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Research Paper

Obturator Innovations for Individuals Post-Hemimaxillectomy: Confronting Challenges

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Abstract: *Hemimaxillectomy patients frequently experience difficulties in speech, swallowing, and overall quality of life due to the loss of anatomical structure and function. Advancements in obturator design and materials enhance fit, retention, and comfort, as well as innovations in digital fabrication techniques that allow for customized solutions tailored to individual anatomical needs. Common challenges faced by patients, including issues related to adaptation, psychosocial impact, and the importance of interdisciplinary care, are addressed. Through case studies and recent research findings, effective strategies for optimizing obturator functionality and improving patient outcomes are highlighted. This review aims to provide insights into the evolving landscape of prosthetic rehabilitation for hemimaxillectomy patients, highlighting the importance of ongoing innovation in enhancing their quality of life. It explores the latest advancements in obturator systems tailored for individuals who have undergone hemimaxillectomy, a procedure that leads to significant functional and aesthetic challenges.*

Keywords: *Obturator, Hemimaxillectomy, Prosthetic Rehabilitation, Digital Fabrication, Functional & esthetic outcomes, Psychosocial Impact*

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I. Introduction:

The term "obturator" generally refers to a device or structure that closes or blocks an opening. The term "obturator" is derived from the Latin word "obturare," which means "to close up" or "to block." [1] Maxillary defects can be classified as congenital anomalies or acquired conditions; often resulting from the surgical excision of oral tumors. The dimensions and placement of these openings greatly impact the hard and soft palate, alveolar ridges, and the base of the nasal cavity. Acquired palatal defects from hemimaxillectomy (**Figure 1**) can severely disrupt speech, swallowing, and chewing, significantly affecting the overall quality of life.[2]

Figure 1: Patient with left hemimaxillectomy
Courtesy: Fayad M, Atito I. Oral health related quality of life in hemimaxillectomy patients rehabilitated with obturator prosthesis fabricated using different materials. Egyptian Dental Journal. 2019; 65(1):611-618.

The loss of tissue can also lead to noticeable changes in appearance, causing emotional distress and depression. Individuals who lose parts of their maxillofacial region often experience increased social anxiety compared to those with losses in other body areas. Effective rehabilitation after malignant tumor treatment in the maxilla requires a collaborative approach that includes surgical intervention, radiotherapy, chemotherapy, phonetic rehabilitation, physiotherapy, and prosthetic management.[3] Surgical options may consist of free micro vascular or pedicled flaps.[4] For larger resections (**Figure 2**) , defects can be effectively closed using dental or maxillofacial prostheses supported by remaining teeth, soft tissues, or dental implants.[5]

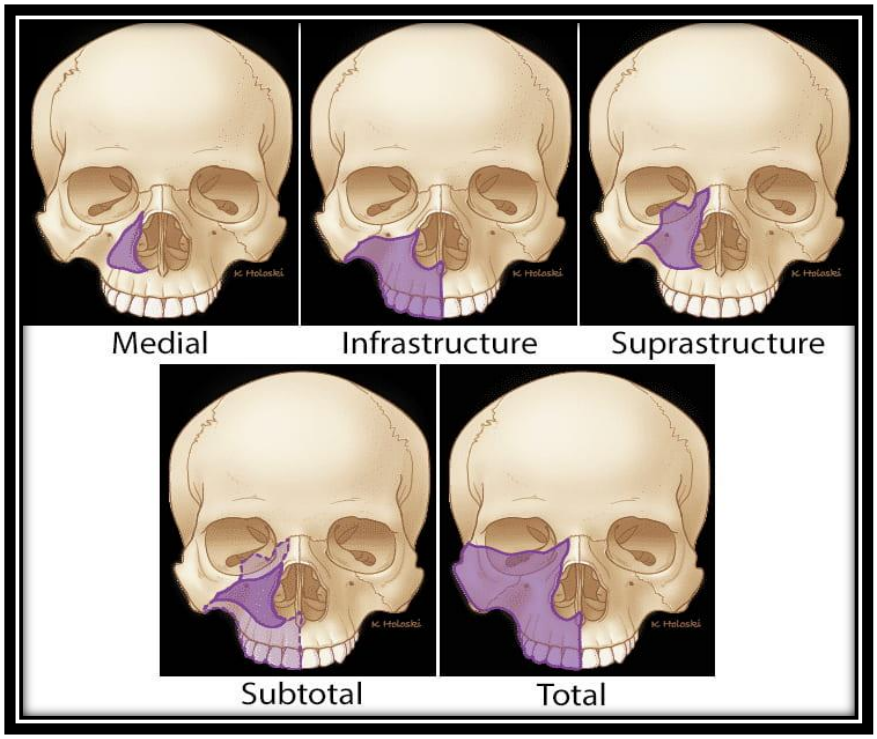

Figure 2: Larger resection of maxilla
Courtesy: https://voices.uchicago.edu/grosspathology/head-neck/maxilla/
Acquired defects of the soft palate often arise from trauma, infection, or surgical excision, especially related to tumor treatment.[6] Tumors of the soft palate, primarily squamous cell carcinomas, account for less than 15% of

oropharyngeal cancers.[7] Various epithelial malignancies can be found in the maxillary sinus, including adenocarcinoma, squamous cell carcinoma (SCC), adenoid cystic carcinoma, malignant melanoma, or salivary gland carcinoma (**Figure 3**).[8]

Figure 3: Malignant tumor of the hard palate
Courtesy: Hammouda Y, Halily S, Oukessou Y, Rouadi S, Abada R, Roubal M, Mahta M. Malignant tumors of the hard palate: Report of 4 cases and review of the literature. Int J Surg Case Rep. 2020; 78(3):10-12.

