sciendo
10.2478/AMB-2025-0036

CASE SERIES

MAXILLOFACIAL REHABILITATION WITH DEFINITIVE HOLLOW OBTURATORS USING GLYCERIN SOAP AND ICE CUBE TECHNIQUES: TWO CASE REPORTS

M. Rathee, M. Stalin, S. Singla, S. Tomar, S. Balavignesh

Department of Prosthodontics, Post Graduate Institute of Dental Sciences, Rohtak – Haryana, India

Abstract. *Maxillofacial rehabilitation of patients with maxillary defects poses significant challenges due to the need for functional, esthetic, and psychological restoration. Hollow obturators offer a lightweight, effective solution for improving speech, mastication, and overall comfort. These two case reports highlight the fabrication of definitive hollow obturators using two innovative techniques, the glycerin soap and ice cube techniques, tailored for patients with maxillary defects. The glycerin soap technique involved creating a hollow spacer, which was removed after curing, ensuring optimal weight reduction and structural integrity. Conversely, the ice cube technique utilized ice as a spacer, which melted post-processing, leaving a hollow core. Both techniques used conventional fabrication methods to ensure clinical feasibility and cost-effectiveness. The outcomes demonstrated excellent patient satisfaction, enhanced retention, and improved functionality. This study emphasizes the practicality and adaptability of these methods in diverse clinical scenarios, contributing to advancements in maxillofacial prosthetic rehabilitation.*

Key words: *maxillofacial prosthesis, obturators, hollow prostheses, maxillary defects, rehabilitation*

Corresponding author: *Dr. Stalin M, Post Graduate Student, Department of Prosthodontics, Post Graduate Institute of Dental Sciences, Rohtak, Haryana, India, tel: +8754801476, email: stalinclan@gmail.com*

ORCID: *0000-0002-0007-542X – Manu Rathee*

ORCID: *0009-0005-0298-3762 – M. Stalin*

ORCID: *0000-0002-1443-6054 – Shefali Singla*

ORCID: *0000-0001-5945-365 – Sarthak Singh Tomar*

ORCID: *0009-0008-1264-9698 – Balavignesh S*

Received: *23 January 2025;* ***Accepted:*** *07 March 2025*

INTRODUCTION

The essence of prosthodontics lies in restoring function and form and the confidence and quality of life of patients. Prosthodontics is fundamentally focused on restoring function, esthetics, and patient well-being, particularly in the context of complex oral and maxillofacial defects. Maxillofacial rehabilitation plays a pivotal role in addressing the functional and psychological challenges faced by patients with defects resulting from malignancies, trauma, or congenital conditions. These defects often disrupt vital functions such as mastication, deglutition, and speech, while significantly

negatively affecting facial esthetics and the patient's quality of life [1].

Maxillary defects, especially those involving extensive resection or congenital absence, present unique challenges in terms of restoration. Prosthetic obturators, which close oro-nasal communications and restore both functional and esthetic aspects, have long been integral to maxillofacial prosthetic rehabilitation [2]. However, the substantial weight of conventional obturators can compromise retention, stability, and patient comfort, reducing the overall efficacy of these devices. In response, hollow obturators have been developed as a solution to this issue, offering notable weight reduction while maintaining structural integrity and functional performance [3].

The use of hollow obturators, made possible by various spacer materials and fabrication techniques, has gained increasing attention in recent years. Traditional spacer materials such as salt, wax, and caramel have been employed, but more modern approaches have incorporated materials like glycerin soap and ice cubes [4]. These innovative materials allow for precise and reproducible hollowing of obturators, offering significant advantages in terms of weight reduction, retention, and ease of fabrication.

These two case reports present two distinct cases in which hollow definitive obturators were fabricated for patients with maxillary defects using either the glycerin soap or ice cube technique. The report highlights the procedural details and outcomes of each technique, demonstrating their efficacy in providing lightweight, stable, and esthetically pleasing prosthetic solutions for individuals with significant maxillary defects [5].

