

Rehabilitation of Post-COVID-19 Mucormycosis Surgical Defect Using an Unconventional Obturator with Precision Attachments: A Case Report

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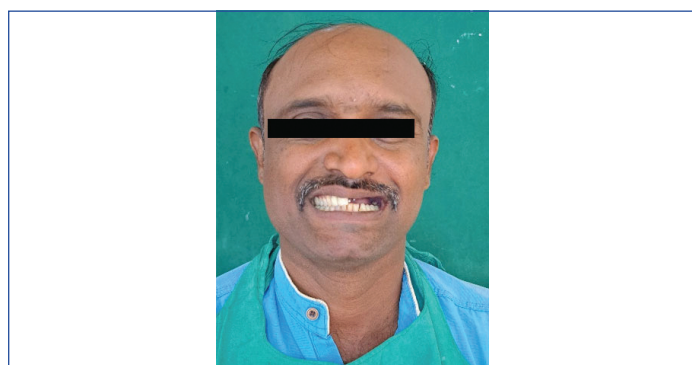
ABSTRACT

Mucormycosis, also known as black fungus, is a rare fungal disease caused by a filamentous fungus that primarily affects the nose, paranasal sinuses, and brain. A significant number of mucormycosis cases were reported during the COVID-19 pandemic, many of which required surgical intervention. Parts of orofacial structures such as the alveolar process of the maxilla, palate, contents of the orbit, and nasal cavity were often removed to prevent fatalities. The extent of hard tissue structures removed depended on the degree of involvement. Following surgical procedures, individuals were left with a variety of defects, ranging from lost alveolar processes and teeth to partial or total maxillectomy, and oronasal communication due to a missing palate. In such situations, Prosthodontists play a critical role in rehabilitating patients prosthetically. They analyse the defects in each case and design a prosthesis to replace the missing structures, aiding in the restoration of function and aesthetics. Hereby, the authors present a case report of 36-year-old-male with missing teeth in the upper left posterior and anterior regions and this clinical report aimed to describe an innovative aesthetic alternative to conventional cast partial obturators using OT attachments to achieve retention.

Keywords: Coronavirus disease-2019, Defect in sulcus, OT strategy

CASE REPORT

A 36-year-old male patient visited the Department of Prosthodontics, reporting a chief concern of missing teeth in the upper left posterior and anterior regions. The patient's history included a past infection with COVID-19, followed by black fungus, for which surgical removal was performed at a private hospital. There were no other notable medical issues in the patient's history. Despite an average physical constitution, the patient exhibited a psychologically cooperative attitude, with aesthetic considerations driving the need for a prosthesis. External examination revealed an unsupported left-side of the lip, resulting in facial asymmetry [Table/Fig-1]. The intraoral examination identified missing teeth and the surgically removed alveolar process in the entire second quadrant, accompanied by an oronasal communication in the left distobuccal sulcus [Table/Fig-2]. The mandibular teeth were fully intact.



[Table/Fig-1]: The preoperative image shows unsupported lip on the left-side and facial asymmetry.

Before taking preliminary impressions of the upper and lower arches using irreversible hydrocolloid (Zhermack Tropicalgin) and a stock metal tray, the patient received a recommendation for oral prophylaxis. To avoid the lodging of impression material in the nasal cavity and potential irritation, a gauze piece soaked in betadine solution was positioned in the defect [Table/Fig-3]. It was secured



[Table/Fig-2]: The intraoral image shows the defect in the second quadrant along with missing teeth. **[Table/Fig-3]:** Shows the impression made using irreversible hydrocolloid with gauze pack. (Images from left to right)

with a thread that extended outside the oral cavity. Following this precaution, impressions were made, and the diagnostic casts were subsequently poured using dental plaster and analysed.

A conventional cast partial obturator was initially considered for the specific case. However, the patient expressed concern about the visibility of metal clasps on the right central incisors.

