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Case Report

Hollow ocular prosthesis for rhinocerebral mucormycosis: A post-COVID-19 rehabilitation

Prakash Pugazhendhi[1], **Anil Kumar Gujjari**[1]*, **Raghavendraswamy KN**[1]

[1]*Dept. of Prosthodontia, JSS Dental College and Hospital, Mysore, Karnataka, India*

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ABSTRACT

Introduction: Mucormycosis is an uncommon but significant developing opportunistic fungal co-infection (COVID-19) that is frequently linked with substantial morbidities. Rhino-orbit-cerebral mucormycosis (ROCM) is the severe clinical type, appearing in debilitated individuals in association with sinus or paranasal sinus involvement because of the proclivity for contiguous spread. Prompt care of Rhino-orbit-cerebral mucormycosis focuses on therapeutic medications such as antifungals, antibiotics, and vigorous surgical debridement. Post-operative orbital defect restoration can be accomplished by utilising either surgical reconstructive procedures or a prosthesis.

Case Description: The design of an ocular prosthesis to rehabilitate the patient based on the underlying clinical condition, prosthetic material, and prosthetic retention. The current report discusses the rehabilitation of an exenterated orbit with a cranio-naso-orbital fistula defect and contracted eyelid by a hollow ocular prosthesis with a magnet-assisted handle. The objective was to preserve the biological health of the underlying postsurgical tissue, prosthetic design and optimal aesthetics.

1. Introduction

Mucormycosis is a rare opportunistic fungal infection in the maxillofacial region. Rhino-orbit-cerebral mucormycosis (ROCM) is one of the most devasting co-infections with (COVID 19), which is the combined effect of pneumonia, immune modulation by therapies with steroids, broad-spectrum antibiotics, and a predilection for superinfections.[1] ROCM is invasive and may originate from the sinonasal mucosa and further spread into the orbit and brain. Orbital invasion from the ethmoidal air sinus through lamina papyracea is a more common route. Vascular thrombosis and tissue necrosis are frequently induced by widespread and disastrous angioinvasion.[2]

ROCM requires a multidisciplinary approach for optimal therapy. It includes appropriate antifungal therapy and the surgical debridement of necrotic tissue. Postsurgical rehabilitation is either done by surgical reconstruction or prosthesis.[3] The advantages of prosthetic treatment include a lifelike appearance, minimal surgical intervention, and avoiding the recurrence of pathology.

The goal of this report is to maintain the biological health of defects that have been surgically resected by isolating the cranio-naso-orbital fistula, attaining adequate retention of the prosthesis, and achieving aesthetic outcomes.

2. Case Description

A male patient in his 30s was referred to the Department of Prosthodontics with the chief complaint of loss of orbital contents (left) due to orbital exenteration.

* *Corresponding author*.
E-mail address: anilgujjari@yahoo.co.in (A. K. Gujjari).

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2.1. Investigation

Two years ago, the patient was diagnosed with COVID-19. Post-COVID-19, the patient reported pain on the right side near the root of the nose and an inability to open the eye for a week. The diagnosis of mucormycosis was confirmed by microbiological investigation, and magnetic resonance imaging showed a heterogeneously enhancing lesion along the outer aspect of the alveolar process as well as fungal sinusitis in the right frontal, ethmoid, and right and adjacent left maxillary sinuses. An ophthalmologic examination diagnosed endophthalmitis.

2.2. Treatment

Multidisciplinary interventions include the administration of amphotericin B with regular monitoring of the glycemic index. The surgical exenteration of the right orbital content along with the lateral border of the orbital bone and frontal bone, ethmoidal bone, and upper part of the maxillary sinuses. After surgical debridement, the patient lost his right vision and had difficulties leading a social life. Along with the loss of vision, the patient presented with a cranio-naso-orbital fistula, and the defect was not closed with the conformer, which led to the contraction of the palpebra during the healing period. One year later, the patient presented with a contracted eyelid for the ocular prosthesis (Figure 1A).

2.3. Fabrication of hollow ocular prosthesis

The defect formed a cranio-naso-orbital fistula since it expanded medially into the ethmoid sinus and was categorised as orbital exenteration (Type IV A) (Figure 1B).[4]

Figure 1: A: Post-exenterated orbital socket with contracted eyelid; **B**: Cranio-naso-orbital fistula in an exenterated orbital socket.

The prosthetic design was challenging due to inadequate bone support for retention and the cranio-naso-orbital fistula. The treatment plan was designed to treat the patient using an ocular prosthesis with a magnet retrieval handle.

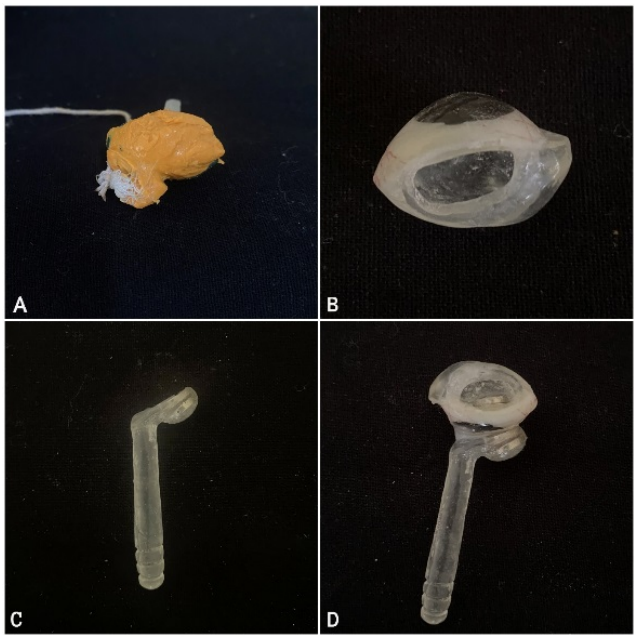

Figure 2: A: Final impression made using a custom-made tray; **B:** Ocular prosthesis made hollow using the lost salt technique; **C**: Magnet-assisted handle for retrieval of ocular prosthesis; **D:** Hollow ocular prosthesis with magnet-assisted handle;

