

# Post-maxillectomy rehabilitation of a rhino-cerebral mucormycosis case with a patient-specific eposteal implant-supported removable hollow bulb obturator: A case report.

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## ABSTRACT

Rhino-cerebral mucormycosis is a rare and rapidly progressing angio-invasive infection affecting immunocompromised individuals, with an extensive surgical resection of the affected bone resulting in a huge defect. Rehabilitation of such surgical defects requires bone augmentation and extended rehabilitation time, with donor site morbidity and inconsistent graft resorption rates. Patient-specific eposteal implants (PSEI) are an alternative approach that can circumvent the shortcomings mentioned above with accuracy and reduced operating time. Quad-zygoma implants-supported prosthesis and removable obturators with cast-partial framework are the other rehabilitation methods in the literature. PSEIs shall be the choice where inadequate zygomatic bone restricts the endosteal zygomatic implant placements. The presented patient suffered from speech disarticulation, dysphagia, food and fluid reflux, and hypernasal twang. The present case report describes the prosthetic rehabilitation of a post-rhino-cerebral mucormycotic surgical defect with a PSEI-supported removable hollow bulb obturator with a 12-month post-prosthetic follow-up.

## Keywords

Maxillectomy, mucormycosis, obturator, patient-specific eposteal implants, rehabilitation.

## INTRODUCTION

Mucormycosis is a rapidly invasive fungal infection that primarily affects immunocompromised individuals from the second wave of the COVID-19 pandemic, with 77.6% of cases being of the rhinocerebral type.<sup>[1]</sup> The surgical intervention for the advanced stage of this debilitating condition necessitates a wide excision of necrotic osseous tissue, frequently requiring either a total or partial maxillectomy with or without orbital exenteration. Rehabilitating the maxillectomy site with traditional bone augmentation with autologous bone grafts is fraught with donor site morbidity, inconsistent rates of graft resorption, extended

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rehabilitation time, financial strain on patients, and supplementary surgical interventions. Patient-specific eposteal implants (PSEI) are subperiosteally placed, rigid multi-vector bone-anchored frameworks fused to implants above the bone surface. PSEIs represent an innovative approach allowing for high accuracy, pristine adaptation over bone, and less operating time.<sup>[2]</sup> The present case report aims to describe a distinct and successful functional rehabilitation of a post-rhino-cerebral mucormycotic surgical defect with a PSEI-supported removable hollow bulb obturator.

### Case report

A 63-year-old South Indian male with rhino-cerebral mucormycosis underwent an infrastructural maxillectomy two years ago in a private medical center and hospital, Coimbatore, resulting in a significant surgical defect. The patient experienced speech disarticulation, dysphagia, nasal regurgitation of food and fluids, and hypernasal twang. The defect exposed the nasal cavity roof, revealing mucosa covering the ethmoid and superior concha plates. The vomer, ostiomeatal complex, and nasal septal cartilage were absent. The patient's midface was depressed, retruded, with a flattened nose and short upper lip [Figure 1A and B]. The defect was classified as Brown's Class 2C. The mandibular arch was dentulous with generalised attrition, anti-Monson's curve (premolars and molars), and supra-erupted incisors. Cone beam computed tomography (CBCT; NewTom GiANOHR, Italy) confirmed the surgical defect [Figure 2A and B]. The bone in the zygoma was inadequate for the quad-zygoma implants approach. Virtual sectional PSEIs with two implant cylinders for implant fusion on each side were designed with a unique nasal bumper at the midline (RealGUIDE 5.4 version, ZimVie Inc. U.S.A) and 2 mm diameter holes to accommodate titanium anchorage screws [Figure 3A and B]. Matte-finished grade-IV titanium frameworks were printed, and four 6-mm implant fixtures (4.2 mm diameter: Quickdent Dental Implant System, Quickdent Devices Private Limited, Mumbai, India) were fused in the framework's implant cylinders.

After obtaining the patient's consent, under general anaesthesia, a full-thickness mucoperiosteal flap was elevated following a bilateral Dieffenbach's modification of the Weber-Ferguson incision to

expose the zygomatic prominence, zygomatic arch, and residual naso-maxillary complex. The PSEIs were fixed to the naso-zygoma using twenty-three 2 mm diameter titanium anchorage screws [Figure 4]. The muscles and skin were sutured in layers. The mucosa was sutured over and around the implants after buccal fat pad herniation. Postoperatively, Ryle's tube was placed for a week, and medications were prescribed. The patient was periodically recalled to monitor post-operative complications such as infections, wound dehiscence, and extra-oral PSEI framework exposure. Soft tissue dehiscence around the implant cylinders was not evident after 4 months postoperatively [Figure 5]. The implants were loaded following the conventional loading protocol for the osseointegration of the anchorage screws.

After a 4-month postoperative period, an impression was made using a custom-splinted open-tray technique with vinyl polysiloxane material [Figure 6A and B]. The complete trial jig seating on the implants was confirmed with orthopantomogram imaging. Four ball abutments (1 mm) were attached on the implant analogs in the master cast and maxilla-mandibular relationships with wax rims were transferred to a semi-adjustable articulator. The mandibular teeth were occlusally adjusted with a custom-made 4-inch radius occlusal plane resin template.<sup>[3]</sup> A bilaterally balanced trial prosthesis with monoplane acrylic teeth was evaluated for aesthetics and phonetics in the patient's mouth. A closed hollow bulb was fabricated on the model with auto-polymerizing resin by the lost-salt technique. The final prosthesis was processed along with metal housings secured on the ball abutments using heat-polymerizing acrylic denture resin (Dental Products of India - DPI, Mumbai, India) with the hollow bulb, trimmed, and polished [Figure 7A and B]. The prosthesis was lined with soft silicone reline material (Molosil, DETAX GmbH & Co., Germany) and fastened to the implants. The patient was instructed to perform all the possible functional movements to obtain a hermetic seal at the borders to prevent food encroachment and accumulation into the defect. The prosthesis restored mastication and reduced hypernasal speech and disarticulation. Post-rehabilitation oral hygiene instructions, diet counseling, speech exercises, and follow-up review visits were elaborated to the patient. In a 12-month post-prosthetic review, the patient was comfortable with the existing prosthesis [Figure 8A and B].