CLINICAL CASE DESCRIPTIONS

Case examination 1

A female patient in her 30s presented with discomfort and a loose fit of the current definitive obturator prosthesis (Figure 1a, 1d). The patient had undergone a hemi-maxillectomy 4 years ago due to rhinocerebral mucormycosis and had been using a conventional definitive obturator without a hollow structure. Upon examination, the maxillary arch was partially edentulous with Armani class IV maxillary defect, and the mandibular arch was fully dentulous (Figure 1b, c). The patient reported that the prosthesis had become loose, affecting retention and comfort. Considering her economic condition, the treatment plan involved fabricating a definitive hollow obturator to improve retention, comfort, and functionality. The patient provided informed written consent prior to the commencement of treatment.

Case examination 2

A male patient in his 40s presented with a complaint of discomfort and inadequate retention of his interim obturator prosthesis (Figure 4a). The patient had undergone a hemi-maxillectomy due to rhinocere-

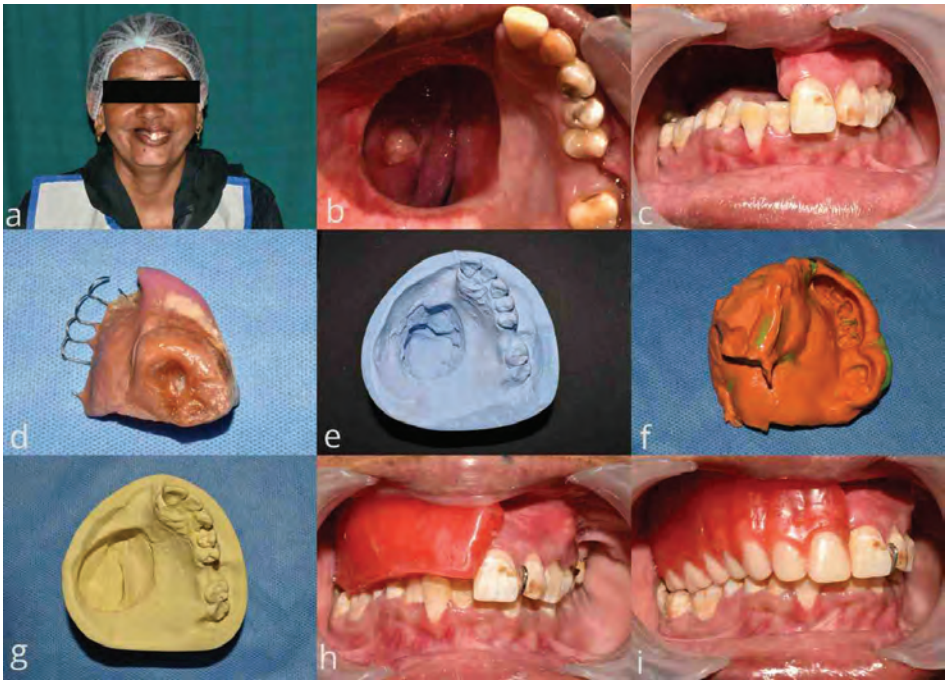

Fig. 1. 1a. Pre rehabilitative extraoral view; **1b.** Maxillary defect; **1c** Front occlusal view; **1d.** Previous prosthesis; **1e.** Primary cast; **1f.** Secondary impression; **1g.** Master cast; **1h.** Jaw relation; **1i.** Try in

bral mucormycosis one year ago. For the past eight months, he had been wearing the interim obturator but was dissatisfied with its fit and functionality (Figure 4d). Upon examination, the maxillary arch was partially edentulous with Armani class IV maxillary defect, and the mandibular arch was fully dentulous (Figure 4b, c). The patient requested a definitive obturator prosthesis. After evaluation, a definitive obturator prosthesis was planned to improve retention, comfort, and overall functionality. Prior to beginning the treatment, the patient was fully informed about the procedure and its potential risks and benefits, and written consent was obtained.

Treatment progress

Case 1

A preliminary impression of the maxillary arch was made using irreversible hydrocolloid material (Zelgan 2002, dust-free easy mix, Dentsply, India). To prevent the material from entering the palatal defect, a layer of cotton gauze was placed over the defect area. The impression was poured with Die stone (Figure 1e) (Kalident, Kalabhai Dental Pvt. Ltd., India), and a custom tray was fabricated using autopolymerizing acrylic resin (self-cure acrylic repair material, Dentsply, India). Border moulding was completed using a green stick impression compound (Pinnacle, DPI, India), including a precise capture of the palatal defect. A final impression was then made with light-viscosity condensation silicone material (Figure 1f) (Oranwash, Zhermack, Italy), and the master cast was poured using die stone (Figure 1g) (Kalstone, Kalabhai, India). The palatal defect was blocked out with modelling wax, and a record base was fabricated using autopolymerizing resin. A wax occlusal rim was constructed, and maxillomandibular relationships were recorded (Figure 1h). This was transferred to the articulator for further steps.