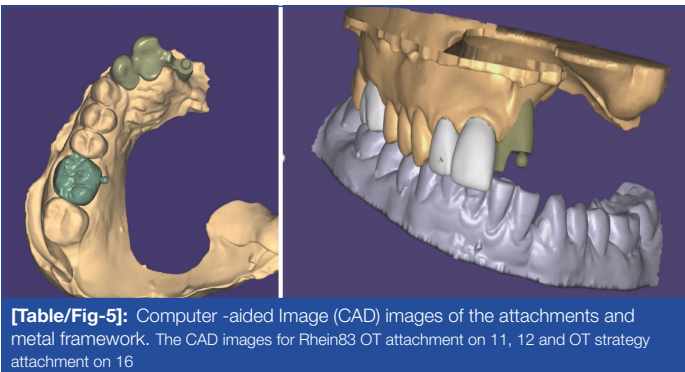
Consequently, an obturator featuring precision attachments was devised. Intraoral periapical radiographs were conducted for teeth 11, 12, and 16 to rule out any caries or periapical pathologies. The treatment plan involved the incorporation of two precision attachments: a Rhein83 OT box attachment on the mesial aspect of tooth 11 with splinted crowns on 11 and 12, and an OT Strategy attachment on the palatal aspect of tooth 16. To facilitate the attachment placement, teeth 11, 12, and 16 underwent preparations for full-coverage porcelain fused to metal crowns and porcelain facing crowns, respectively [Table/Fig-4]. Following adequate gingival retraction, a single-step impression was taken using medium phase elastomeric impression material (Aquasil Ultra+ Smart Wetting Impression material). Temporary crowns for the prepared teeth were crafted using auto-polymerising acrylic material and cemented using GC Freegenol™ temporary luting cement.

The impressions were cast, resulting in models that underwent scanning using a model scanner. Utilising ExoCad software, splinted



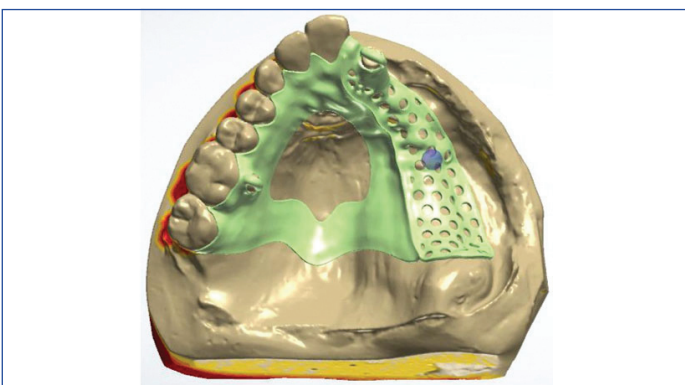
[Table/Fig-4]: Depicts the crown preparation and gingival retraction done in relation to tooth number 11, 12 to receive full coverage crown.

copings were designed for teeth 11 and 12 with attachments, while a single facing coping was designed for tooth 16 with an attachment [Table/Fig-5]. All coping and attachment designs were then 3D-printed in Co-Cr alloy (Cobalt-chromium) using the Direct Metal Laser Sintering (DMLS) technique.



[Table/Fig-5]: Computer-aided Image (CAD) images of the attachments and metal framework. The CAD images for Rhein83 OT attachment on 11, 12 and OT strategy attachment on 16

Following the 3D printing process, the metal copings and components were tried intraorally, and any high points were identified and subsequently eliminated. A pick-up impression was taken using a single-step medium phase elastomeric impression material (Aquasil Ultra+ Smart Wetting Impression material) on a custom tray. Shade selection was accomplished using the Vita Classic shade guide for porcelain layering. After the metal try-in procedure, the copings were repositioned on the casts, nylon female components were inserted, and the model underwent rescanning to facilitate the design of the palatal plate and the metal housing for accommodating the nylon female components of the attachments [Table/Fig-6]. Once again, the metal framework was 3D-printed in Co-Cr alloy.



[Table/Fig-6]: Depicts the CAD images of the attachments and the framework with the female housing for the retentive component.

