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Case Report

Digital workflow in fabrication of a definitive obturator for post-COVID rhinocerebral mucormycosis: A case report

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Abstract

Maxillary defects are among the most debilitating intraoral deformities, leading to impaired mastication, deglutition, hypernasal speech, and facial disfigurement. These defects may arise congenitally or, more commonly, as a consequence of surgical resections for neoplasms or infections. In recent years, post-COVID rhinocerebral mucormycosis has emerged as a major etiological factor, particularly in immunocompromised patients and those exposed to corticosteroids or prolonged oxygen therapy. Surgical management of mucormycosis often necessitates maxillectomy, creating extensive oro-nasal communications that severely compromise quality of life. Prosthodontic rehabilitation with an obturator prosthesis plays a pivotal role in restoring oral function, esthetics, and psychological well-being.

This clinical case report described the rehabilitation of a 62-year-old male patient with an acquired maxillary defect following inferior maxillectomy for post-COVID mucormycosis and highlighted the importance of timely prosthodontic rehabilitation in patients with post-mucormycosis maxillary defects. The integration of digital workflows with traditional principles offers superior outcomes, ensuring functional recovery, esthetic restoration, and psychosocial reintegration in affected individuals.

Keywords: Maxillary defect, Post-COVID mucormycosis, Obturator prosthesis, Maxillectomy, Prosthodontic rehabilitation, Digital dentistry.

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1. Introduction

Maxillary defects are among the most frequently encountered intraoral deformities, often presenting as communications with the maxillary sinus or nasopharynx.[1] These defects may be congenital, as in cleft palate, but are more commonly acquired, typically following surgical resection of oral and maxillofacial neoplasms.[2] Their extent can range from a small oroantral communication to extensive involvement of the hard and soft palate, alveolar ridge, and nasal floor.[3] Such defects compromise vital functions, resulting in hypernasal speech, nasal regurgitation of food and fluids, and impaired mastication, all of which greatly diminish the patient's quality of life.[4]

In recent years, mucormycosis has emerged as a major cause of acquired maxillary defects.[5] This rapidly progressing and often fatal fungal infection usually originates in the nasal cavity and paranasal sinuses. During the second wave of COVID-19, numerous cases were reported, particularly in patients who had received oxygen therapy and corticosteroid medication.[6] The fungus invades arterial walls, leading to thrombosis and tissue necrosis, and may extend into orbital and intracranial structures.[7] Clinically, it presents most commonly as rhinocerebral mucormycosis, but pulmonary, gastrointestinal, cutaneous, and disseminated forms are also observed.[8] Due to its aggressive nature, surgical resection is often necessary, resulting in maxillary discontinuities that require prosthetic rehabilitation.

The prosthesis most widely used for restoring such defects is the obturator, derived from the Latin word *obturare*, meaning "to stop up."[8] By separating the oral and nasal cavities, obturators restore essential functions such as

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speech, swallowing, and mastication.[9] In addition, they may provide support to orbital contents, restore midfacial contours, and improve facial esthetics.[10] Prosthodontic rehabilitation is generally carried out in three phases—surgical, interim, and definitive obturators—each corresponding to the stage of healing.[11] These prostheses remain indispensable in re-establishing function, comfort, and psychosocial well-being for patients with maxillary defects.

2. Case Report

2.1. Case history and examination

A 62-year-old male presented with complaints of difficulty in swallowing and impaired speech due to a persistent palatal defect for the past six months. His medical history revealed a COVID-19 infection one year earlier, for which he was managed with inhalational oxygen therapy for two weeks, intravenous corticosteroids, and antiviral medication (Remdesivir for 7 days). Four months later, he developed palatal pain and ulceration, accompanied by mild extraoral facial and orbital swelling.

The patient was a known diabetic and hypertensive, both under regular medical management. Based on clinical and laboratory investigations, a diagnosis of post-COVID rhinocerebral mucormycosis was established. He subsequently underwent an inferior maxillectomy (involving resection of the hard palate, maxillary teeth, and the lower portion of the maxilla) six months ago, followed by antifungal therapy with intravenous liposomal Amphotericin B administered daily for 14 days.

Extraoral examination revealed peri-orbital swelling and left eyelid apraxia, along with midfacial collapse, deficient upper lip support, a retrognathic profile, and a senile facial appearance secondary to complete tooth and maxillary ridge loss.