In cases of SCC, concurrent chemo radiation and debulking may be considered. The treatment typically involves either surgery alone or radiotherapy.[9] Traditional surgical excision of a maxillary oral SCC often results in defects that lead to oro-antral communication. Maxillectomy defects can be reconstructed with either a prosthetic obturator or free flap transfer, though there is no consensus on the most suitable technique.[10] Surgical treatment without reconstruction or obturation of the defect can lead to air, food, and liquid escaping into the sinus and nasal cavities, resulting in severe dysfunction of speech and swallowing, drastically diminishing the patient's quality of life. The obturator prosthesis (**Figure 4**) is crucial for the functional recovery of patients' post-maxillectomy.[11]

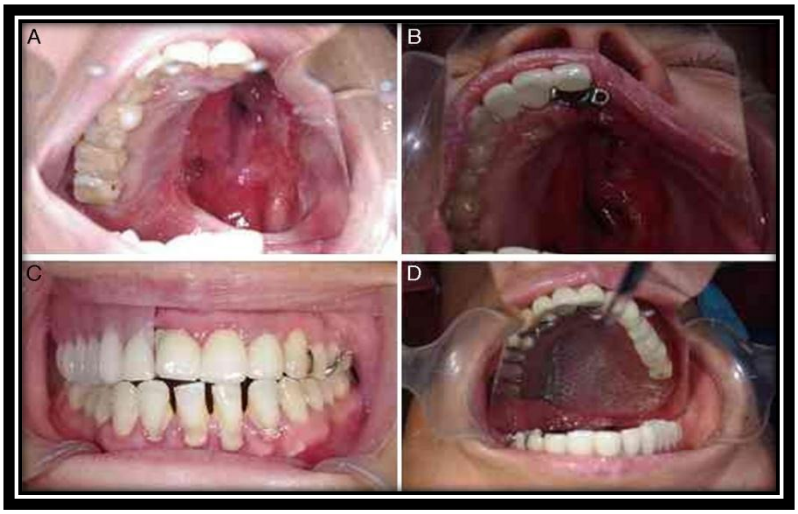

Figure 4: Obturator prosthesis
Courtesy: Chen C, Ren W, Gao L, Cheng Z, Zhang L, Li S, Zhi PK. Function of obturator prosthesis following maxillectomy and prosthetic obturator rehabilitation. Braz J Otorhinolaryngol. 2016; 82(2):177-183.

An interim obturator prosthesis is usually placed 7 to 10 days after surgery, followed by a definitive obturator fabricated approximately 3 to 4 months post-surgery once healing is complete.[12] The definitive

obturator impression should include the skin-graft mucosal junction, lateral aspect of the orbital floor, and the velopharyngeal area, depending on the defect's extent.[13] In 2018, France reported an incidence of oropharyngeal cancer at 31.9 cases per 100,000 person-years for males and 10.9 for females.[14] Defects in the soft palate can cause velopharyngeal insufficiency, resulting in airflow escape that negatively impacts swallowing and speech, often producing hyper nasal vocal quality and decreased intelligibility. These functional limitations contribute to a significant decline in quality of life, both psychologically and socially.[15] Conventional methods for repairing soft palate defects include surgical reconstruction with flap placement and prosthetic rehabilitation using obturators, often combined with speech therapy. While surgical reconstruction provides a definitive solution—utilizing local, regional, or free flaps—it also presents challenges such as extended hospital stays, potential morbidity at donor sites, and complications associated with advanced age, systemic diseases, previous radiotherapy, and insufficient recipient vessels.[16] A prosthetic pharyngeal obturator offers a removable alternative, allowing for ongoing monitoring of cancer recurrence at a lower cost. This rigid prosthesis, developed in the 19th century, features a posterior extension that separates the oropharynx from the nasopharynx, effectively restoring sphincter function when adequate retention (**Figure 5**) and stability are achieved.[17]

Figure 5: Adequate retention of obturator prostheses
Courtesy: Kirtika, Jain R, Jabbal R, Kansal G, Chopra S. Retention of maxillofacial prosthesis: A review. IP Annals of Prosthodontics and Restorative Dentistry. 2023; 9(3):135–141.

However, challenges remain when remaining velopharyngeal muscles lack sufficient contraction, complicating airflow modulation and resulting in gaps between tissues and the obturator.[18] This impedes the full restoration of phonation and swallowing functions, further affecting quality of life. Restoring chewing and swallowing abilities in these patients is a critical concern.[19] The most common intraoral defects are found in the maxilla, which may manifest as openings into the antrum and nasopharynx.[20] Patients with postsurgical maxillary defects frequently encounter challenges such as hyper nasal speech, nasal fluid leakage, and difficulties with chewing.[21]To address these issues, a maxillary obturator is utilized—essentially a disc or plate that closes the opening resulting from partial or total resection.[22] The primary objectives of prosthetic rehabilitation for maxillectomy patients include separating the oral and nasal cavities to improve swallowing and speech, supporting orbital contents to prevent complications like enophthalmos and diplopia, restoring mid-facial contour for soft tissue support, and enhancing aesthetics. These goals are vital for improving the overall quality of life and functionality for individuals facing maxillary defects.[23] The history of prosthodontic management of palatal defects is rich and diverse.[24] Ambroise Paré pioneered artificial methods for addressing palatal defects in the 1500s, while Claude Martin introduced surgical obturator prostheses in 1875. Paré (1517-1590) created innovative prosthetic designs featuring two notable mechanisms for securing devices. One type included a dry sponge affixed to the upper surface of the prosthesis, which expanded when moistened, effectively preventing the obturator from dislodging. In another design, he incorporated a turnbuckle mechanism that ensured the prosthesis remained securely in place. These advancements highlighted Paré's creativity in improving the functionality and stability of prosthetics.[25] The significance of pre-surgical impressions was highlighted by Fry in 1927, and in 1956, Steadman described an acrylic resin prosthesis lined with gutta-percha to stabilize a skin graft within a maxillectomy defect.[26] Indications for using an obturator (**Figure 6**) include serving as a temporary solution during the surgical correction period, quickly restoring aesthetics for social

interactions, and providing an option when primary surgical closure is not feasible due to factors such as age, defect size, or poor tissue condition.[27]