Teeth selection and arrangement were completed, and a try-in was conducted to evaluate retention, stability, phonetics, and esthetics (Figure 1i). Once the try-in was approved, the flashing and dewaxing procedures were carried out during the fabrication process. During packing, the palatal defect area was first loaded with heat-cure acrylic resin (Figure 2a), and a pre-customized glycerin soap bolus and heat-cure were positioned over it (Figure 2b). The remaining area was then filled with heat-cure acrylic resin and processed using conventional curing methods (Figure 2c).

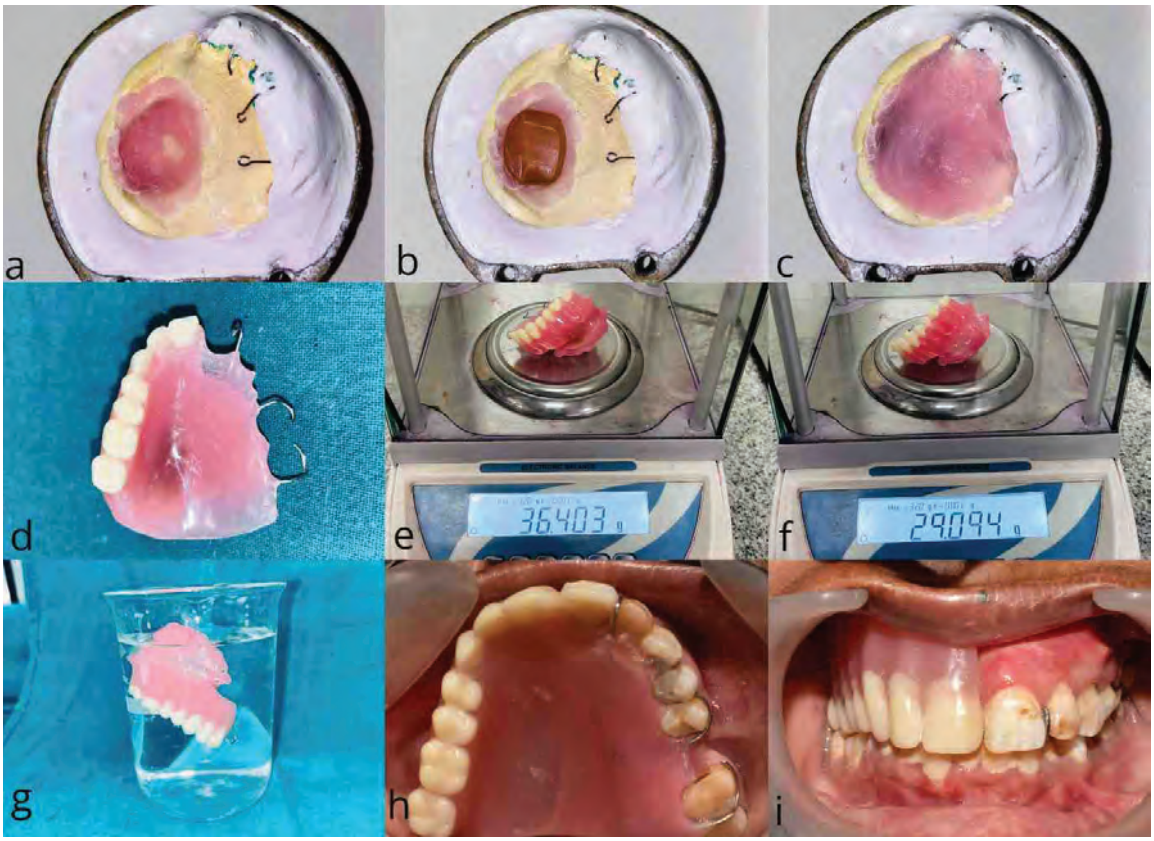

Fig. 2. 2a. Layer a head cure resin placed; **2b.** Pre-customized glycerin soap placed in a hollow area; **2c.** Completed coverage with heat-cure acrylic; **2d.** Definitive hollow obturator prosthesis; **2e.** Prosthesis with glycerin soap; **2f.** After the removal of glycerin soap; **2g.** Water floating; **2h, i.** Final prosthesis placed – intraoral and front occlusal views

