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CASE REPORT

Fabricating Hollow Bulb Interim Obturator Using an Ice Block

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ABSTRACT

Background: The rehabilitation of maxillofacial defects presents a multifaceted challenge requiring a comprehensive approach to restore both form and function. Among the various treatment modalities available, obturators stand out as the preferred choice following maxillary resection.

Objective: This case report describes the steps to fabricate a hollow bulb interim obturator plate using an ice block to treat a hemi maxillectomy patient.

Methods: The process involves the use of an ice block to create a hollow space within the obturator, which aids in distributing stresses more evenly over the underlying and adjacent tissues, enhancing comfort and longevity.

Results: The fabricated hollow obturator effectively separates the oral and nasal cavities, facilitates mastication, preserves occlusion, supports mandibular and facial structures, and reinstates speech and aesthetics.

Conclusion: Hollowing obturator prostheses offers significant benefits, including improved stress distribution, comfort, and prosthesis longevity. The described method using an ice block is a viable approach for interim obturator fabrication in hemi maxillectomy patients.

Key words: Rehabilitation, Obturator, Hollow Bulb, Maxillofacial Prosthetics

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INTRODUCTION

Ablative surgical therapy is frequently used to treat oral cavity malignancies and other abnormal growths, but it can significantly impact the form and function of the stomatognathic system and facial contour.[1] Maxillectomy, which involves the partial or total removal of the maxilla for benign or malignant tumors, often results in complications like hyper nasal speech, nasal fluid leakage, and aspiration due to the creation of complex defects in the hard and soft palate, leading to oro-antral or oro-nasal communications.[2]

Free flap surgery provides optimal functional and aesthetic outcomes for rehabilitating maxillary defects, but prosthetic rehabilitation, specifically maxillary obturator prostheses, is preferred when surgical intervention is not feasible.[3] These prostheses are easy to fabricate and maintain, playing a crucial role in reconstructing the partition between the oral and nasopharyngeal regions to improve mastication, swallowing, and speech intelligibility.[4]

Historically, Ambroise Paré in the 1500s pioneered the artificial closure of palatal defects, and Martin introduced surgical obturators in 1875. Fry's 1927 innovation involved using prosthodontic

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impressions to close surgical defects, while Steadman in 1956 used gutta-percha to stabilize an acrylic resin prosthesis on a skin graft to seal a maxillectomy defect.[5] Surgery to address such defects is often not recommended due to deformity complexity, limited accessibility, concerns regarding vascularization, and potential tumor recurrence. Therefore, obturators are vital in rehabilitating maxillofacial defects, providing temporary solutions to allow tissues to heal before prosthetic reconstruction.[6]

The term "obturator" is derived from the Latin "obturare," meaning to seal, and these devices are crucial for addressing maxillary defects from conditions like cleft palate or maxillectomy for tumor excision.[7] They minimize the psychological impact of surgery, prevent nasal regurgitation, enable effective speech, and enhance aesthetics. Meatal obturators, designed for large soft palate defects, address areas with limited muscle activity but can affect nasal resonance and air emission.

Creating both open and closed hollow obturators involves various methodologies, but many are burdened by intricate fabrication steps.[8] While both types reduce prosthesis weight and cover the defect adequately, open variants can accumulate nasal secretions, leading to malodour and increased mass. Maintaining hygiene within open hollow obturators is challenging due to saliva, mucous crusts, and food debris. Closed hollow bulb obturators, however, mitigate moisture retention issues, promote better adaptation within the defect site, and reduce residual air space, enhancing patient comfort and functional outcomes.[9]

In extensive defects, the obturator must be enlarged both vertically and horizontally, which increases its weight, compromising patient comfort and retention.[10] Custom-made hollow bulb obturators, as outlined by Wu and Schaaf, significantly reduce prosthesis weight by 6.55% to 33.06%, depending on the defect size, improving the device's functional efficacy.[11]

CASE PRESENTATION

A 66-year-old male patient reported to the department of Prosthodontics, SGT Dental College and Hospital, Haryana with a complain of difficulty in speech, deglutition, and mastication. The patient's medical history revealed that he was diagnosed with spindle cell (sarcomatoid) squamous cell carcinoma of left buccal mucosa for which he underwent surgical excision for the same. Intraoral examination revealed subtotal maxillectomy (Figure 1) and hemi-mandibulectomy on the left side and the mouth opening of the patient was severely restricted. Maxillary defect was Aramany class I, with oronasal communication, mandibular defect according to Cantor and Curtis's classification class III. A hollow bulb interim obturator using an ice block was planned for the prosthetic rehabilitation of this patient.

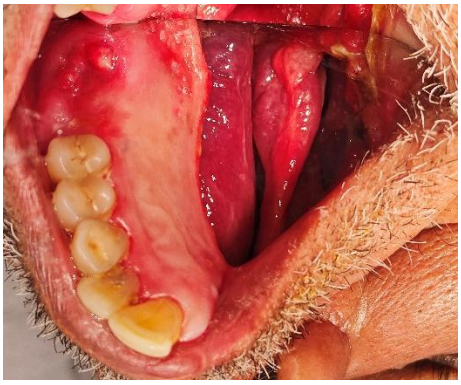

Figure 1: Post Maxillectomy

PROCEDURE

a. **Impression making**:

- *Primary impression*: Due to restricted mouth opening, a plastic perforated impression tray was trimmed and adjusted to fit the patient's mouth for the primary impression of the maxillary arch. Alginate powder was mixed with cold water, and a portion was loaded into a syringe after removing the needle. The remaining material was loaded into the modified tray. The material was injected into the maxillary defect via a syringe, followed by placing the tray into the oral cavity (Figure 2). The primary maxillary cast was poured using type III gypsum material. Undercuts in the cast were blocked out using modelling wax, and a custom tray was fabricated with auto polymerizing resin.