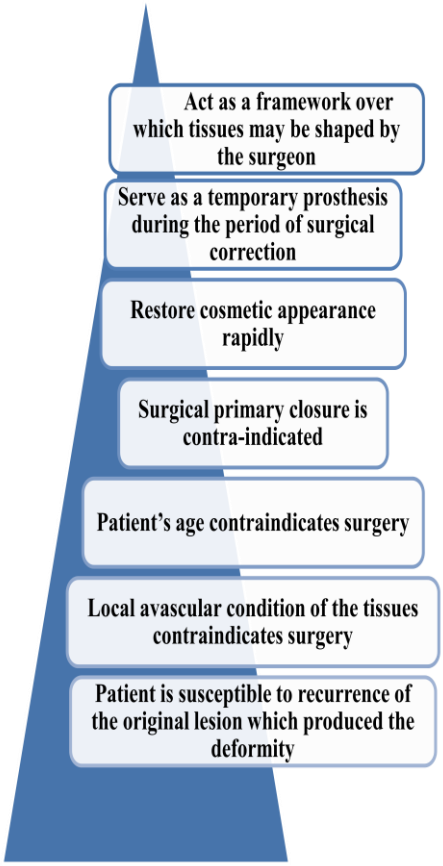

Figure 6: Indications of obturator

Furthermore, obturators are essential when there is a risk of recurrence of the original condition that caused the defect. Most acquired palatal defects arise from the resection of neoplasm's in the palate and paranasal sinuses, with the extent of resection influenced by tumor size, location, and behavior. Rehabilitation typically consists of three phases, each with specific objectives (**Figure 7**). [28]

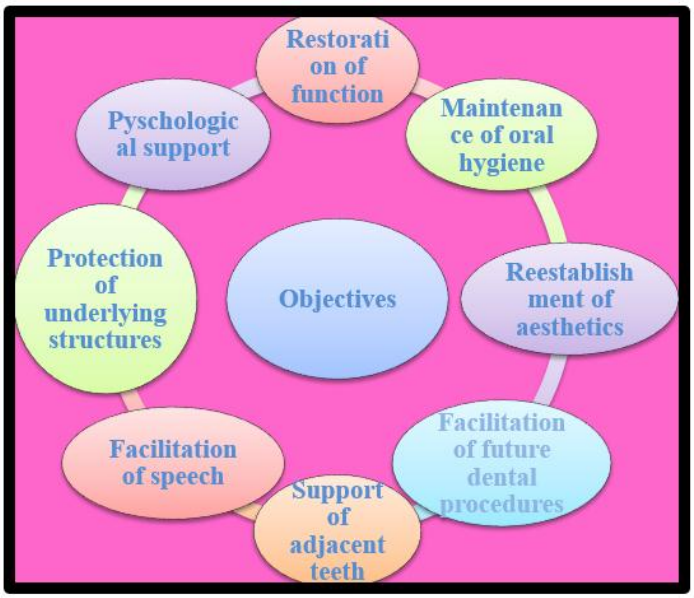

Figure 7: Objectives of obturator therapy

Prosthetic treatment (**Figure 8**) for maxillectomy patients can be intricate due to challenges in achieving adequate retention, stability, and support. The size and location of each defect significantly influence the rehabilitation process, necessitating customized management for each patient. Therefore, prosthodontists must be equipped with various designs and techniques to effectively obturate defects and minimize patient discomfort. [29]

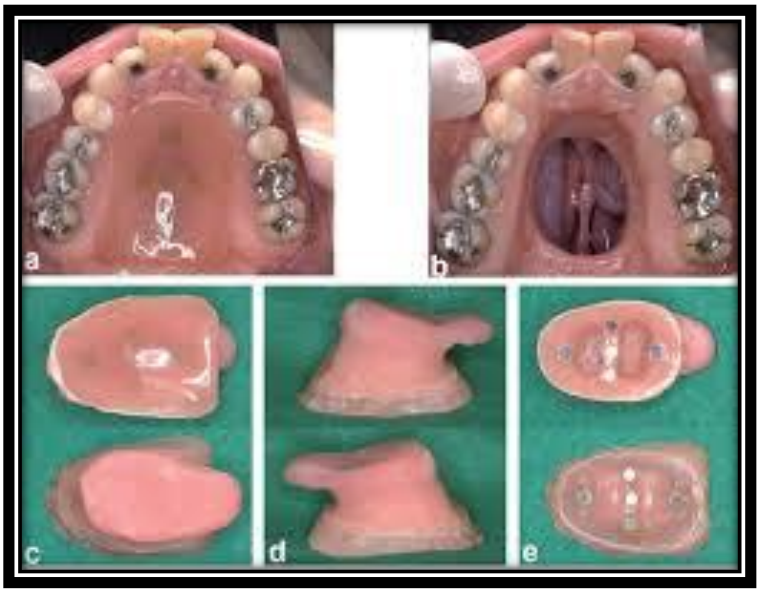

Figure 8: Prosthodontic rehabilitation of patient with retainer free prosthesis for palatal defects Courtesy: Murakami M, Nishi Y, Shimizu T, Nishimura M. A retainer-free obturator prosthesis in a fully dentulous patient with palatal defects. J Oral Sci. 2020; 62(1):122-124.

Reconstructing maxillectomy defects with an obturator offers multiple advantages.[30] It not only replaces lost soft and hard tissues, facilitating normal swallowing, mastication, and speech but also acts as a barrier between the nasal and oral cavities. Additional benefits include the removability of the obturator, allowing for clear observation and early detection of any recurrent tumors, as well as enhanced facial aesthetics by providing support to the facial tissues.[31] The rehabilitation of hemimaxillectomy patients presents unique challenges, primarily in achieving adequate retention, stability, and support. The size and location of the defect significantly influence the level of impairment and the complexity of prosthetic rehabilitation.[32]

The obturator prosthesis is crucial for managing hemimaxillectomy cases, especially in large maxillary defects where movement of the prosthesis can occur. To minimize rotation, indirect retention methods are often necessary.[33] The primary goal of prosthodontics is to rehabilitate missing oral and extra oral structures while restoring vital functions such as mastication, speech, swallowing, and aesthetics. Surgical interventions for oral malignancies can create connections between the oral cavity, nasal cavity, and maxillary sinus, leading to difficulties in normal functions. This review highlights that obturator prostheses not only restore missing structures but also act as an essential barrier between these cavities, improving both functionality and quality of life for patients.[34]

