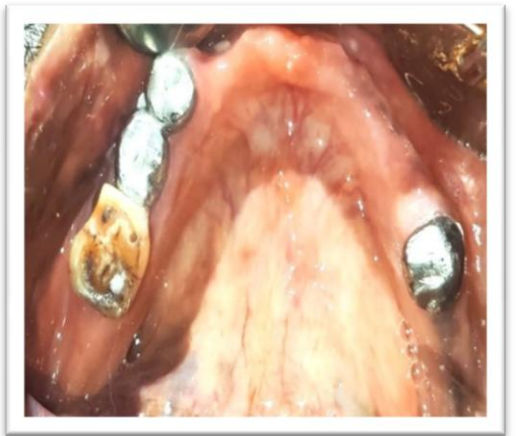


Figure 1C: Intraoral examination mandibular arch

Class IIc, indicating a unilateral maxillary defect without orbital involvement involving more than half of the unilateral maxilla[10].

Considering the ongoing tissue remodeling and incomplete healing of the surgical site, a **closed hollow bulb interim obturator** was planned to restore speech, mastication, deglutition, and facial support while facilitating continued healing before definitive prosthetic rehabilitation[1].

Clinical Procedure

A preliminary impression of the maxillary arch was recorded using irreversible hydrocolloid impression material(**Algitex, DPI, Mumbai, India**) after gently packing the surgical defect with sterile gauze to prevent the impression material from engaging the deep undercuts of the defect and to facilitate atraumatic removal of the impression. A preliminary impression of the mandibular arch was subsequently recorded using irreversible hydrocolloid impression material in a suitably selected perforated stock tray. The maxillary preliminary impression was poured in **impression plaster** to accurately reproduce the surgical defect(**Figure 2A**), whereas the mandibular preliminary impression was poured in **Type III dental stone(BN Stone Type III Dental Stone, BN Dental Products, India)** to obtain diagnostic casts for treatment planning and