After polymerization, the prosthesis was removed from the flask (Figure 2d). The glycerin soap bolus was first removed by drilling a hole into the defect portion and immersing the prosthesis in warm water. Any remaining soap material was flushed out by applying hot water pressure to the hollow area. Before removing the glycerin soap, the prosthesis was weighed to record its pre-removal weight (Figure 2e). Once the soap material was eliminated, the prosthesis was weighed again to determine its post-removal weight (Figure 2f), confirming the weight reduction achieved through the hollow design. A floating test was performed to validate the hollow design's effectiveness (Figure 2g). The denture was placed in a container of water, and it floated on the surface, further confirming the successful creation of a lightweight hollow structure after the removal of the glycerin soap material. Finishing and polishing were performed using standard protocols. The completed hollow obturator was inserted into the patient's mouth (Figure 2h, i). Compared to the pre-rehabilitation phase, where the patient experienced compromised function, speech difficulties, and esthetic concerns, the post-rehabilitation outcomes demonstrated significant improvement. The hollow obturator provided enhanced functionality, clearer speech, and improved facial esthetics, leaving the patient highly satisfied with the overall results (Figure 3a, b).

Fig. 3. 3a. Pre rehabilitative view; **3b.** Post rehabilitative view

Case 2

The initial steps of the procedure up to the try-in stage followed the same protocol as the previous case (Figure 4e, f, g, & i). An innovative technique was introduced by applying a layer of modelling wax to block out the hollow portion (Figure 5a) strategically. During the dewaxing procedure, the wax was carefully removed by immersing the flask in boiling water, ensuring the hollow area was accurately preserved for subsequent steps (Figure 5b). The defect area was carefully filled with water, which was then refrigerated to form a solid ice block of the desired dimensions. After the ice block was created, it was removed, and a thin layer of heat-cure acrylic resin was meticulously packed around the hollow space left by the ice (Figure 5c). The remaining portion was filled with heat-cure acrylic resin, and the entire assembly was processed using conventional laboratory techniques (Figure 5d). This approach ensured precise adaptation and structural integrity while maintaining a lightweight design.

Following curing, the ice block melted back into the water, which was easily drained through the preformed vent hole (Figure 5e). The hollow prosthesis was then weighed with the water intact to record its pre-removal weight (Figure 5f). Once the water was completely drained, the prosthesis's weight was reduced and weighed again to determine its post-removal weight (Figure 5g). Standard finishing and polishing procedures were performed to achieve a smooth and aesthetic surface. The final hollow obturator was carefully inserted, ensuring a precise fit that seamlessly integrated with the patient's oral anatomy (Figure 5h, i). The lightweight design contributed to enhanced comfort and minimized any strain on the surrounding tissues. Additionally, the obturator provided significant functional improvements, including better speech clarity, improved mastication, and re-