II. Discussion:

Maxillectomy defects can be classified as partial, limited, medial, total, subtotal, radical, or extended.[35] Although few researchers suggest that free surgical flaps offer the surgeon with an opportunity of dealing with the issues of prosthetic obturation like nasal leakage, cleansing, and regular prosthetic correction, it must be realized that surgical flap reconstruction (**Figure 9**) remains associated with increased operation time, failure rates, and donor site morbidity.[36]

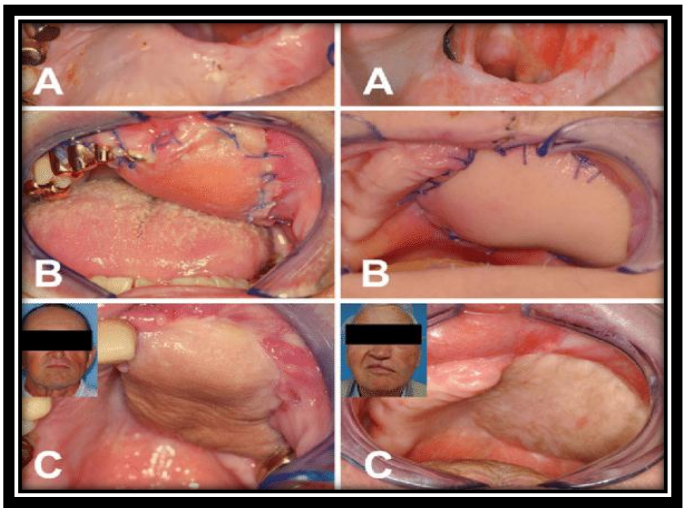

Figure 9: Surgical reconstruction of palatal defect
Kesting M, Hölzle F, Wales CJ, Steinsträsser L, Wagenpfeil S, Mücke T, et al. Microsurgical reconstruction of the oral cavity with free flaps from the anterolateral thigh and the radial forearm: a comparison of perioperative data from 161 cases. Ann Surg Oncol. 2011; 18 (7):1988-94.

The fabrication of an obturator prosthesis shortens the operation time extensively and gives the opportunity of immediate rehabilitation.[37] Prosthetic rehabilitation of maxillary defects can be categorized into three stages in which different type of obturator is fabricated in each stage.[38] The obturator design may vary based on the classification system of the surgical defect.[39] In few cases, the support is gained from the remaining teeth and palate.[40] Complete coverage of the remaining palate is planned to ensure maximum distribution of the load during function.[41] Successful obturation of the maxillectomy defect is guided by the volume of the defect, and the positioning of postsurgical hard and soft tissues to be used for retention, stabilization, and support of the obturator. The weight of the prosthesis must be reduced to increase the retention of the obturator.[42] The main advantages of titanium include its low density (4500 kg/m^3), excellent corrosion resistance, and high strength.[43] The fabrication of obturator prosthesis involves a meticulous two-stage process, where the body and lid are crafted separately before being expertly joined. This innovative method not only enhances functionality but also significantly reduces the weight of the prosthesis through a strategic hollowing procedure, which is essential for improving comfort without compromising performance. Hollowing out an obturator employs various techniques aimed at creating a hollow space that enhances both comfort and functionality. The process begins with comprehensive design planning, where the patient's anatomy and the extent of the palatal defect are carefully assessed. Accurate impressions are taken to create a custom obturator, followed by a crucial wax try-in. During this phase, a wax pattern is created (**Figure 10**), pinpointing areas for hollowing and allowing patients to provide vital feedback on fit and comfort. [44]

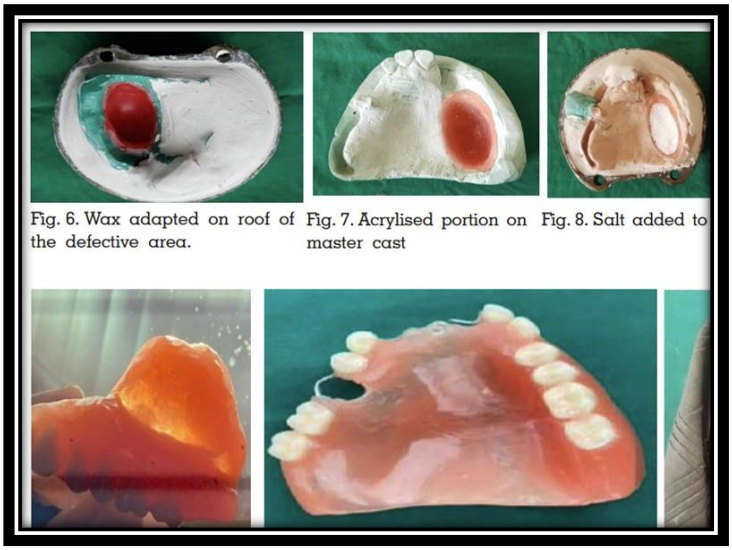

Figure 10: Accurate impressions are taken to create a custom obturator, followed by a crucial wax try-in. During this phase, a wax pattern is created

Sheejith M, Ranjith M, Fahim As Ad K. Fabrication of closed hollow bulb obturator using lost salt technique: a case report. J Prosthet Implant Dent. 2024; 7(2):91-95.

Several hollowing techniques can be utilized:
Direct Hollowing: Dental instruments are used to carve the interior from a solid block, ensuring consistent wall thickness for optimal strength
Indirect Hollowing: A mold is formed from a solid model, enabling the casting of a hollow obturator in a suitable material like acrylic
Layering Technique: This method builds the obturator in layers, gradually creating a hollow space that enhances both comfort and functionality.[45] Once hollowing is complete, meticulous finishing and adjustments are performed, including polishing the interior surfaces for maximum comfort. The obturator is then fitted in the patient's mouth, allowing for final modifications to ensure an ideal fit. Post-operative care is crucial for patient satisfaction. Patients receive detailed cleaning and maintenance instructions, along with scheduled follow-ups to monitor fit and function, enabling necessary adjustments to be made for enhanced effectiveness and comfort.
A closed hollow obturator (**Figure 11**) is typically crafted by skillfully attaching two parts with auto polymerizing or light-polymerized resin, resulting in a robust yet lightweight solution that significantly enhances patients' quality of life. This comprehensive approach underscores the importance of personalized care and precision in prosthodontic rehabilitation, ultimately empowering patients to reclaim essential functions and restore their sense of self. Through this process, prosthodontists do not merely replace structures but help individuals regain their dignity and confidence, enabling them to embrace a fuller, more vibrant life. Each obturator stands as a testament to the profound impact of skilled prosthodontic care, transforming not just smiles, but lives.[46]

