IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 8 Ser.1 (August 2025), PP 68-77
www.iosrjournals.org

Functional Recovery of a Mucormycosis-Induced Palatal Defect: Case Report

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Abstract
The number of mucormycosis cases has increased as a result of the COVID-19 pandemic, particularly among immunocompromised individuals having diabetes mellitus, malignancies, transplants, corticosteroid therapy, iron overload, trauma, persistent neutropenia, and malnutrition often necessitating surgical intervention and resulting in maxillary defects. Such defects compromise essential functions, including speech, mastication, and swallowing, and require prompt rehabilitation to restore oral and facial integrity. This case report details the prosthetic rehabilitation of a post-mucormycosis maxillary defect using a definitive obturator with a cast metal framework. Early prosthetic planning and close collaboration between surgeons and prosthodontists are emphasized as vital for optimizing functional and psychosocial outcomes in affected patients.

I. Introduction

Mucormycosis is a severe, invasive fungal infection primarily affecting immunocompromised individuals, especially those who have experienced recent COVID-19 infection. The disease is caused by mucormycetes (a group of fungi within the Zygomycetes class) and is notorious for its rapid progression and aggressive tissue invasion.[1] Among the most notable predisposing factors are diabetes mellitus, malignancies, transplants, corticosteroid therapy, iron overload, trauma, persistent neutropenia, and malnutrition. Inhaling airborne spores is the most common route of infection.[2]

Clinical Presentations
Mucormycosis can appear in various clinical forms:
- **Rhinocerebral**
- **Rhinomaxillary**
- **Pulmonary**
- **Gastrointestinal**
- **Cutaneous**
- **Disseminated**

Disease Complications
When mucormycosis affects the midface and palate, rapid tissue necrosis can develop, potentially causing:
- **Palatal defects**
- **Oro-antral fistulas**
- **Maxillectomy (surgical removal of the maxilla)**
- **Blindness**
- **Craniofacial damage**

These defects often result in functional difficulties like nasal regurgitation, hypernasal speech (nasal twang), impaired mastication, and psychosocial distress.[3]

Management and Rehabilitation
Treatment typically involves:
- **Aggressive antifungal therapy**
- **Surgical excision of necrotic tissues**
- **Correction of underlying metabolic or immune disorders**

For defects resulting from maxillectomy or tissue removal, **prosthetic rehabilitation using obturators** is essential. According to the Glossary of Prosthodontic Terms, an obturator is "a maxillofacial prosthesis used to close a congenital or acquired tissue opening, primarily of the hard palate and/or contiguous alveolar or soft

tissue structures." [1-4] The design and extent of the obturator depend on the defect's size, tissue characteristics, and patient-specific functional requirements.

Phases of Obturator Therapy

- Immediate (Surgical) Obturator: Placed at surgery to facilitate healing.
- Interim Obturator: Provided 3–4 weeks post-operatively for tissue stabilization.
- Definitive Obturator: Delivered after 3 months for ongoing long-term function.

Benefits of Obturator Prosthesis

- Restores the oronasal barrier, preventing food and liquid from entering the nasal cavity.
- Improves speech articulation, reducing hypernasality.
- Enhances mastication and swallowing.
- Contributes to psychosocial well-being and quality of life.

Design Considerations

- Defect size and location
- Lining tissue nature
- Functional needs for support, stability, and retention

Importance of Interdisciplinary Care

Comprehensive management of patients with palatal defects post-mucormycosis requires collaboration among surgeons, prosthodontists, speech therapists, and psychologists. This approach ensures restoration of function and aesthetics while addressing mental health and social reintegration.[5]

In summary, prosthetic rehabilitation using obturators is a cornerstone in managing maxillary and palatal defects following mucormycosis. It plays a critical role in restoring oral function, speech, and psychological well-being, helping patients return to normal life after a devastating illness.[6]

II. Case Report

A 50-year-old male patient reported to the Department of Prosthodontics and Crown and Bridge with the chief complaint of Nasal Regurgitation of water and food difficulty in chewing, Nasal voice and loss of lip contour leading to poor facial appearance due to a post-surgical defect in the left side of the palate. Medical history revealed Patient was diabetic and underwent Left Partial Maxillectomy for the treatment of mucormycosis of maxilla seven days back.