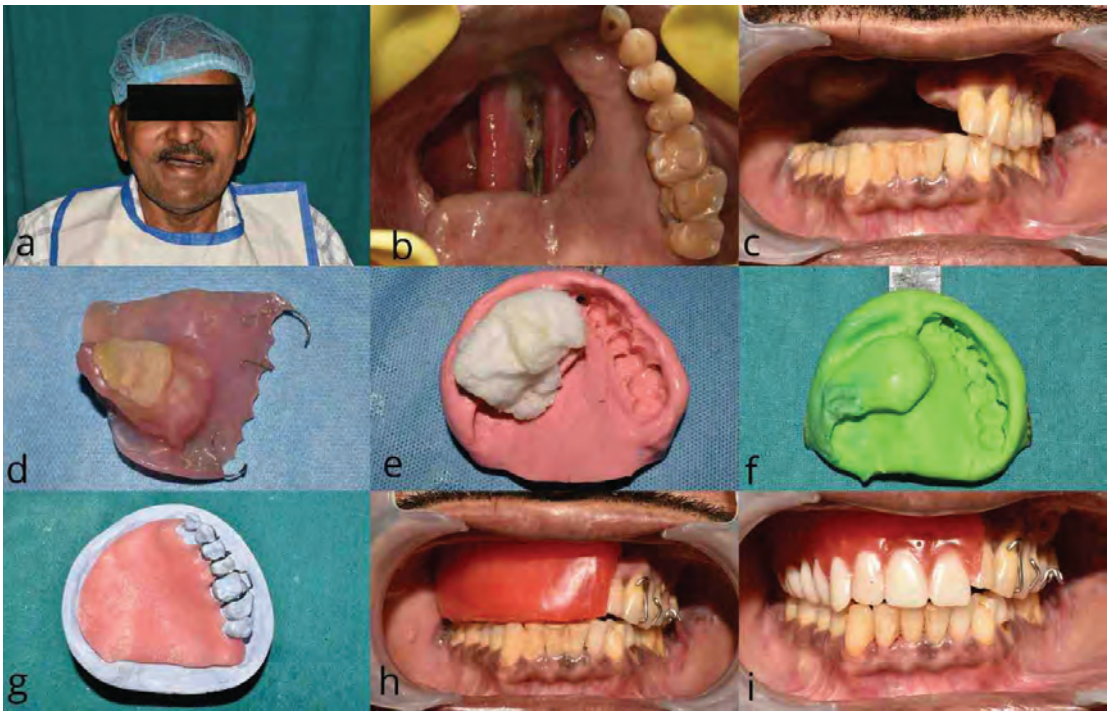

Fig. 4. 4a. Pre rehabilitative extraoral view; **4b.** Maxillary defect; **4c.** Front occlusal view; **4d.** Previous prosthesis; **4e.** Primary impression; **4f.** Secondary impression; **4g.** Master cast with denture base; **4h.** Jaw relation; **4i.** Try in

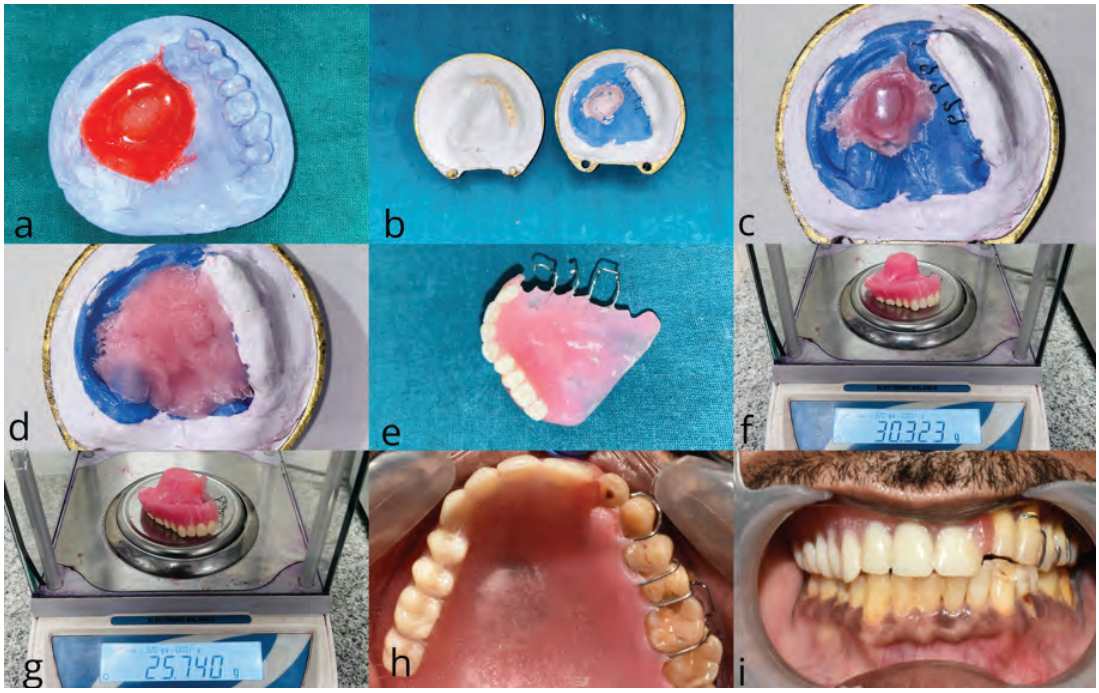

Fig. 5. 5a. Ice cube customization; **5b.** After dewaxing; **5c.** Ice cube placed in a hollow area; **5d.** Definitive hollow obturator prosthesis; **5e.** Before the water is removed from the hollow cavity of the prosthesis; **5f.** After removal of water from the hollow cavity of the prosthesis; **5h, i.** Final prosthesis placed – intraoral and front occlusal views