Figure 2: Impression making

- *Secondary impression:* Border moulding was performed with greenstick to record the posterior border, and then a final impression was made using alginate impression material. The definitive cast was obtained by pouring the impression with die stone (Figure 3 A).

b. **Wax up**: Wrought wire clasps were adapted for retention, and modelling wax was adapted in uniform thickness over the defect area and the area to be covered for the fabrication of the obturator plate (Figure 3 B).

c. **Flasking and curing**: Flasking and dewaxing procedures were carried out, followed by the packing procedure with heat-polymerizing acrylic resin. The Intaglio surface of the prosthesis, i.e. the side facing the defect was obtained in a uniform thickness.

Figure 3: Wax-up

d. **Fabrication of ice block:** To create an impression of the defect area of the prosthesis, alginate was mixed in a rubber bowl, and the prosthesis facing the palatal side was placed into it. The impression was then poured with die stone (Figure 4 A). A thin plastic sheet was adapted into the defect as a separator, and then water was filled into it and it was kept in the refrigerator until an ice block was formed (Figure 4 B & C).

Figure 4: Fabrication of Ice block

e. **Fabricating hollow bulb:** The ice block was placed into the hollow area of the heat-cured prosthesis (Figure 5) and covered with self-cure resin material. Once set, a small hole was made in the obturator plate, and the ice water was retrieved. Later, self-cure resin was used to close the hole. The prosthesis was then finished and polished (Figure 6 A: Palatal surface; B: Intaglio surface). After adjustments were made, and any sore points that could irritate the mucosa were relieved, the hollow bulb obturator plate was then delivered to the patient (Figure 7).

Figure 5: Fabircation of hollow buln

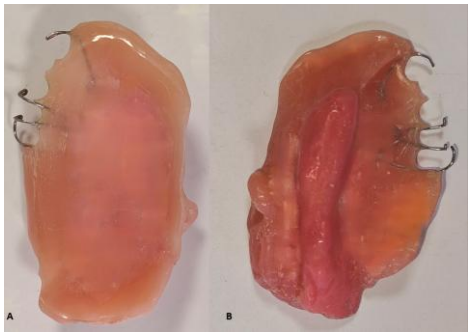

Figure 6: Finished prosthesis

Figure 7: Obturator inserted intro-orally

DISCUSSION

Subtotal maxillectomy is a primary treatment for squamous cell carcinoma, involving partial removal of the maxilla and associated teeth, often affecting speech, mastication, and occlusion. While surgery and radiation therapy are effective for stage I or II oral cavity cancers, chemoradiation offers an alternative approach.[12] Reconstructive techniques such as non-vascularized grafts, local-regional flaps, free flaps, and obturator prostheses are utilized, with obturator prostheses being particularly effective if the defect's vertical and horizontal components are managed well. These prostheses prevent air, liquid, and food from passing between nasal and oral cavities and support facial tissues post-surgery.[13]

However, the weight of conventional prostheses can stress the residual alveolar ridge, causing bone resorption. Despite the availability of various techniques for constructing hollow bulb obturators, common methods such as silicon putty, salt, alum, wax, polyurethane foam, and cellophane-wrapped asbestos are often employed.[14] Each technique presents unique drawbacks, ranging from difficulties in removal and time consumption to brittleness, displacement, and allergic reactions.

Schneider et al. introduced using crushed ice for hollowing obturators in 1978, but it couldn't uniformly occupy the defect space, increasing prosthesis weight.[15]

In this case report ice block is used to construct hollow obturator prostheses. Pros of this technique is that it ensures ease of retrievability and maintains even thickness in the hollow portion. Ice does not adhere to acrylic resin and the ice block can withstand the pressure of the compression molding technique. Additionally, ice does not create porosities and it leaves no lines of demarcation that could discolor the denture and aids in the complete curing of the bulb portion. Complete removal of ice is possible, allowing for thorough hollowing of a prosthesis. Cons of this procedure is that it is technique sensitive and might have an impact on the strength of the prosthesis. The melting of the ice can create voids within the obturator, potentially compromising its structural integrity and making it more prone to fracture. The process of creating and managing the ice block during the fabrication requires additional steps and labor, making it more time-consuming compared to other techniques. The technique requires careful handling and precise timing to ensure that the ice block does not melt prematurely, which can add complexity and difficulty to the fabrication process.

Due to restricted mouth opening and absence of left jaw muscles, only a plate was fabricated to close the defect, as occlusion maintenance was not possible.

CONCLUSIONS

Restoring function, speech, and aesthetics in cases of large defects resulting from surgery and radiation therapy can pose considerable challenges. However, successful rehabilitation was achieved in this case involving subtotal maxillectomy and a large associated defect through the fabrication of a hollow obturator using an ice block. The ice block offers advantages such as easy retrievability and non-adherence to acrylic resin. Additionally, it ensures an even thickness of acrylic resin during the packing stage and maintains resistance to deformation during mould closure.

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