Extraoral examination revealed asymmetry of face with collapsed cheek and swelling Present In the left infraorbital region. Intra oral examination reveals defect in the left side of the hard palate, extending posteriorly and laterally towards the alveolar ridge. The mucosa appears erythematous, with visible loss of palatal bone and tissue continuity creating an opening between the oral and nasal cavities (oronasal communication). The defect extends from the midline to the lateral aspect, involving much of the left hard palate and possibly the alveolar process up to the remaining teeth. The posterior extension appears to involve the soft palate or its junction with the hard palate. Tissue appeared as irregular, with exposed bone and areas of granulation tissue visible. The surrounding mucosa appears erythematous and possibly inflamed, with yellowish-white slough or necrotic tissue in some areas—suggestive of healing tissue or residual infection. Missing teeth include 21,22,23,24,25,26,27. The defect was categorised as Aramany's Class-I type *(Fig 1)*.

Fig 1: Intra oral view of defect

Initially late surgical obturator was fabricated & was given to patient till the time the defect was healed.

III. Procedure of Making Interim Obturator

Following oral prophylaxis, a primary impression was recorded using irreversible hydrocolloid impression material with a stock tray *(Fig 2)*. The impression was then poured with dental stone, and the primary cast was carefully retrieved for subsequent prosthetic procedures.

Fig 2: Primary impression of the defect

An interim obturator is fabricated using cold cure acrylic resin and the retention is given by C-clasp on the maxillary right central incisor. Obturator was delivered to the patient *(Fig 3)*.

Fig 3: (a) Intaglio surface of obturator, (b) Cameo surface of obturator, (c) Obturator inside the oral cavity covering the defect

After 6 months of interim obturator patient again reported to the Department of Prosthodontics and Crown & Bridge with complaints of nasal regurgitation of water and food, difficulty in chewing. Following comprehensive intraoral, extraoral, and radiographic examinations, defect was healed *(Fig 4)* & the patient was advised to undergo oral prophylaxis. Various prosthetic treatment options were discussed, including surgical reconstruction of hard and soft tissues followed by implant-supported prosthesis, as well as rehabilitation using a definitive obturator with a cast metal framework. Due to financial considerations, the patient opted for rehabilitation with a definitive obturator fabricated with a cast metal framework.

Fig 4: Intra oral view of defect after 6 months of healing

IV. Procedure of Making Definitive Obturator

Following thorough oral prophylaxis to ensure the oral cavity was in optimal condition, a primary impression was made using irreversible hydrocolloid (alginate) impression material with a suitable stock tray *(Fig 5)*. This initial impression captured the anatomical details of the maxillary arch, including the extent of the post-surgical defect. The impression was subsequently poured with high-quality dental stone to create an accurate primary cast.

Fig 5: Primary impression of the defect

The primary cast was carefully retrieved and subjected to detailed surveying using a Ney surveyor. This step was critical in guiding the design and fabrication of a cast metal framework by identifying the most favourable paths of insertion, undercuts, and strategic locations for retentive and stabilizing components.

Based on the survey analysis, direct retainers were planned on the maxillary teeth numbered 14, 15, and 17, providing essential clasping action to secure the prosthesis. To enhance prosthesis stability and prevent dislodgement during function, indirect retention was planned utilizing the canine tooth, number 13. The inclusion of indirect retainers mitigates rotational forces around the fulcrum line of the prosthesis.

The prosthesis design also incorporated a mesh-type denture base minor connector framework extending over the palatal defect. This mesh base allows for optimal distribution of occlusal forces and facilitates adequate coverage of the defect area while enabling a proper acrylic resin base to be formed.

The mesio-occlusal rest seat was prepared on 15. The disto-occlusal rest seats were prepared on 14, and 17. The canine rest seat was prepared on 13. Special tray was fabricated on the Primary cast by giving double spacer *(Fig 6)*.