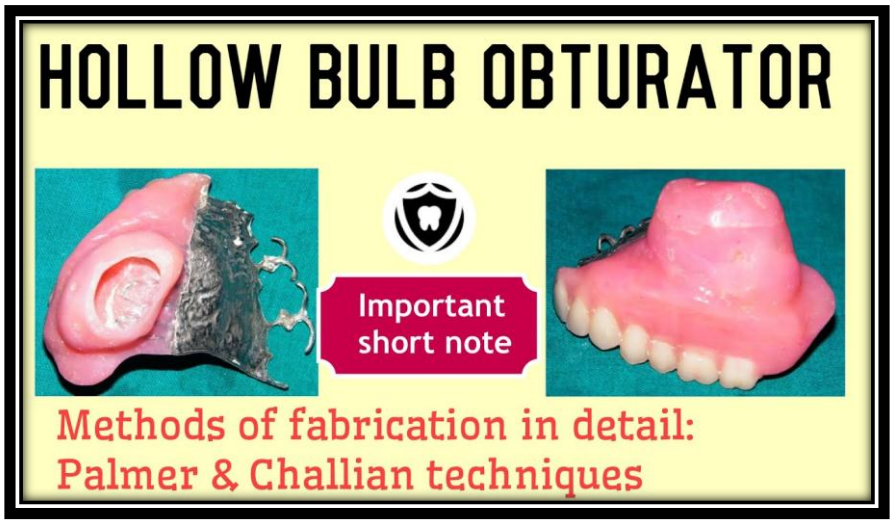

Figure 11: Hollow bulb obturator
Courtesy: https://www.youtube.com/watch?v=tZcwJcSdAZg

The bulb and the lid must be sealed tightly after the procedure preventing the leakage of water into the hollow region promoting bacterial growth.[47] The factors that ensure the daily routine use of the obturator by the patient are its comfortable prosthetic fit and functional success. Also, referral to a speech pathologist will contribute to its success by improving the ability of the patient to adequately speak and swallow.[48] Patients who undergo maxillofacial prosthetic rehabilitation can resume their usual social habits in the normal way. Obturator prostheses have been extensively used in the functional rehabilitation of maxillectomy patients. [49]

Feature	Closed Hollow Obturator	Open Hollow Obturator
Design	Solid base, completely closed with no openings	Hollow interior with possible openings
Function	Seals oral cavity from nasal cavity, improving speech and preventing nasal leakage	Separates oral and nasal cavities, allows some airflow
Usage	Used for maximum closure and support, especially in substantial palatal defects	Used for patients needing nasal airflow or less bulk

Maintenance	**Easier to clean; no openings for debris accumulation**	**Requires careful cleaning to prevent buildup in hollow spaces**
Considerations	**Depends on individual patient needs and anatomical factors**	**Affects speech and swallowing function based on patient adaptation**

Table 1: Closed vs open hollow bulb obturator

The Palmer and Challeian techniques are notable methods utilized in the fabrication of dental prostheses, each serving distinct purposes in orthodontics and prosthodontics. The Palmer technique is primarily designed for the fabrication of removable partial dentures focusing on the individualization of the prosthesis to accommodate the unique contours of the patient's mouth. The process begins with a thorough diagnosis and treatment planning, where the dental and medical history of the patient is assessed. This is followed by taking impressions using flexible materials to capture the intricate details of the arches. A diagnostic cast is then created to aid in planning, after which a metal framework is designed to support the prosthetic teeth. Once the framework is constructed, a try-in is conducted to check the fit and esthetics with the patient, leading to the finalization of the prosthesis based on the feedback received.[50] In contrast, the Challeian technique is more frequently employed in constructing complete dentures, with a strong emphasis on achieving functional and aesthetic outcomes. This method begins with taking initial impressions using stock trays, followed by the fabrication of custom trays for more precise secondary impressions. Establishing proper jaw relations is crucial in this technique, often accomplished with a wax rim. After confirming fit, function, and esthetics through the fabrication of a trial denture, the final processing involves creating the complete denture using acrylic materials. The process culminates in the delivery of the prosthesis, accompanied by necessary adjustments to ensure optimal comfort and function. In comparing the two techniques, a key difference lies in their application: the Palmer technique is tailored specifically for partial dentures, while the Challeian technique is predominantly used for complete dentures. Furthermore, the focus of the Palmer technique is on the design and individualization of the framework, ensuring a tailored fit, whereas the Challeian technique prioritizes the overall functional and aesthetic integration of the complete denture. Together, these techniques underscore the importance of personalized care in prosthodontics, ensuring that each prosthesis effectively meets the specific needs of the patient.[51]

Proposed Classification:

Achieving universal consensus on a singular classification system that addresses both surgical and prosthodontic requirements is nearly impossible.[50] Numerous classifications for maxillectomy defects have been documented, as highlighted by Aggarwal et al. in 2015, categorizing defects based on horizontal and vertical dimensions (**Figure 12**).[52]

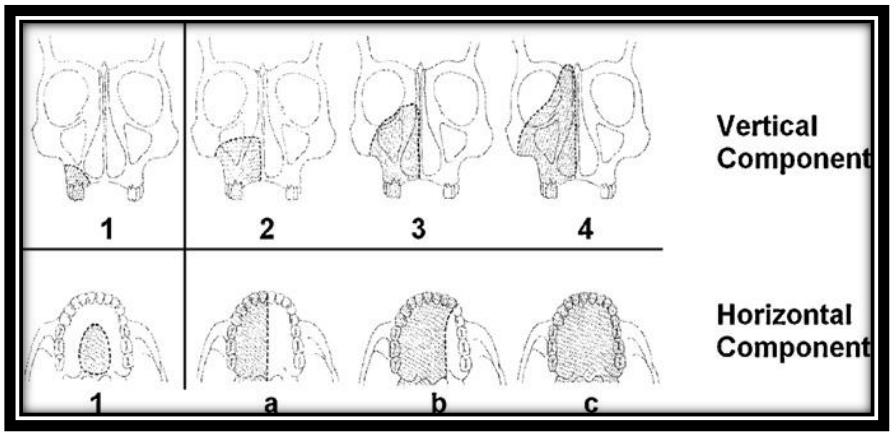

Figure 12: Categorizing Maxilloectomy defects into horizontal and vertical dimensions
Courtesy: Kreeft AM, Krap M, Wismeijer D, Speksnijder CM, Smeele LE, Bosch SD, Muijen MSA, Balm A. Oral function after maxillectomy and reconstruction with an obturator. Int J Oral Maxillofac Surg. 2012; 41(11):1387-92.