stored facial esthetics. The overall outcome demonstrated the successful application of the hollow design, providing both structural integrity and comfort, while significantly enhancing the patient's quality of life (Figure 6a,b).

Post-operative care for a definitive obturator involves gently inserting it to ensure a comfortable and precise fit. The obturator should be removed during sleep and cleaned daily with a soft toothbrush and mild soap. After each meal, the mouth should be

rinsed to maintain hygiene. It is important to avoid hard, sticky foods and to stay hydrated to ensure comfort and moisture retention in the oral cavity. The obturator should be handled with care and stored in a safe, dry place when not in use. Regular follow-up appointments should be scheduled to monitor the fit and function of the prosthesis and make any necessary adjustments.

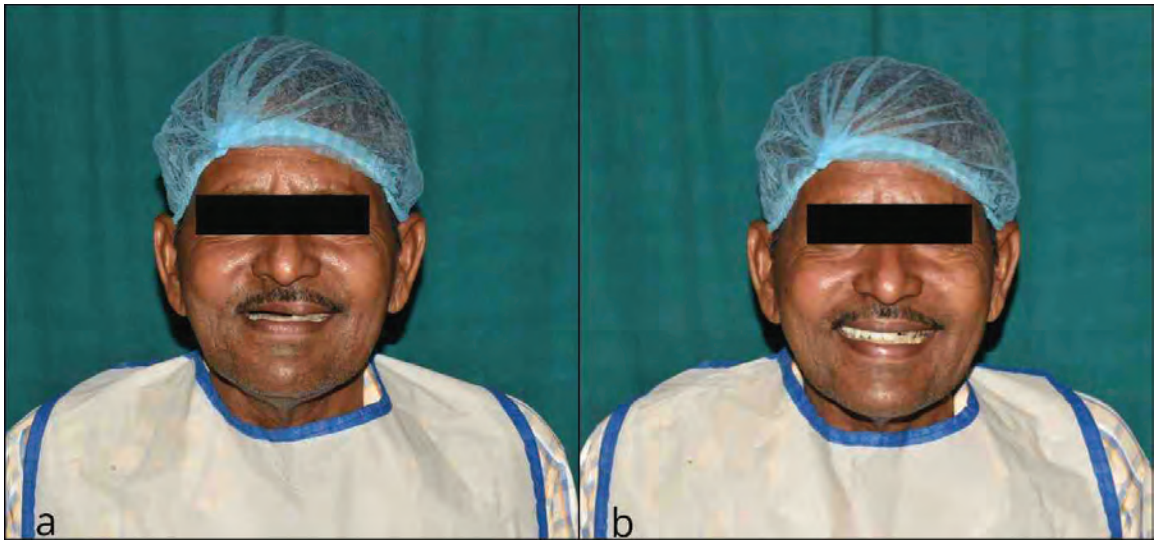

Fig. 6. 6a. Pre rehabilitative view; **6b.** Post rehabilitative view

DISCUSSION

Maxillary defects caused by trauma, congenital anomalies, or surgical resection, such as in cancer cases, create significant challenges for both function and esthetics [6, 7]. These defects disrupt normal anatomy, impairing essential functions like speech, swallowing, mastication, and facial aesthetics, with profound psychological and social consequences for affected individuals [8, 9]. Prosthetic rehabilitation plays a critical role in restoring these functions and improving the quality of life for patients [10].

Obturators, prosthetic devices designed to close maxillary defects, are indispensable for restoring functionality and esthetics. They can be classified into three types based on the rehabilitation stage. Immediate obturators are placed post-surgery to protect the surgical site, minimize infection risk, and restore basic functions. Interim obturators are used during the healing phase to maintain continuity and enhance comfort, speech, and eating. Definitive obturators, custom-fabricated for long-term use, provide precise fit, functional stability, and esthetic restoration, making them integral to maxillofacial prosthetic rehabilitation [11, 12].