Fig 6: (a) Adaption of spacer on primary cast (b) Special tray is fabricated with cold cure acrylic resin (c) Special tray is retrieved from the primary cast

Prior to making the final impression, the spacer material was carefully removed from the custom tray to provide an optimal space for the impression material *(Fig 7)*. The holes were created all over the custom tray for the mechanical bonding of Polyvinyl siloxane material to the tray *(Fig 8)*. The final impression was then recorded using a two-step polyvinyl siloxane (PVS) technique, employing both putty and light body consistency materials. The putty material was initially applied to capture the overall form and bulk, while the light body material was used to record fine anatomical details and undercut areas around the defect and remaining dentition *(Fig 9)*.

Subsequently, the impression was poured immediately with high-strength die stone to produce a highly accurate and durable master cast. The master cast, retrieved carefully after setting, served as the definitive working model for the design and fabrication of the cast metal framework and prosthetic components *(Fig 10)*.

Fig 7: Spacer was removed from the special tray

Fig 8: Holes were made for mechanical bonding

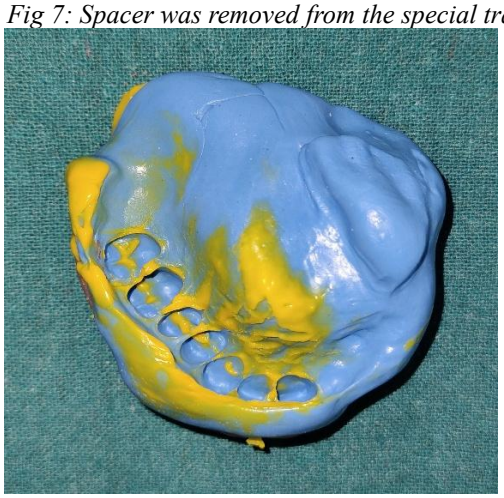

Fig 9: Final impression

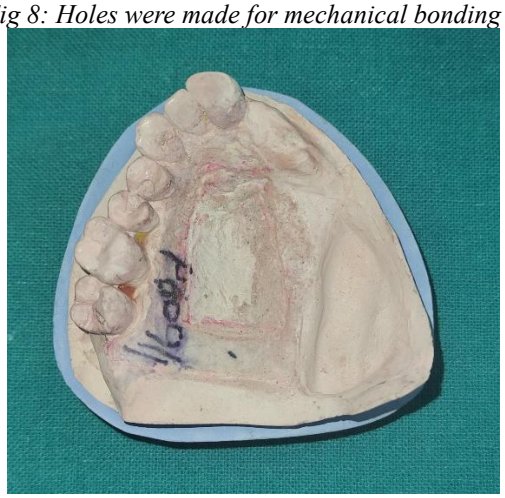

Fig 10: Master Cast

The cast was duplicated to fabricate a refractory cast. Upon obtaining the refractory cast, a wax pattern was meticulously crafted over it, followed by casting of the metal framework using conventional laboratory procedures. The cast metal framework was then finished and polished employing a sequence of abrasive stones to ensure a smooth and precise surface *(Fig. 11)*.