Following the fabrication of crowns, they were inserted into the oral cavity, and a provisional jaw relation and centric bite were recorded. These records were then mounted on a semi-adjustable articulator, and the arrangement of teeth was performed. Acrylic denture teeth were utilised, incorporating an occlusal scheme characterised by minimal defective contacts to ensure the stability of the denture. It is emphasised that contacts should be present in centric occlusion but not in eccentric occlusion, and the patient is advised against masticating on the side of the defect [1].

A trial of the provisional denture was conducted to assess occlusion, aesthetics, and functionality. During the same session, the patient was instructed to drink water to evaluate the peripheral seal. If water passed into the nasal cavity, wax could be added to the defect area to achieve an appropriate peripheral seal. Subsequently, the trial denture underwent acrylic processing, and nylon female components were inserted into the metal housings of the metal framework [Table/Fig-7a,b,8].



[Table/Fig-7a,b]: Depicts the metal try-in done to confirm the fit of the coping and clearance for ceramic layering.



[Table/Fig-8]: Intraoral try-in of the framework to check for the fit of the prosthesis.

The final crowns were cemented using GC Gold Label luting and lining Glass Ionomer Cement (GIC), and the patient was scheduled for a follow-up after 24 hours. The definitive prosthesis was placed only after this period, as GIC requires a minimum of 24 hours for complete setting [2]. Occlusal adjustments were carried out during the same appointment. The patient received guidance on placing and removing the denture by applying finger pressure to support the crowns on 11 and 12 [Table/Fig-9,10 a,b]. Additionally, the patient was educated on maintaining oral and denture hygiene and advised to attend regular check-ups [Table/Fig-11].



[Table/Fig-9]: Final prosthesis with female housing.



[Table/Fig-10a,b]: Intraoral images of the final prosthesis.

DISCUSSION

The predominant type of mucormycosis associated with COVID-19 was rhino-orbital-cerebral, followed by the pulmonary type.



[Table/Fig-11]: Depicts postoperative smile. After prosthesis insertion adequate lip support and satisfactory aesthetics were achieved.

As of the end of July 2021, the reported case count had reached 40,000. Treatment strategies involved a combination of antifungal drugs and surgical debridement, encompassing procedures such as orbital exenteration, turbinectomy, orbital wall resection, and palatal resection. Post-extensive surgical debridement, clinical observations revealed defects with communication to the nasopharynx or oropharynx [3]. Achieving optimal aesthetics, function, and occlusion is crucial for a prosthodontist when rehabilitating patients of this nature [4]. A perioral seal is necessary for deglutition, which is hampered when there is communication present between the oral cavity and surrounding cavity. In the absence of this seal, food can get pushed out of the oral cavity, leading to nasal regurgitation. Apart from this, there will be difficulty with mastication and speech [5]. A careful examination of the defect and the existing hard tissue structure is necessary to plan a treatment that would help fabricate a prosthesis that is retentive, stable, and restores function.

During the fabrication of a cast partial obturator, the visibility of metal clasps can compromise aesthetics, particularly in the anterior region [6]. An alternative to traditional clasps includes aesthetic options such as Mesial Groove Rest (MGR) clasps [7] or Round Rest or Distal Depression (RRDD) clasps [8]. However, these clasps still entail some degree of metal display. To eliminate metal visibility entirely, precision attachments can be employed for retention. Two commonly used low-profile attachments by Rhein83, namely OT strategy and OT equator, are prevalent in present context. The OT equator, with a diameter of 4.4 mm and a height of only 2.1 mm [9], must be placed perpendicular to the path of prosthesis insertion. In present specific case, this positioning was impractical due to potential interference with the palate and tongue space. On the other hand, the OT strategy, a spherical attachment with a flat head of 1.8 mm diameter, can be placed parallel to the path of prosthesis insertion.