Definitive obturators are fabricated using materials such as heat-cured acrylic resin, silicone elastomers, polymer composites, or advanced three-dimensional (3D)-printed materials. Hollow obturators are particularly advantageous for large maxillary defects due to their reduced weight, which minimizes tissue stress, improves retention, and enhances patient comfort. However, their fabrication is technically challenging, requiring precision to ensure structural integrity and durability [13, 14]. Despite their benefits, including improved esthetics and functionality, hollow obturators face challenges like prolonged fabrication times, technical complexity, and the risk of leakage at polymerized junctions [15].

Various materials have been used to create hollow spaces in obturators, each with its benefits and limitations. Wax shims are easy to handle but prone to dimensional changes. Sugar is moldable but brittle. Acrylic resin shims offer structural integrity but are time-intensive. Polyurethane foam is easy to recontour but challenging to remove. Cellophane-wrapped asbestos ensures uniform thickness but poses severe health risks. Silicone putty is simple to use but difficult to retrieve without residue. Ice cubes, in contrast, are cost-effective, easy to remove, and ensure complete hollowing without compromising curing [16, 17].

The ice cube technique is an efficient, cost-effective approach to fabricating hollow obturators. It ensures uniform thickness, eliminates porosity and allows complete spacer retrieval. Ice's non-adhesion to acrylic resin preserves mechanical properties and esthetics, making this technique versatile and suitable for other prosthetic applications, including finger prostheses, vaginal stents, and complete dentures

for atrophic ridges. However, its impact on the flexural strength of hollow structures remains uncertain, necessitating further research. Advanced methodologies, such as finite element analysis (FEA) and numerical modeling, can provide insights into the mechanical properties and stress distribution in obturators fabricated using ice [18].

The glycerin soap technique is another innovative method for fabricating hollow obturators. Its advantages include ease of recontouring, accessibility, and thermal stability during curing. However, incomplete removal of glycerin soap can lead to fluid seepage and compromise structural integrity. Additionally, the junctions between polymerized portions may be prone to leakage, requiring precise fabrication techniques [19]. Innovative fabrication techniques, such as the ice cube and glycerin soap methods, address critical challenges in hollow obturator fabrication, such as weight reduction and retention. These cost-effective solutions are accessible for a wide range of clinical settings, improving patient comfort and prosthesis functionality. Future studies should focus on evaluating glycerin soap's effects on heat-cured acrylic resin's mechanical properties, including flexural strength, compressive strength, and durability. Future research should investigate the long-term clinical outcomes of obturators fabricated with various spacer materials. Studies should explore the mechanical and physical properties of prosthetic devices to optimize performance and durability. Incorporating digital technologies like CAD/CAM and 3D printing into these techniques offers potential advancements in precision, efficiency, and patient outcomes [20, 21].

CONCLUSION

Maxillary defects significantly affect function and esthetics, requiring innovative prosthetic solutions. Hollow definitive obturators provide lightweight, functional rehabilitation, with techniques like the ice cube and glycerin soap methods offering cost-effective fabrication. The ice cube technique ensures uniform hollowing, while glycerin soap provides flexibility, though both have limitations such as potential leakage. Future research should focus on the mechanical properties, durability, and clinical outcomes of these methods. Integrating Computer-Aided Design and Computer-Aided Manufacturing and 3D printing can enhance precision and efficiency. Comparative studies and patient-reported outcomes are vital to refining clinical protocols. Advancing these innovations will improve maxillofacial rehabilitation and patient quality of life.