However, a review of cases has revealed a new category of maxillary defect that necessitates improved pre surgical collaboration from the prosthodontist. [53]This specific type of defect is not addressed by current classifications. Consequently, a modification to the classification is suggested, alongside necessary designs for cast partial frameworks.[54] Additionally, a treatment-oriented classification is proposed to streamline the planning process for these cases.[55] A series of maxillectomy patients with various defect types has been rehabilitated

using obturators that incorporate different designs, retention strategies, and fabrication techniques in line with the new classification.[56] While several classifications exist for maxillectomy defects, none assess the defects as favorable or unfavorable from the prosthodontist's perspective.[57] The classification of palatal obturator defects generally focuses on the size, location, and extent of the defect in the palate, which can arise from various conditions such as congenital abnormalities, trauma, or surgical resections. A widely used system includes several key categories.[58] The Aramany classification system is used to categorize palatal defects, particularly those resulting from surgical procedures or congenital conditions. It helps in planning surgical interventions and prosthetic rehabilitation. The classification is based on the size and location of the defect and is divided into several types (**Table 2**). [59]

Type	Description
Type I	A small defect in the hard palate, often involving the midline and not extending into the soft palate. This type typically allows for easier prosthetic management.
Type II	A larger defect that extends into the soft palate but does not involve the alveolar ridge. This may require more complex prosthetic solutions.
Type III	A defect that extends through both the hard and soft palate, and may involve the alveolar ridge. This type can be more challenging due to its size and location.
Type IV	A large defect that includes the hard palate, soft palate, and a significant portion of the alveolar ridge. This type usually necessitates advanced surgical and prosthetic interventions.
Type V	This type typically refers to total or near-total loss of the palate, which may require extensive reconstructive surgery and custom prosthetics.

Table 2: Aramany classification of palatal defects

Classification based on phase of treatment:
The surgical obturator (**Figure 13)** is a base plate device made from the preoperative impression cast and is inserted during maxillary resection in the operating room.

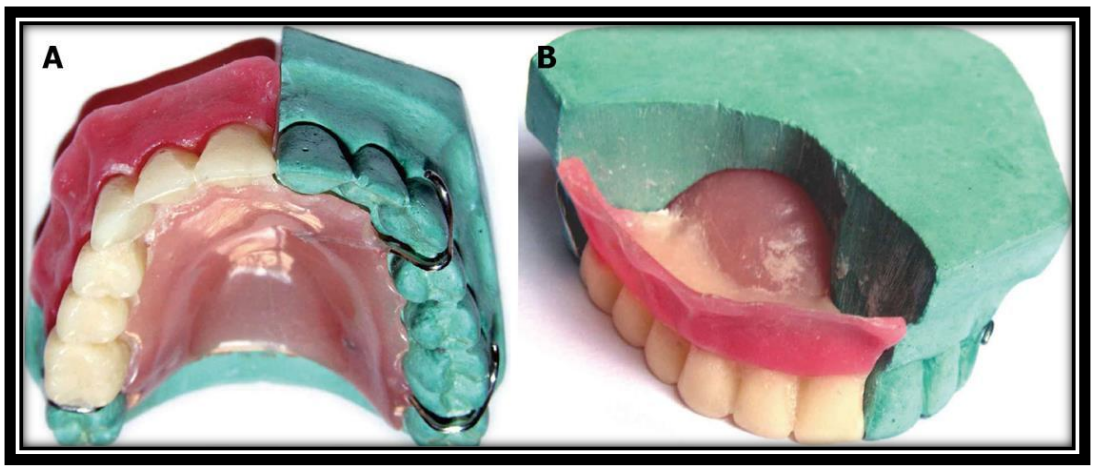

Figure 13: Surgical obturator
Courtesy: Patil PG. Surgical obturator duplicating original tissue-form restores esthetics and function in oral cancer. World J Stomatol. 2013; 2(4):97-102.

It acts as a framework for placing surgical packing, ensuring it remains in the correct position to promote proper adaptation of the skin graft.[60] Additionally, the obturator helps minimize oral contamination of the wound in the immediate postoperative period, potentially lowering the risk of local infection, and may facilitate earlier removal of the naso gastric tube.[61] Surgeons request a surgical obturator to close any defects that may be present until the maxillofacial prosthodontist can assess the patient and begin crafting a definitive obturator. These surgical prostheses can also guide surgeons during procedures such as bone grafting, implant placement, and jaw repositioning surgeries.[62]

The temporary obturator/ Immediate surgical obturator/plate This type of appliance (**Figure 14**) is created from an impression taken before surgery and is inserted immediately after the maxillary resection.[63]

Figure 14: Temporary obturator
Courtesy: Fadhil SMT, Mumcu E. Rehabilitation of a patient with palatal defect: A case report. J Surgery Surg Res. 2019; 5(2):093-096.