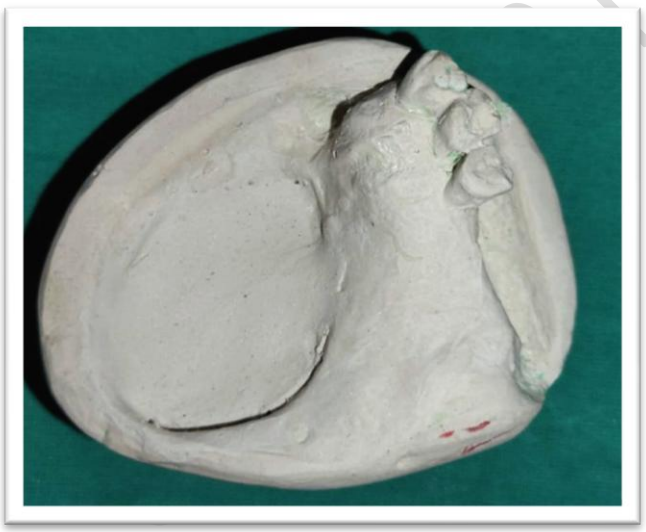


Figure 2A: Preliminary maxillary cast

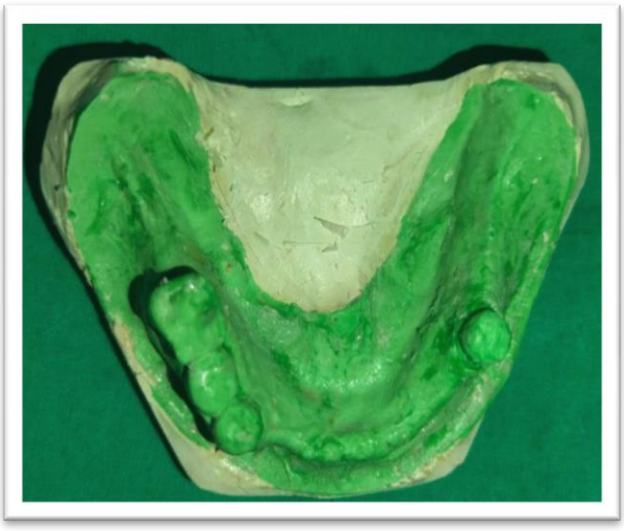


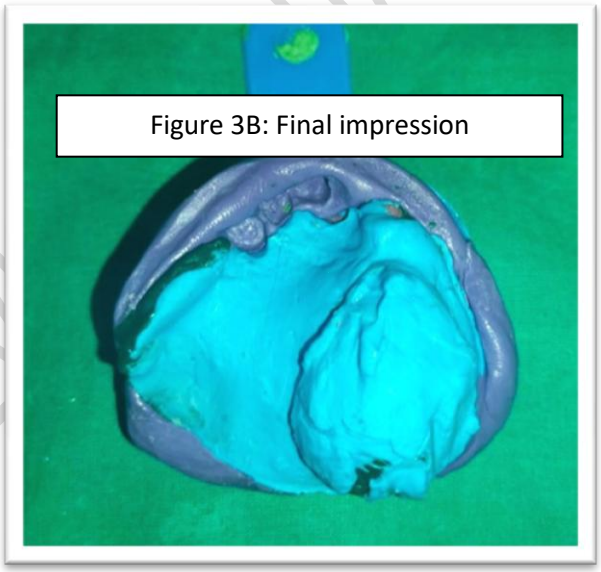
Figure 2B: preliminary mandibular cast

custom tray fabrication (**Figure 2B**)

Final impression of the maxillary arch was recorded using a custom tray fabricated with autopolymerizing acrylic resin and a single-sheet wax spacer (Figure 3A). Border molding was performed using low-fusing green stick impression compound to accurately record the peripheral extensions and functional limits of the surgical defect. Following border molding, the wax spacer was removed, and a dual-stage addition silicone impression technique was employed. Medium-body addition silicone impression material(**Photosil Medium Body, DPI, Mumbai, India**) was first used to record the surgical defect, peripheral extensions, and supporting tissues. Subsequently, putty consistency addition silicone(**Photosil Medium Body, DPI, Mumbai, India**) was adapted over the dentulous portion of the arch to reinforce the impression and accurately record the remaining teeth (Figure 3B). As the mandibular preliminary impression was considered satisfactory, a separate definitive impression was not required. The completed maxillary impression was evaluated for surface detail and anatomical accuracy before being poured in Type III dental stone to obtain the master cast for prosthesis fabrication (Figure 3C).

Figure 3A: custom tray

Figure 3B: Final impression



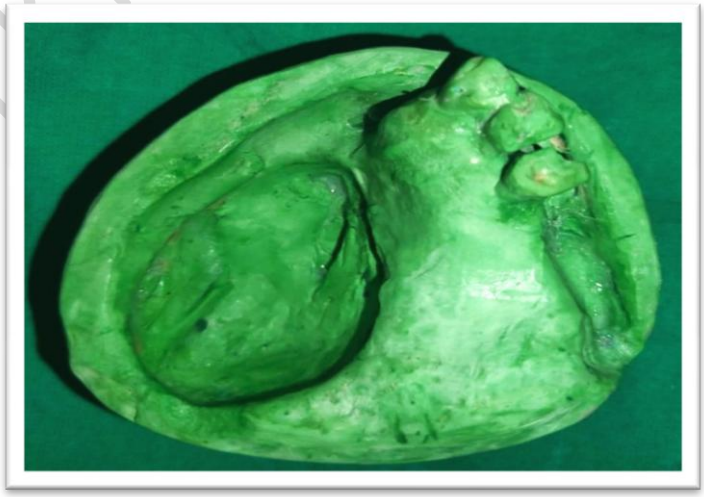


Figure 3C: Master cast

Record bases and wax occlusal rims were fabricated on the master cast. Maxillomandibular jaw relations were established, and the maxillary and mandibular casts were mounted on an articulator(Figure 4A). Artificial teeth were arranged according to the recorded jaw relation(Figure 4B,4C). A wax trial was performed to evaluate esthetics, phonetics, occlusion, vertical dimension, and overall prosthesis stability. Necessary modifications were made