Intraoral examination showed a partially edentulous maxillary arch with complete loss of the alveolar ridge and palate on the right side, while the left side retained normal dentition. The mandibular arch was fully dentulous. The defect extended from the premaxillary region to the maxillary tuberosity, measuring approximately 8 × 9 cm in depth into the nasal cavity and 7 × 8 cm in width intraorally. The nasal septum, inferior conchae, and exposed bone were visible (**Figure 1**). A through-and-through oro-nasal communication was present, accompanied by restricted mouth opening.

Figure 1: Preoperatory intra-oral view

2.2. Treatment procedure

The treatment plan for this patient focused on the fabrication of a definitive obturator prosthesis to restore function and esthetics. Primary impressions of both maxillary and mandibular arches were made using irreversible hydrocolloid (alginate), and the casts were poured with Type III dental stone. The primary maxillary cast was surveyed, and undesirable undercuts were carefully blocked. Following the required mouth preparations, a custom tray was fabricated with a 1 mm spacer over the teeth and soft tissues, and borders were trimmed 1 mm short to achieve accurate functional extension. Border molding was performed to capture the functional depth and width of the sulci, and the final impression was recorded using light-body addition silicone. (**Figure 2**, **Figure 3**) This impression was poured in Type IV die stone to obtain the master cast, which was subsequently scanned digitally.

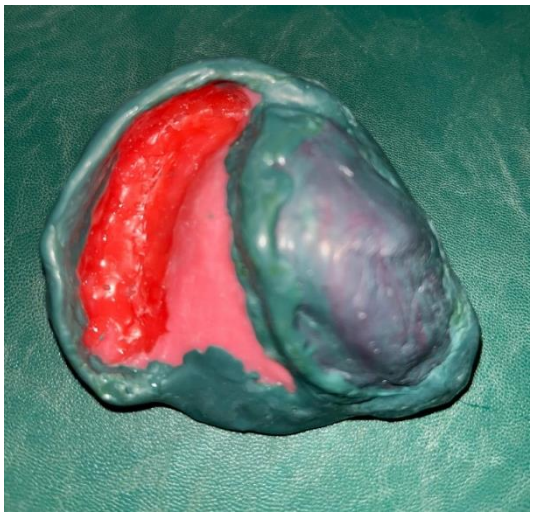

Figure 2: Border moulding

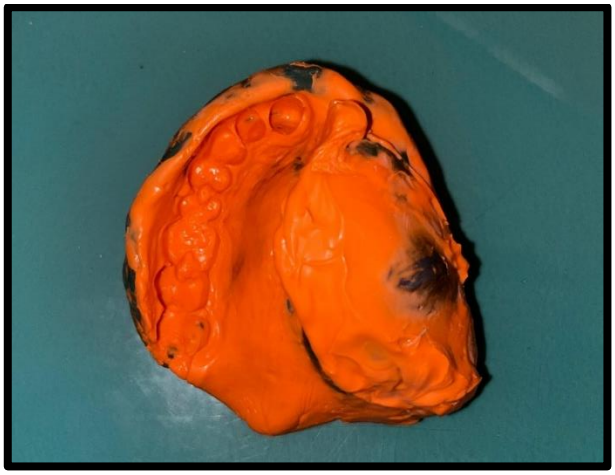

Figure 3: Final impression

The digital scan enabled virtual elimination of undercuts, after which a partial framework was designed using CAD software and fabricated through 3D-printing technology. (**Figure 4**) Jaw relation was recorded with modelling wax, and teeth were arranged to meet esthetic and functional requirements. A wax try-in was conducted to evaluate occlusion, phonetics, and esthetics, and necessary modifications were made before final processing. The definitive obturator was then processed with heat-cured acrylic resin. (**Figure 5**) To minimize weight and enhance patient comfort, a hollow design was created using the lost-salt technique.