The immediate surgical plate offers several advantages, including providing a stable matrix for surgical packing, forming a barrier between the oral cavity and the surgical site during initial healing, and enabling the patient to speak and swallow more effectively. Additionally, the presence of the surgical plate can alleviate the psychological impact of post-resection deficits.[64] The immediate surgical plate is fabricated prior to surgery and inserted right after the resection, relying on the remaining teeth for retention without adding any new ones.[65] This ensured proper occlusion between the maxillary and mandibular teeth without obstruction.[66] The temporary obturator, made from a postsurgical impression (**Figure 15**), features an artificial palate and ridge, typically without teeth. The closed bulb extends into the defect area and is hollow.[67]

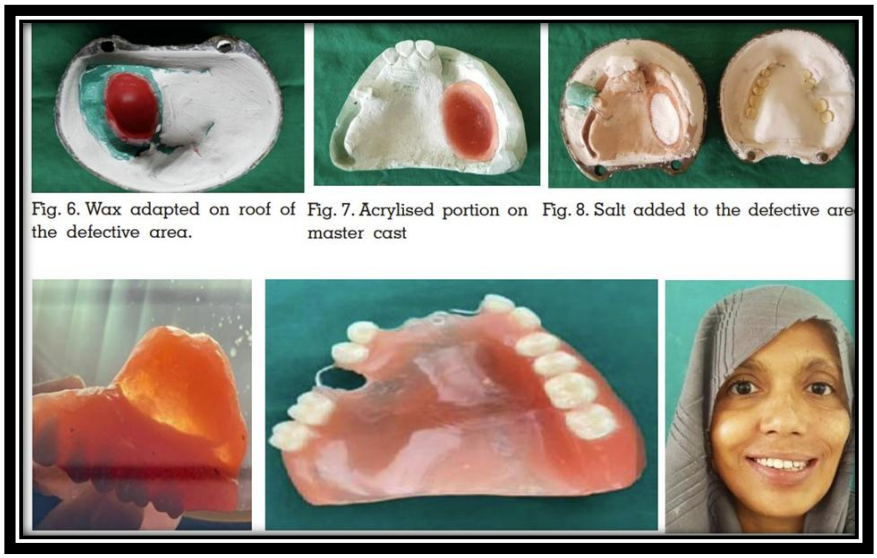

Figure 15: **The temporary obturator made from a postsurgical impression**
Courtesy: Sheejith M, Ranjith M, Fahim As Ad K. Fabrication of closed hollow bulb obturator using lost salt technique: a case report. J Prosthet Implant Dent. 2024; 7(2):91-95.

Patients are usually seen every two weeks due to rapid changes in soft tissue during healing. At these visits, the lining material is either applied or replaced. It's essential to remove the old interim lining completely to prevent porosity, which can lead to bacterial contamination, unpleasant odors, and mucosal irritation. Regular replacement of interim lining material is crucial, as it can increase the bulk and weight of the obturator and may become coarse and unsanitary over time.[68]

The definitive obturator

The definitive obturator should not be constructed until the defect site has completely healed and is dimensionally stable, a process that may take between 3 to 6 months post-surgery. Factors influencing this time frame include tumor prognosis, defect size, healing progress, and the presence of teeth.[69] Approximately six months post-surgery, consideration may be given to fabricating the definitive obturator prosthesis, which is crafted from the postsurgical maxillary cast. This obturator features a metal framework (**Figure 16)** functioning as the palate, supporting the teeth and a hollow closed bulb.[70]

Figure 16: Metal framework of obturator
Courtesy: Singh M, Limbu IK, Parajuli PK, Singh RK. Definitive obturator fabrication for partial maxillectomy patient. Case Rep Dent. 2020; 2:1-4.

The design of the obturator varies according to the classification of the defect.[71] Support is derived from the remaining teeth and palate, with rests strategically placed on the molars, first premolar, and canine. Full coverage of the remaining palate is essential to ensure optimal distribution of functional load.[72] The quality of life for patients with maxillary defects can be significantly improved with a well-designed obturator, which can restore mastication, swallowing, aesthetics—especially in the mid face—resonance, and speech. Patients with maxillofacial defects who undergo rehabilitation can return to their normal social activities. Challenges with retention, stability, and support is common for patients who have undergone maxillectomy.[73] The height and contour of the residual alveolar ridge and the depth of the sulcus are crucial for both edentulous and dentulous patients.[74] A broad, well-shaped ridge typically provides better retention, stability, and support compared to a small, narrow ridge with a tapering contour. Natural teeth are invaluable for retaining the obturator prosthesis; if sound teeth remain, the bracing components of the prosthetic framework can help minimize movement in all three dimensions.[75] Obturator abutments near distal extension maxillary resection sites are subject to significant rotational forces.[76] Fixed splinting of some or all remaining teeth may be necessary to dissipate stresses directed toward primary abutment teeth.[77] In cases where remaining teeth are positioned unilaterally, intra-coronal retainers can help reduce vertical movement of the prosthesis within the defect. For smaller defects with stable remaining teeth, intra-coronal retainers may be an option.[78] Conversely, for larger defects with weak remaining teeth, extra-coronal retainers should be utilized. If the remaining teeth are not parallel to the defect walls and their palatal surfaces are inadequate, guiding planes may be implemented to resist vertical displacement of the obturator and prevent disengagement of the retentive clasp arms.[79] The fundamental principles of removable partial denture design must be revisited when creating the framework for an obturator.[80] Major connectors need to be sturdy, occlusal rests must guide occlusal forces along the long axis of the teeth, and guide planes should be structured to enhance stability and bracing.[81] Retention should remain within the physiological limits of the periodontal ligament, and optimal support should be derived from the residual soft tissues.[82] Following surgical