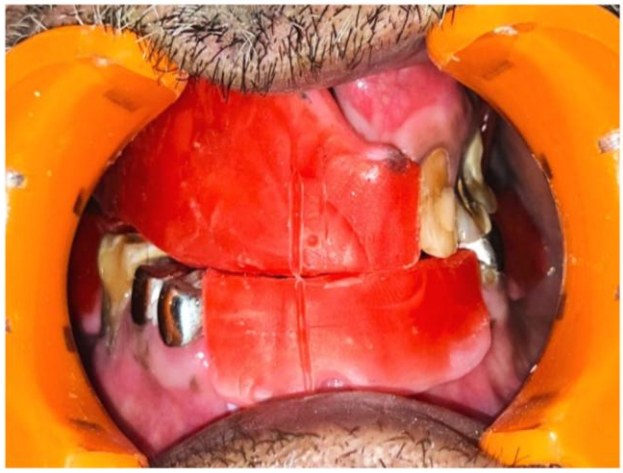


Figure 4A: Jaw relation

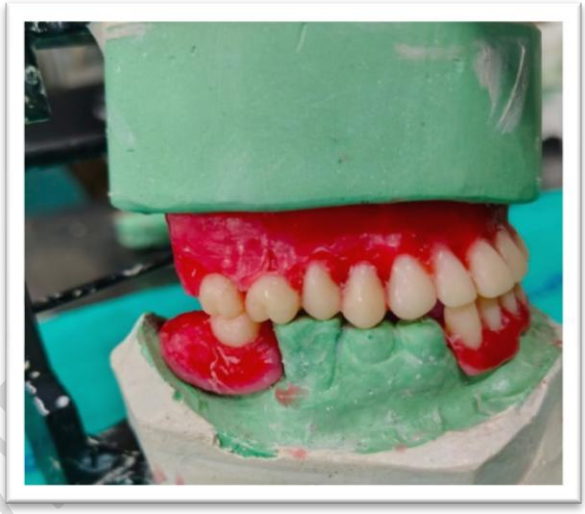


Figure 4B: Articulation and Teeth Arrangement

before proceeding with the processing of the definitive interim obturator.

Figure 4C: Wax trial

Following a satisfactory wax trial, the prosthesis was conventionally flasked and dewaxed (Figure 5A). A wax pattern corresponding to the hollow bulb portion was adapted within the defect area of the mold cavity. Water was then poured into the wax pattern and frozen to obtain a **custom-shaped ice spacer** that precisely conformed to the dimensions of the bulb (Figure 5B).

After removal of the wax pattern, heat-polymerizing acrylic resin was adapted to the defect portion of the mold to form the outer shell of the obturator. The custom-shaped ice spacer was positioned within the bulb space

, and the remaining mold cavity was packed with heat-polymerizing acrylic resin using the conventional compression molding technique . The flask was processed according to the manufacturer's recommended heat-curing cycle.

During heat polymerization, the custom ice spacer melted, leaving a hollow cavity within the bulb of the obturator without requiring retrieval of a solid spacer material or the creation of an access opening. The processed prosthesis was subsequently retrieved, finished, and polished using conventional laboratory procedures (Figure 5C). The completed closed hollow bulb obturator was inspected for integrity, reduced weight, and the absence of defects before clinical insertion.

Figure 5A:Conventionally flasked and dewaxed

The finished and polished closed hollow bulb interim obturator was inserted, and (Figure 6A). The obturator effectively restored the separation between the oral and nasal cavities, resulting in improved speech, mastication, and deglutition. The lightweight design of the hollow bulb enhanced patient comfort and contributed to satisfactory prosthesis retention and stability (Figure 6B).

The patient was instructed regarding the insertion and removal of the prosthesis, maintenance of oral and prosthesis hygiene, and appropriate wearing schedule.

Figure 5B:Custom shaped ice spacer

Figure 5C: Processed prosthesis

Regular follow-up visits were advised to monitor healing of the surgical site and to evaluate the fit and function of the interim obturator.

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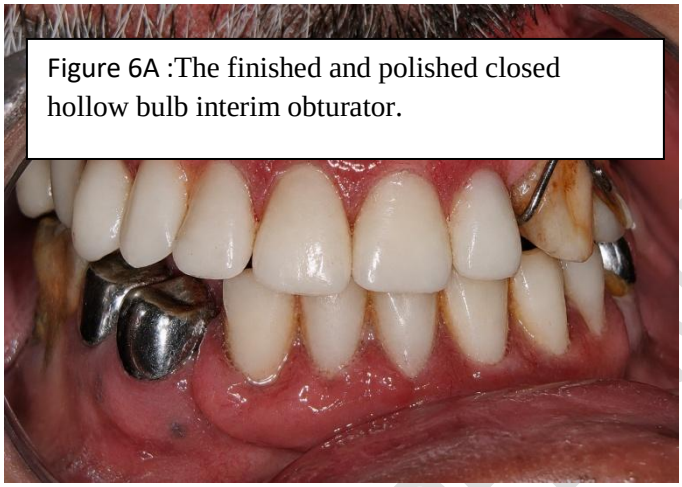

Figure 6A :The finished and polished closed hollow bulb interim obturator.