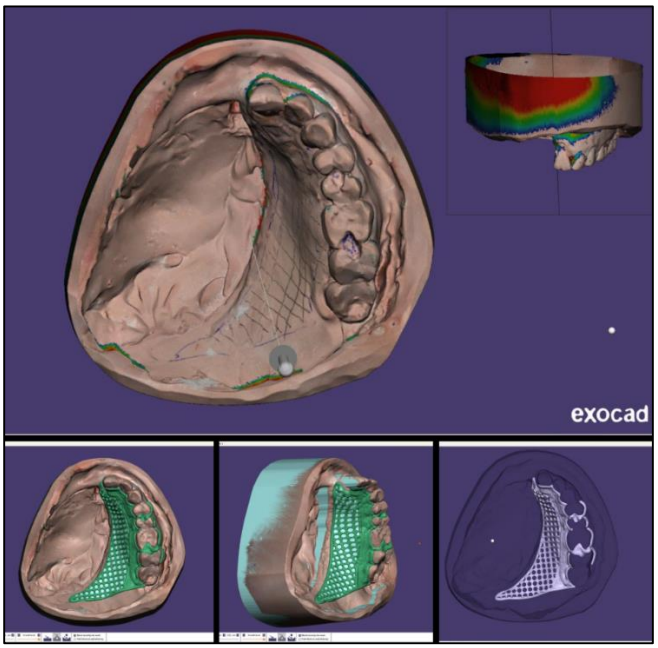

Figure 4: Digital designing of metal frame-work

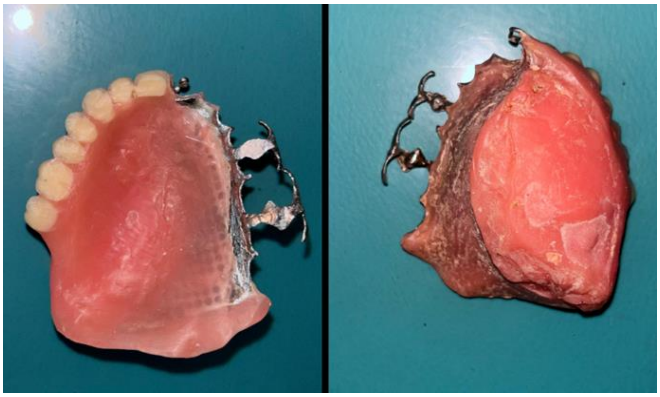

Figure 5: Final obturator

The finished and polished prosthesis was inserted intraorally and assessed for retention, stability, and comfort. (**Figure 6**) The patient was given instructions regarding oral hygiene maintenance, prosthesis cleaning, and the importance of regular follow-up visits for ongoing evaluation and care.

Figure 6: Intraoral view of final prosthesis

3. Discussion

Maxillary defects present significant functional and psychological challenges to patients due to their direct impact on mastication, deglutition, speech, and facial esthetics.[11] The presence of oroantral and oronasal communications results in nasal regurgitation and hypernasality, while loss of alveolar support further compromises mastication and facial profile.[12] These functional limitations, compounded by altered appearance, often lead to social withdrawal and reduced quality of life, underscoring the importance of timely rehabilitation.

In recent years, post-COVID mucormycosis has emerged as a major etiological factor for acquired maxillary

defects, particularly in immunocompromised individuals and those exposed to prolonged corticosteroid therapy or oxygen supplementation.[13] Rhinocerebral mucormycosis remains the most common clinical form and often necessitates aggressive surgical intervention to arrest disease progression.[14] However, such life-saving procedures result in extensive maxillary resections that leave patients severely debilitated. Hence, prosthodontic rehabilitation becomes an essential part of comprehensive care.

The obturator remains the prosthesis of choice for rehabilitation of maxillary defects.[15] It re-establishes the separation of the oral and nasal cavities, thereby improving swallowing, articulation, and overall oral function.[16] In addition, it aids in restoring midfacial contour and esthetics, which contributes to psychological well-being and social reintegration. Depending on the stage of healing, surgical, interim, and definitive obturators can be employed sequentially to provide continuous functional support.[17]

Advancements in digital technologies have further enhanced the precision and predictability of obturator fabrication. Digital scanning, CAD design, and 3D printing allow for accurate reproduction of anatomical details, elimination of undercuts, and fabrication of lightweight, prostheses. These innovations significantly reduce chairside time, improve patient comfort, and enhance prosthesis retention and stability compared to conventional methods.[18]

In our case the patient presented with nasal regurgitation, impaired speech, and midfacial collapse. A definitive hollow obturator prosthesis was fabricated using a combination of conventional techniques and advanced digital technologies, including CAD design and 3D printing, to enhance precision and reduce prosthesis weight. The prosthesis effectively re-established separation of the oral and nasal cavities, improved speech and swallowing, restored facial support, and enhanced the patient's overall comfort and confidence.

4. Conclusion

The rehabilitation of maxillary defects with obturators continues to play a vital role in multidisciplinary management. The integration of modern digital workflows with established prosthodontic principles provides promising outcomes, ensuring that patients regain function, esthetics, and psychosocial confidence after devastating maxillofacial resections.

5. Source of Funding

None.

6. Conflict of Interest

None.

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