resection, a lateral scar band forms at approximately the level of the mucobuccal fold.[83] Due to its lack of bony support, this scar band can stretch with continued use, necessitating incremental adjustments to the prosthesis, which may be limited by cosmetic considerations and the size and weight of the prosthetic device.[84] The height of the lateral wall of the defect can be utilized for indirect retention; a taller lateral wall will experience less vertical displacement than a shorter one.[85] Stability is primarily determined by occlusion, making it essential to ensure maximal distribution of occlusal forces in both centric and eccentric jaw positions to minimize prosthesis movement and the forces acting on individual structures.[86] Lateral stress can be reduced through careful selection of an occlusal scheme, removal of premature occlusal contacts, and a broad distribution of stabilizing components.[87]Acrylic resin teeth with a diminished occlusal contact area are recommended, and adjustments to the cusp angle of posterior teeth can influence the stability of the prosthesis on an edentulous resected maxilla.[88] It may be necessary to accept a non-bilaterally balanced occlusion in eccentric positions for an edentulous maxilla or mandible, with non anatomic posterior teeth being preferred in these cases. [89] Tissue dimensional changes can persist for at least a year due to scar contraction and ongoing wound organization. As a result, the prosthesis will need to be rebased to accommodate these changes.[90] Tissue alterations supporting a maxillofacial prosthesis may occur more rapidly than those for conventional prostheses, necessitating regular reevaluation of occlusion and base adaptation, corrected through selective occlusal grinding or rebasing.[91]Although enhancing the quality of life for hemimaxillectomy patients can be more challenging compared to those with conventional prostheses, it is attainable through the expertise and experience of specialists.[92] Addressing the issues faced by hemimaxillectomy patients is most effective when a team approach is employed, ensuring that specialists apply their skills and knowledge at every stage while maintaining regular patient follow-up.[93] Surgical intervention creates communication among the oral cavity, nasal cavity, and maxillary sinus.[94] The obturator prosthesis is commonly used as an effective means for rehabilitating such cases. Managing an isolated defect is more straightforward when there are enough teeth or implants both anteriorly and posteriorly to ensure adequate retention and support for the prosthesis. These cases can utilize both tripodal and quadrilateral designs during the fabrication of the cast framework.[96] It is essential to recognize that if a maxillectomy defect crosses the midline and involves the loss of even a single tooth socket on the opposite maxilla; such defects should be classified as bilateral. [98] This is due to the altered biomechanics resulting from the change in the fulcrum line, which can impact the outcomes of prosthodontic treatment.[99] Although flexible obturators (**Figure 17**) have not been widely adopted; they could serve as a viable alternative in specific cases, such as those involving metal allergies or smaller defects, due to their flexibility, dimensional stability, lightweight nature, high fatigue endurance, and excellent wear resistance. The material is slightly translucent and blends well with the surrounding tissue.[100]

Figure 17: Flexible obturator prosthesis

Courtesy: Shah DD, Patwa DA, Pitti DV. Rehabilitation of a hemimaxillectomy patient with flexible obturator prosthesis. Natl J Integr Res Med. 2012; 3(3):173–6.

Future Prospects for Obturator Prosthesis in Hemimaxillectomy Patients:

The future of obturator prostheses for hemimaxillectomy patients holds great promise through advancements in materials, such as flexible polymers and composites that enhance comfort, durability, and aesthetics, including materials that mimic the translucency of natural tissues. The integration of dental implants with obturators may provide better retention and stability, particularly with mini-implants or zygomatic implants for patients with insufficient bone support.[101] Digital dentistry, through digital scanning and 3D printing, could revolutionize the fabrication process, enabling precise and personalized prostheses with quicker turnaround times. Enhanced imaging techniques, like cone beam computed tomography (CBCT) (**Figure 18**), will aid in treatment planning and improve the accuracy of obturator placement. Future designs will focus on patient comfort and maintenance, incorporating features for easier cleaning and customization.[102]

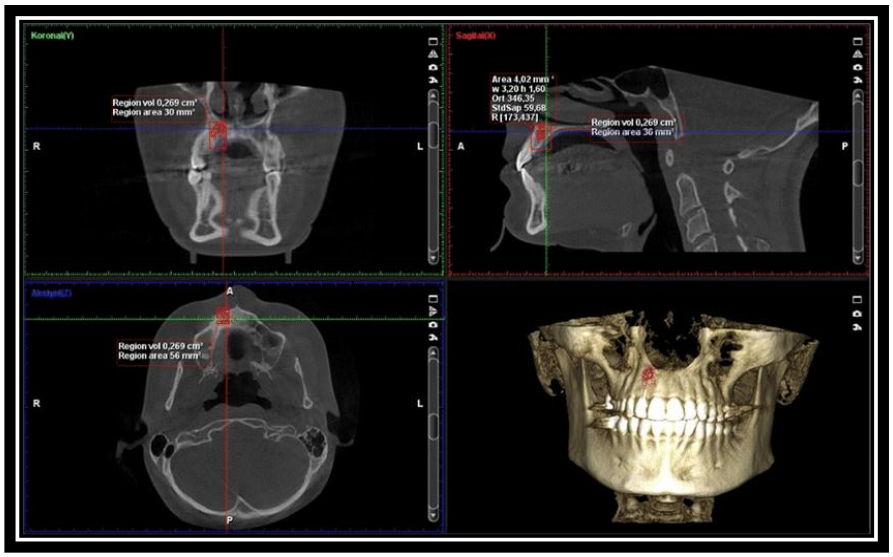

Figure 18: CBCT image showing the measurement of defect volume and bone density
Courtesy: Revnak M, Tatli U, Evlice B. Effects of low-level laser therapy on soft and hard tissue healing after endodontic surgery. Lasers Med Sci. 2018; 33(2):321-326.

A multidisciplinary approach involving prosthodontists, oral surgeons, speech therapists, and psychologists will lead to comprehensive care that addresses both functional and emotional rehabilitation needs.[103] Telehealth integration can enhance patient access to follow-up care, especially for those in remote areas. [126]Ongoing research into the long-term outcomes of various designs and materials will refine treatment protocols and improve prognostic accuracy.[104] Additionally; personalized rehabilitation programs that include speech therapy, nutritional counseling, and psychosocial support will enhance overall quality of life. Finally, an increased emphasis on education and training for healthcare providers in maxillofacial prosthetics will ensure better patient outcomes as more professionals become skilled in managing these complex cases. Ultimately, these innovations aim to improve both functional and aesthetic results for patients, enhancing their quality of life.[105]

III. Conclusion:

Prosthodontic rehabilitation using obturator prostheses is essential for restoring missing structures and creating a barrier between the oral and nasal cavities, greatly improving patients' quality of life. Given the complexities of maxillary anatomy and the variety of maxillectomy defects, a more refined classification system is needed to enhance treatment planning and communication among healthcare providers. While the foundational principles of rehabilitation for oral-nasal communication challenges are similar to those of traditional prostheses, a personalized approach is crucial to meet individual needs. Careful impression-taking and appliance installation are vital for optimal outcomes. Effective rehabilitation helps patients regain essential functions like speaking and eating; allowing them to restore their daily lives with confidence and dignity, and renews their sense of self and well-being.

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