## DISCUSSION

In the present reported case, the surgical intervention for the rhino-cerebral mucormycosis resulted in the unavailability of any retentive characteristics in the patient's oral cavity with a huge palatal defect and the absence of the labio-buccal vestibule, contributing to a lack of retention of the prosthesis. Therefore, a removable cast partial framework-retained hollow bulb obturator was deemed unfeasible due to insufficient intraoral retentive structures, leading to the decision to employ PSEI for the patient's rehabilitation. A matte-finish on the PSEI aided and facilitated the tissue attachment and minimised tissue movement over the framework, thereby preventing tissue dehiscence. The previous case reports hardly described the surface topography of the framework. A bilateral split PSEI framework demonstrated reduced stress and displacement metrics relative to monoblock framework metrics, suggesting a potential superiority in clinical applications.<sup>[4]</sup> In another case reported by Saxena *et al.*<sup>[5]</sup> monoblock PSEI design in infrastructural maxillectomy exhibited significant stress along the thin border of apertura piriformis; however, within allowable limits. Therefore, irrespective of the type of maxillectomy, the monoblock design expresses high stress on the bone. Therefore, in the above-presented case, the bilateral split PSEI framework was employed.

Bilateral balanced occlusion with monoplane teeth was established after selectively grinding mandibular teeth to eliminate lateral forces on the PSEI. Though it is a removable prosthesis, the occlusion was bilaterally balanced to distribute the mandibular natural dentition forces to all four fused implants uniformly to prevent anticipatory implant disjunction from the cylinders due to stress concentration, which could be a result of group function. Previous cases without mid-facial retrusion and depressed nose used removable attachment-retained prostheses without hollow bulbs alongside monoblock PSEIs, but did not address occlusal schemes or mandibular arch orientation.<sup>[5,6]</sup> The current case, utilizing a PSEI with a nasal bumper and a removable hollow bulb prosthesis, differs from past reports. Nasal prominence could have been regained through the acrylic portion of the prosthesis; however, it would apply an undue constant pressure over the PSEI. Therefore, the nasal bumper at the midline was incorporated in the PSEI framework to achieve a spectacular nasal prominence. PSEIs offer

optimal stability and facilitate functional recovery after maxillectomy due to mucormycosis, with success rates similar to traditional quad zygomatic implants.<sup>[1,6-8]</sup>

## CONCLUSION

The PSEI-removable hollow bulb prosthesis with the unique nasal bumper successfully rehabilitated the infrastructural maxillectomy patient with substantial surgical defect in terms of aesthetics, mastication, and phonetics. PSEIs shall be an alternative approach to maxillary reconstruction compared to conventional grafting and quad-zygoma approaches.

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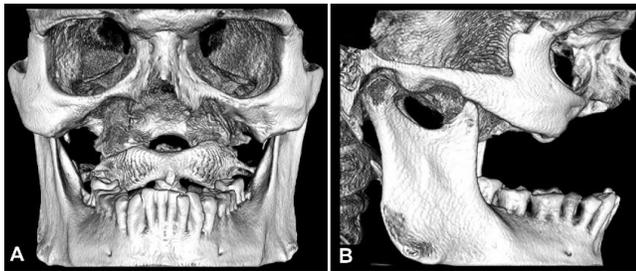
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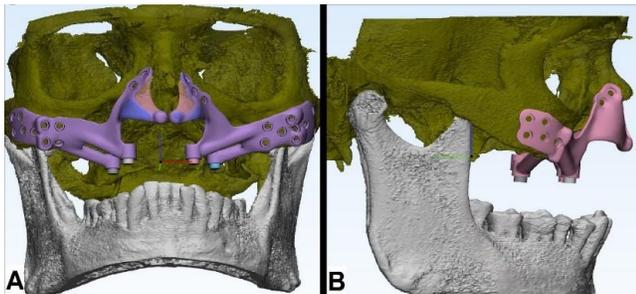
**Figure legends:**



**Figure 1: Clinical presentation of the patient. (A) Frontal view, (B) Sagittal view.**



**Figure 2: Pre-operative CBCT images (A) Frontal view, (B) Sagittal view.**



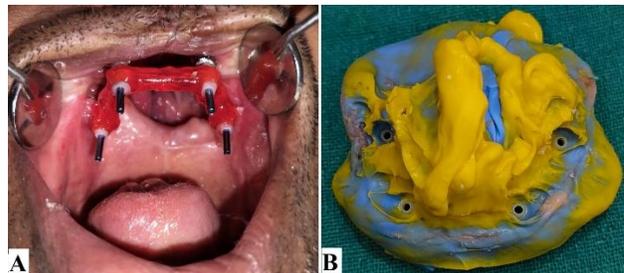
**Figure 3: PSEI virtual design (A) Frontal view, (B) Sagittal view.**



**Figure 4: Surgically fixed PSEIs on the naso-zygomatic bones.**



**Figure 5: Intra-oral post-operative healing.**



**Figure 6: (A) Splinted Impression copings, (B) Impression of the surgical defect.**



**Figure 7: (A) Ball abutments positioned on the PSEI framework, (B) Prosthesis with hollow-bulb obturator.**



**Figure 8: Post-prosthetic presentation of the patient.  
(A) Frontal view, (B) Sagittal view.**