Conflict of Interest Statement: *The authors declare no conflicts of interest related to this work.*

Funding: *The authors did not receive any financial support from any organization for this research work.*

Ethical statement: *This study has been performed in accordance with the ethical standards as laid down in the Declaration of Helsinki.*

Informed Consent for a Clinical Case: *Written informed consent was obtained from the patient(s) for the publication of this case report, including any accompanying images.*

REFERENCES

1. Rathee M, et al. Reconstruction and Rehabilitation of Maxillary Defects Secondary to Mucormycosis. Saudi J Oral Dent Res. 2022;7(1):1-7.
2. Lethaus B, Lie N, de Beer F, et al. Surgical and prosthetic reconsiderations in patients with maxillectomy. J Oral Rehabil. 2010;37(2):138-42.
3. Gerdzhikov I, Dimova M, Georgiev T. Efficiency of prosthetic treatment with post-resection prostheses with solid substitute part. J IMAB. 2016;22(3):1265-1268.
4. Rathee M, Divakar S, Jain P, et al. Post maxillectomy rehabilitation and amelioration of quality of life of post COVID rhinocerebral mucormycosis patients using obturator – A case series. J Family Med Prim Care. 2022;11:7476-82.
5. Nimonkar SV, Belkhode VM, Sathe S, Borle A. Prosthetic Rehabilitation for Hemimaxillectomy. J Datta Meghe Inst Med Sci Univ. 2019;14:99-102.
6. Mihaylov T, Gerdzhikov I, Dimova-Gabrovska M, Mihaylova K. Quality of life after orthopedic rehabilitation of maxillofacial injuries and defects. under the editorship of T. Mihaylov. Varna. Press.mu-varna.bg, 2016; 312.
7. Gerdzhikov I., Dimova-Gabrovska M. Prosthetic treatment of a patient with partial maxillectomy with post resection model cast prosthesis. Knowledge in practice, Scientific papers, Skopie. 2016; 15(3):1157-1160.
8. Dimova-Gabrovska M, Dimitrova D. Protocol for clinical articulation of complete dentures in maximum intercuspation. (Protokol dlia klinicheskogo artikulirovaniia polnykh s''emnykh protezov v maksimal'noĭ interkuspidatsii). Stomatologiia, 2019; 98(1): 45–49.
9. Dimova-Gabrovska M. Algorithm for Computerized Analysis of Static, Dynamic and Functional Occlusion in Patients with Bruxism and Bruxomania. Comptes rendus de l'Académie bulgare des Sciences. 2019; 72(2): 259-266.
10. Nazir O, Pandey KK, Tarranum F, et al. Rehabilitation of a maxillectomy patient with hollow bulb obturator: A case report. IP Ann Prosthodont Restor Dent. 2021;7(1):46-49.
11. Dimova-Gabrovska M, Maksimovskaya L, Dimitrova D Changes in the oral mucosa in patients with bruxism (Izmeneniya slizistoi obolochki rta u patsientov s bruksizmom), Stomatologiia. 2021; 100(6 Vyp 2):48–52 .
12. Gerdzhikov I, Dimova-Gabrovska M. Prosthetic treatment of a patient with maxillary defect. Int J Sci Res. 2017;6(2):750-753.
13. Punjabi AR, Mistry G, Shetty O, Rathod A. Maxillary hollow-bulb obturator: A paradigm shift. J Indian Prosthodont Soc. 2019;19(1):74-78.

14. Gerdzhikov I. Possibilities for Modification of Surgical Obturator into Temporary Obturator. J IMAB. 2021 Jan-Mar;27(1):3615-361.
15. Singh AK, Singh R, Joshi SR, Misra A. Mucormycosis in COVID-19: A systematic review of cases reported worldwide and in India. Diabetes Metab Syndr. 2021; 15:102146.
16. Rathee M, Singh S, Malik S, et al. Reconstruction and rehabilitation of maxillary defects secondary to mucormycosis. Saudi J Oral Dent Res. 2022; 7:173-8.
17. Gerdzhikov I. Types of classifications of maxillary defects. Knowledge International Journal. 2022; 55(4):629-635.
18. Nimonkar SV, Belkhode VM, Asiri AM, et al. A method of hollowing the obturator prosthesis and an overview of the pros and cons of the various materials used for hollowing. J Med Life. 2021;14(3):383-9.
19. Gerdzhikov I. Prosthetic treatment of a patient with total hard palate resection. J IMAB. 2019 Jan-Mar;25(1):2355-2357.
20. Dimova-Gabrovska M, Stamenova M, Shopova D, Yankova M. The modern digital intraoral scanning systems: a review. Acta Medica Bulgarica. 2024; 51(2):58-64.
21. Yazicioğlu H, Yaluğ S. An alternative method for fabricating a closed hollow obturator: a clinical report. J Oral Sci. 2002 Dec;44(3-4):161-4.