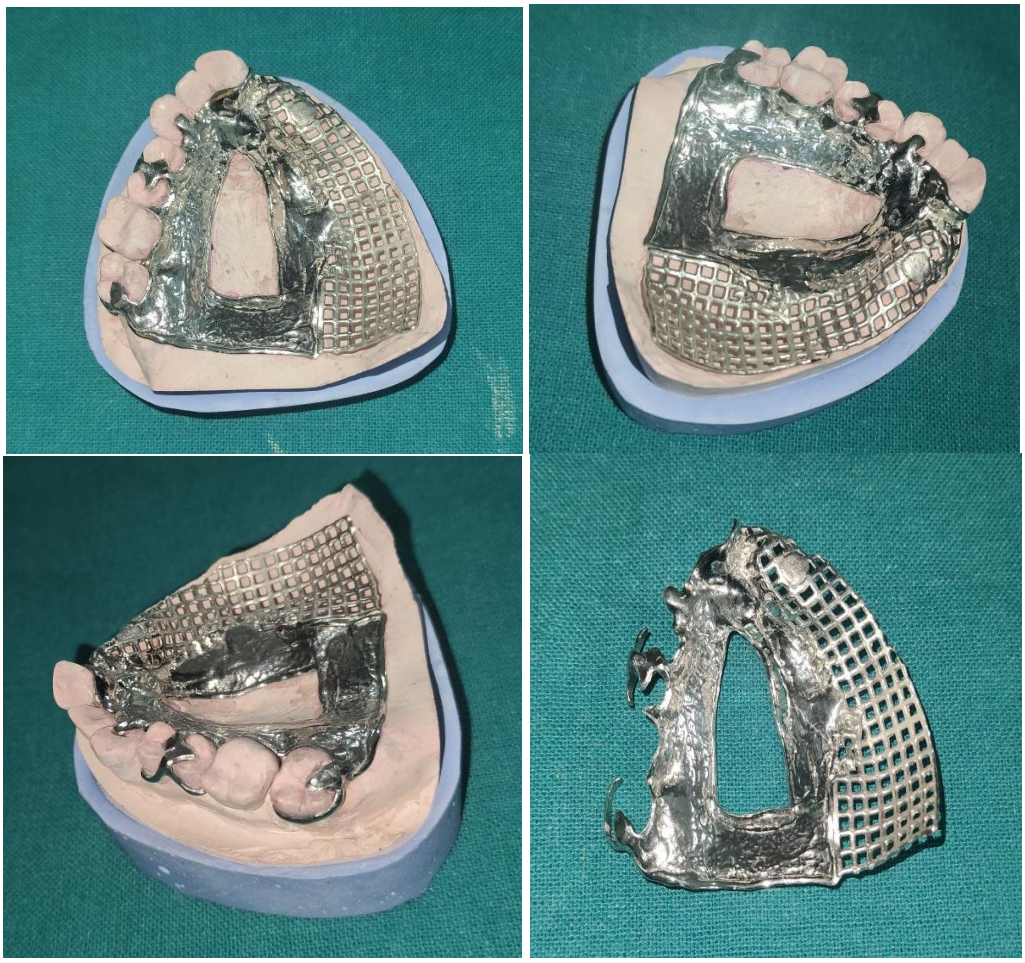

Fig 11: Metal Framework

An intraoral trial of the metal framework was conducted to assess the fit and adaptation within the patient's maxillary defect *(Fig. 12)*. Subsequently, an occlusal rim was fabricated over the edentulous segment using baseplate wax, and an intraoral bite registration was recorded to establish the correct vertical dimension and centric relation *(Fig. 13)*. Tooth shade was carefully selected by matching with the patient's natural dentition to achieve optimal aesthetic harmony.

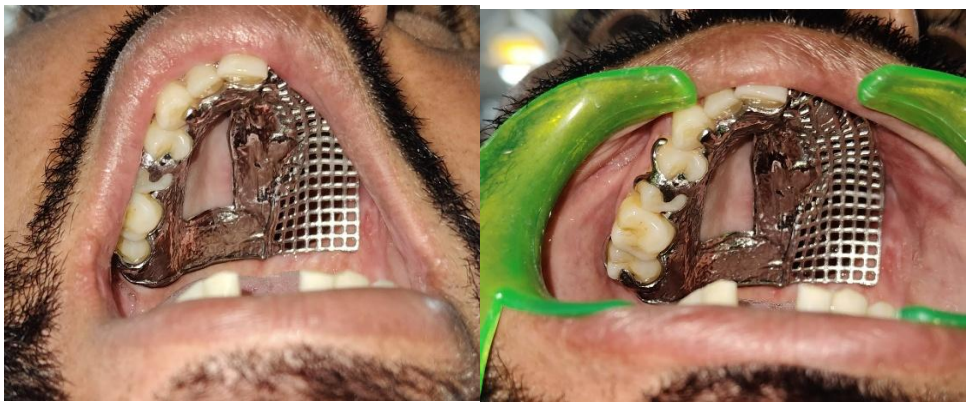

Fig 12: Metal Framework Try in done

Fig 13: Bite was recorded using base plate wax

The recorded bite was mounted on a mean value articulator, and artificial teeth were arranged accordingly. A clinical try-in was performed to evaluate occlusion, aesthetics, and phonetics, ensuring functional and visual satisfaction *(Fig. 14).*