Achieving optimal occlusion for obturators designed for unilateral defects poses a challenging task due to the potential for occlusally directed forces that can be destructive. The absence of underlying bone support in the denture base, once the teeth arrangement is complete, renders it unstable. As a result, individuals with acquired maxillary defects should avoid chewing over the defect area. To minimise prosthesis movement, it is crucial to effectively distribute occlusal forces in both centric and

eccentric positions. In edentulous patients, non-anatomic teeth are often preferred, and there may be a need to accept an occlusion that is not bilaterally balanced in eccentric occluding jaw positions [1].

Obturators retained using precision attachments exhibit satisfactory patient outcomes, offering advantages such as enhanced aesthetics and retention while minimising rotational forces and non-axial loading on abutments [10]. Although the female nylon components of these attachments may experience wear over approximately one year due to multiple insertion and removal cycles, they can be easily replaced at a nominal cost, restoring the prosthesis to its original effectiveness.

Moreover, the utilisation of 3D-printed frameworks instead of conventional casted frameworks in present case provides notable benefits. Extensive research indicates that frameworks produced through rapid prototyping techniques offer superior fit and accuracy, with reduced gaps between the framework and cast, and are lighter in weight [11]. Ultimately, the rehabilitation of the patient using obturators with precision attachments proved instrumental in delivering adequate retention, aesthetics, and overall patient satisfaction.

CONCLUSION(S)

Obturators retained using precision attachments exhibit satisfactory patient outcomes, offering advantages such as enhanced aesthetics and retention while minimising rotational forces and non-axial loading on abutments. The utilisation of 3D-printed frameworks instead of conventional casted frameworks in present case is an innovative aesthetic alternative to conventional cast partial obturators using OT attachments to achieve retention.

REFERENCES

- [1] Srivastava A, Hazra R, Dinesh Kumar DK, Khattak A. Occlusion in obturators: A literature review. *IP Annals of Prosthodontics and Restorative Dentistry*. 2021;7(1):12-15.
- [2] Nicholson JW. Maturation processes in glass-ionomer dental cements. *Acta Biomater Odontol Scand*. 2018;4(1):63-71.
- [3] Anand T, Mukherjee A, Satija A, Velamuri PS, Singh KhJ, Das M, et al. A case control investigation of COVID-19 associated mucormycosis in India. *BMC Infect Dis*. 2022;22(1):856.
- [4] Ali IE, Chugh A, Cheewin T, Hattori M, Sumita YI. The rising challenge of mucormycosis for maxillofacial prosthodontists in the Covid-19 pandemic: A literature review. *J Prosthodont Res*. 2022;66(3):JPR_D_21_00264.
- [5] Goiato MC, dos Santos DM, Moreno A, Santiago JF, Haddad MF, Pesqueira AA, et al. Prosthetic Treatments for Patients With Oronasal Communication. *J Craniofac Surg*. 2011;22(4):1445-47.
- [6] Shetty P, Chowdhary R, Shetty P. A maxillofacial prosthetic obturator using precision attachments. *Indian J Dent Res*. 2020;31(5):799-802. 2020;31(5):799.
- [7] McCartney JW. The MGR clasp: An esthetic extracoronal retainer for maxillary canines. *J Prosthet Dent*. 1981;46(5):490-93.
- [8] Tran C, LaBarre E, Landesman HM. A removable partial denture using an esthetically designed round-rest distal clasp on maxillary anterior abutment teeth: A clinical report. *J Prosthet Dent*. 2009;102(5):286-89.
- [9] Ghiaz K, Shaik S, John P, Kumar A, Vijayakumar N. Precision attachment boon to prosthodontists. *J Pharm Bioallied Sci*. 2022;14(5):1030.
- [10] Rathee M, Divakar S, Jain P, Singh S, Chahal S. Prosthetic rehabilitation of mucormycosis patients using DMDS fabricated cast partial denture with semi-precision attachments- A case series. *Spec Care Dentist*. 2024;44(2):478-85.
- [11] Ahmed N, Abbasi MS, Haider S, Ahmed N, Habib SR, Altamash S, et al. Fit accuracy of removable partial denture frameworks fabricated with CAD/CAM, rapid prototyping, and conventional techniques: A systematic review. *Biomed Res Int*. 2021;2021:3194433.

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