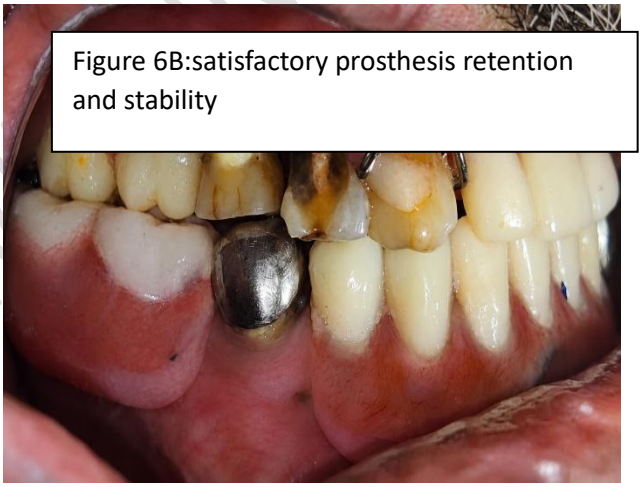

Figure 6B:satisfactory prosthesis retention and stability

Discussion

Acquired maxillary defects resulting from surgical resection significantly impair speech, mastication, deglutition, and facial esthetics by creating an abnormal communication between the oral and nasal cavities.Prosthetic rehabilitation with an obturator prosthesis remains the treatment of choice for restoring these functions throughout the different phases of healing. A surgical obturator is inserted immediately at the time of surgery or within 24 hours postoperatively to protect the surgical wound, support surgical dressings, and facilitate early restoration of function. Following initial wound healing, an interim obturator is typically fabricated 7–10 days after surgery and during the healing and tissue remodeling phase for approximately 3–6 months, during which periodic adjustments or relining may be required. Once complete healing and stabilization of the tissues have occurred, usually after 3–6 months (or longer in patients receiving radiotherapy), a definitive obturator is fabricated to provide long-term functional and esthetic rehabilitation[3,4].An interim obturator not only restores oral function but also protects the surgical site, supports healing tissues, and allows periodic modification until definitive rehabilitation can be undertaken. [1,3,4]

The weight of a conventional solid obturator is a major concern, especially in patients with extensive maxillary defects, as it may compromise retention, stability, and patient comfort. To overcome this limitation, hollow bulb obturators have been widely recommended because they reduce the overall weight of the prosthesis while maintaining its structural integrity. [5,6]

Several techniques have been described for fabricating hollow bulb obturators using spacer materials such as salt, sugar, silicone putty, modeling clay, wax, polyurethane foam, thermocol, and ice. Although these techniques are effective, many require retrieval of the spacer through an access opening followed by sealing of the opening, thereby increasing laboratory procedures and technique sensitivity. [8-12]

In the present case, a **custom-shaped ice spacer** was used to fabricate a lightweight closed hollow bulb interim obturator. The spacer was customized according to the morphology of the defect by freezing water within a wax pattern before processing. During heat polymerization, the ice melted completely, creating a hollow cavity without requiring retrieval of the spacer or preparation of an access opening. The use of an ice spacer for hollow obturator fabrication has previously been described as an alternative hollowing material because it melts completely during processing and eliminates the need for retrieval of spacer material[13]. However, unlike the previously described technique, the present method utilized a **custom-shaped ice spacer fabricated**

from a wax pattern corresponding to the defect morphology, allowing more accurate adaptation within the defect and uniform acrylic resin thickness throughout the hollow bulb.

The use of the customized ice spacer offered several advantages, including low cost, easy availability, complete elimination during processing, and the absence of residual material within the prosthesis. Furthermore, customization of the ice spacer facilitated satisfactory adaptation within the bulb while maintaining the desired contour and structural integrity of the prosthesis.

The fabricated obturator demonstrated satisfactory retention, stability, and patient acceptance. The reduction in prosthesis weight improved comfort while effectively restoring speech, mastication, and deglutition by re-establishing separation between the oral and nasal cavities. These findings are consistent with previous reports demonstrating improved function and patient comfort with lightweight hollow bulb obturators. [6,14]

Although the technique requires timely laboratory manipulation to prevent premature melting of the customized ice spacer, it represents a practical and economical modification of previously described hollow obturator fabrication techniques. Further clinical studies involving larger patient populations and long-term follow-up are recommended to evaluate the reproducibility and long-term clinical performance of this modified technique.

Conclusion

The customized ice spacer technique described in this case report provided a simple, economical, and effective approach for fabricating a lightweight closed hollow bulb interim obturator. By utilizing a custom-shaped ice spacer, the technique eliminated the need for retrieval of spacer materials or the creation of an access opening, while producing a hollow prosthesis with satisfactory structural integrity. The resulting obturator demonstrated adequate retention, stability, and patient comfort, with significant improvement in speech, mastication, and deglutition during the postoperative healing phase. Within the limitations of this case report, the described technique may be considered a practical alternative for the fabrication of lightweight closed hollow bulb interim obturators. Further clinical studies with larger sample sizes and long-term follow-up are recommended to validate its reproducibility and long-term clinical performance.

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