Fig 14: Clinical try in done

Following the try-in appointment, the obturator prosthesis was processed in heat-cured acrylic resin, then subjected to finishing and polishing to enhance comfort and hygiene *(Fig. 15 & 16).*

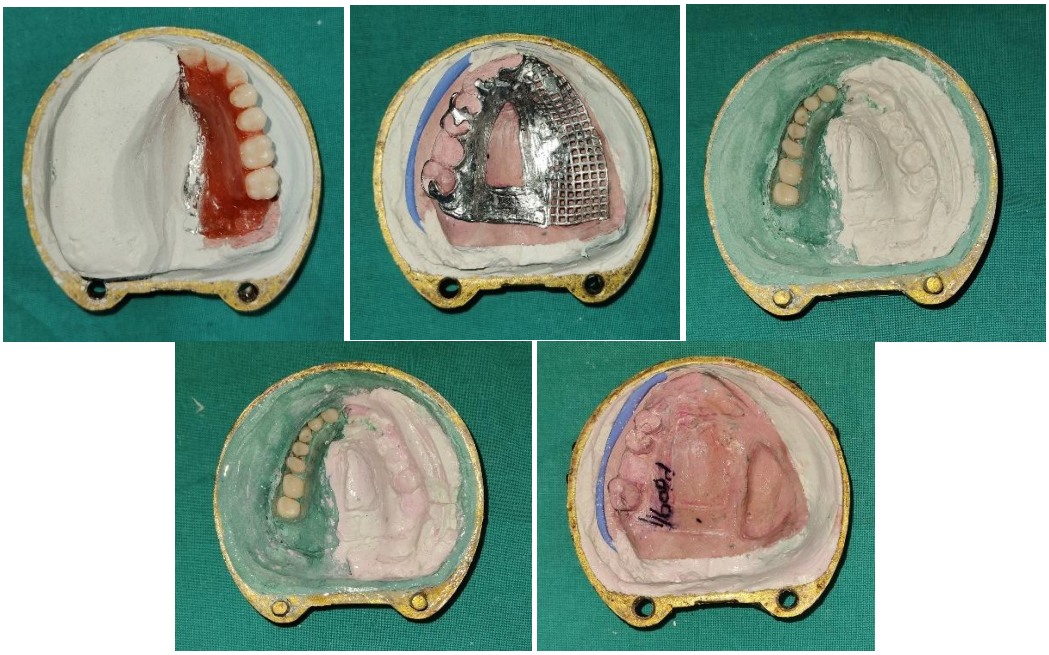

Fig 15: Steps included in the fabrication of obturator

Fig 16: Processed obturator after finishing & polishing (a) cameo surface of obturator (b) intaglio surface of obturator

The definitive obturator was thereafter delivered to the patient along with detailed post-insertion instructions to facilitate adaptation and maintenance *(Fig. 17).*

Fig 17: Delivery of Prosthesis

V. Discussion

Mucormycosis, an opportunistic invasive fungal infection, has seen a notable increase in incidence during the COVID-19 pandemic, particularly in patients with compromised immunity, such as those with diabetes mellitus, malignancies, or those receiving corticosteroid therapy. The aggressive nature of mucormycosis often necessitates extensive surgical resection, including partial maxillectomy, resulting in complex maxillary defects with significant implications for oral function and facial aesthetics.[5-6]