Figure 3: Hollow ocular prosthesis in an exenterated orbital socket

The retention of the prosthesis is solely based on the remaining bony undercut and the contracture of the eyelid.

Prosthesis fabrication starts with the primary impression, and a custom tray was fabricated. The final impression was made using light body elastomeric impression material (addition silicone) (Figure 2A). The undercut present in the superior aspect of the defect was retained to achieve mechanical retention of the prosthesis with a favourable depth of 5 mm. This undercut gives a favourable path of insertion with minimal tissue injury.

Stock eye shell matching was done using the patient's contralateral eye. Wax-up was done on the definitive cast with stock eye shell – heat polymethyl methacrylate positioned over the wax-up. Iris positioning was done using simple and effective anatomical landmarks. After iris positioning with a preformed stock eye shell, the wax was contoured based on available space in the anophthalmic socket.

2.4. Hollow ocular prosthesis

The prosthesis was made hollow using the lost salt technique (Figure 2B).[5] The challenging part of the rehabilitation lies in the insertion and removal, starting from the wax trial up to the finished prosthesis. The reason for difficulties is the cranio-naso-orbital fistula, because of which the prosthesis might slip into the fistula during the insertion and retrieval of the prosthesis. The patient also experienced discomfort during the instructions for the insertion and retrieval of the prosthesis.

2.5. Fabrication of magnet-assisted handle

For ease of retrieval, a pair of magnets (Round neodymium-boron-ferrous magnets - 1.5 mm x 3 mm) were used. The customised handle was carved in modelling wax and later processed using heat-cured acrylic (PMMA) (Figure 2C). It has unlike poles of a magnet on one end, and another magnet is arranged in the lateral part of the hollow ocular prosthesis, facing under the stock eye shell (Figure 2D). Final characterization was done using extrinsic stain. A hollow ocular eye prosthesis with a magnet-assisted handle was delivered to the patient, and post-insertion instructions were given (Video) (Figure 3).

A follow-up visit was conducted every week for one month, and then every three months. During the follow-up visit, the soft tissue condition, the retention of the ocular prosthesis, and the magnet-assisted retrieval handle were evaluated. In order to improve the ocular prosthesis' aesthetics and retention, the prosthesis will be relined in a series of visits to lessen the scar tissue contracture.[6]

3. Discussion

Rhinocerebral mucormycosis can occur in any age group and generally occurs in patients with systemic predisposing factors such as diabetes mellitus.[7] In this current situation, COVID-19 also joined the list of predisposition factors, and it developed lymphopenia, which may increase the risk of opportunistic infections, which include mucormycosis.[8] In rhinocerebral mucormycosis, the infection begins from the PNS to the retro-orbital region or through lacrimal, angular, and ethmoid vessels through hemogenous spread, where the fungus can disseminate into the brain and lungs. Orbital mucormycosis (ROCM) provokes cranial nerve (II, III, IV) paresis, proptosis, papillary dilation, visual impartment, and eventually blindness.[9]

The most appropriate treatment options are surgical debridement, antifungal drugs, and hyperbaric oxygen therapy. During the surgical and healing phases, the conformer and provisional ocular prosthesis were not included, which led to a shrunken orbital space and scar tissue contracture. This negligence leads to compromising the aesthetic appearance and adequate eyelid support for future prostheses.[10]

3.1. Hollow ocular prosthesis – Magnet-assisted handle

The prosthesis was designed to be hollow to reduce weight and large enough to occupy the noticeable residual enophthalmos socket.[11] The prosthesis is made hollow using a lost salt technique,[5] which is the simplest way to reduce the weight and facilitate attaching magnets inside the prosthesis. Soft tissue undercuts and contractured eye lids aid with prosthesis retention.

Magnets have prompted significant attention in dentistry. Magnets were used for the retrieval of the prosthesis to overcome the complications of the cranio-naso-orbital fistula. This is a highly effective and inexpensive prosthesis fabricated using routinely available materials and magnet retrieval aids to rehabilitate complex clinical conditions.

4. Conclusion

1. The primary goal is to isolate the cranio-naso-orbital fistula from the external environment before attempting aesthetic restoration for infection control.
2. Even though the defect is rehabilitated with the ocular prosthesis, the prosthesis still needs relining for proper aesthetic restoration.

5. List of abbreviations

COVID-19 (Corona Virus Disease 2019 caused by SARS-CoV-2), PMMA (Polymethyl methacrylate), ROCM (Rhino-orbit-cerebral mucormycosis.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Author biography

Prakash Pugazhendhi, Post Graduate https://orcid.org/0000-0002-6325-2331

Anil Kumar Gujjari, Professor https://orcid.org/0000-0001-9696-4397

Raghavendraswamy KN, Professor & HOD https://orcid.org/0000-0001-9037-3094

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