In this case, the patient presented with a left-sided maxillary defect post-surgical excision of mucormycosis, accompanied by symptoms such as nasal regurgitation, impaired mastication, and hypernasal speech, alongside compromised facial symmetry due to soft tissue collapse. These clinical manifestations are consistent with the typical sequelae of maxillary defects, which disrupt the oronasal barrier and affect crucial physiological functions — speech, swallowing, and mastication — as well as psychosocial well-being.[7-8]

The prosthetic rehabilitation approach chosen in this case involved the fabrication of a definitive obturator using a cast metal framework. This modality remains a cornerstone in the management of maxillary defects due to its ability to restore the oronasal partition effectively, thus preventing nasal leakage and improving function.[9] The phased treatment approach, starting with a late surgical obturator followed by an interim and ultimately definitive obturator, aligns with established clinical protocols that prioritize tissue healing, progressive functional restoration, and patient adaptation.[10-11]

Key considerations in this case included:

1. **Patient-Centered Treatment Planning:** Given the patient's financial constraints, the definitive obturator with a metal framework provided a cost-effective yet functionally durable rehabilitation option, avoiding more invasive or expensive alternatives such as surgical reconstruction followed by implant-supported prostheses.
2. **Use of Metal Framework:** The cast metal framework enhances the prosthesis's retentive and supportive capabilities, imparting long-term durability while allowing for optimal distribution of occlusal forces. Surveying of the cast facilitated accurate design of direct and indirect retainers (on teeth 14, 15, 17, and 13), improving stability and minimizing rotational forces during function.
3. **Impression Techniques and Fabrication:** Accurate impression techniques, including the use of polyvinyl siloxane with a custom tray and double spacer, yielded a precise master cast that is critical for intimate adaptation of the obturator. The fabrication workflow—from refractory cast duplication, wax pattern fabrication, metal casting, to clinical try-ins—ensured a prosthesis tailored for functional and aesthetic demands.
4. **Functional and Aesthetic Outcomes:** The clinical try-in and final prosthesis delivery demonstrated improvements in mastication, speech articulation, and prevention of nasal regurgitation, while the metal framework supported restoration of facial contour and lip support, thereby enhancing patient confidence and quality of life.
5. **Interdisciplinary Collaboration:** The rehabilitation process underscores the essential collaboration between surgeons and prosthodontists. Early prosthetic planning can influence the surgical approach, such as preservation of strategic anatomical structures to aid prosthesis retention. Post-surgical management involving regular follow-up ensures timely modifications and addresses patient adaptation.

Despite the prosthetic benefits, certain limitations and challenges persist, including the need for meticulous oral hygiene to prevent fungal or bacterial colonization on the obturator, patient compliance with regular follow-up, and possible need for future adjustments as tissues remodel over time.

Overall, this case exemplifies the critical role of definitive obturator prostheses with cast metal frameworks in restoring essential oral functions and aesthetics for patients with maxillary defects secondary to mucormycosis. It reinforces that with careful planning, appropriate material selection, and phased rehabilitation, patients can achieve substantial functional recovery and improved psychosocial well-being, even in settings where financial or medical constraints limit more invasive reconstructive options.

VI. Conclusion

The rehabilitation of maxillary defects secondary to mucormycosis remains a complex clinical challenge due to the multifaceted impact on oral function and facial aesthetics. This case report highlights that the use of a definitive obturator fabricated with a cast metal framework offers a reliable, cost-effective, and functionally satisfactory treatment modality. Through comprehensive treatment planning, precise impression techniques, and phased prosthetic fabrication, adequate retention, stability, and patient comfort were successfully achieved. The interdisciplinary coordination between surgical and prosthodontic teams was instrumental in optimizing clinical outcomes. Given the constraints posed by patient factors and healthcare resources, definitive obturators remain an indispensable component in the management of such defects. This approach not only restores essential physiological functions—mastication, speech, and deglutition—but also significantly contributes to psychosocial rehabilitation and improved quality of life. Future studies with larger cohorts and long-term

follow-up are warranted to further validate the efficacy and durability of obturator prostheses in post-mucormycosis maxillary defect rehabilitation.

Source of Funding
None
Conflict of Interest
None

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