Case Report

Fabrication of orbital prosthesis by two different methods in patients with post-COVID-19 rhino-orbital maxillary mucormycosis: A case series

ABSTRACT

Neoplasms, congenital disorders, fungal infections, and traumatic injuries are the predominant causes of orbital defects. Various retentive mechanisms such as application of adhesive, utilization of mechanical undercuts, and implant-supported attachments are generally used in the maxillofacial prosthesis. In the orbital region, the result of magnet-retained attachments is favorable compared with other mechanisms. Different advantages of the magnet-retained prosthesis are less manual dexterity needed during insertion or removal and better maintenance of hygiene. The skin–implant interface and thick tissues in the maxillofacial region are the critically important points that should be given importance during the planning and placement of implants. Ideally, implant sites for orbital prosthesis are the lateral, infra-, and supraorbital rims of the orbital region. The following case series describes two different methods to rehabilitate patients with an exenterated eye due to mucormycosis by individually designed implant with magnetic attachment and mechanical undercut-retained orbital prosthesis.

Keywords: Exenteration, magnetic attachment, mucormycosis, orbital prosthesis

INTRODUCTION

Rehabilitation of maxillofacial defects is one of the critical and important aspects of the working domain of a prosthodontist. Prosthetic rehabilitation of these defects improves the appearance and form of that area.[1,2] It also boosts the confidence of the patient, which increases active participation in social activities. The increased number of mucormycosis cases due to immunosuppression in recent times due to coronavirus disease 2019 (COVID-19) is one of the major causes of the increase in patients with maxillofacial defects. Invasive surgical procedure in the maxillofacial region due to this fungal disease caused a major postoperative setback for the patients related to form, function, and esthetics. The maxillofacial prosthesis can be retained by various mechanisms such as application of adhesive, utilization of mechanical undercuts, and implant-supported attachment-retained mechanism. Adhesive-retained restorations have various disadvantages such as deterioration of prosthetic margin, allergy of various patients due to adhesive, and application of adhesive and removal for multiple times.[3] Implant-supported restorations have gained huge importance in recent times to act as a retentive source in maxillofacial defects. The first placement of implants for maxillofacial prosthesis was done in 1977 for a bone-anchored hearing aid and a bone-anchored auricular prosthesis in 1979, at the University of Gothenburg.[4] Orbital defects can be caused by congenital

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disorders, traumatic injuries, malignancies, and infections. The skin–implant interface and thick tissues in the maxillofacial region are critically important points that should be given importance during the planning and placement of implants. Ideally, implant sites for rehabilitation of orbital defects are the lateral, infra-, and supraorbital rims of the orbital region. All three sites sometimes cannot be utilized due to inadequate quality and quantity of bone. The medial orbital rim is generally avoided to place implants because of the thin cortex and important anatomical structures.[5,6] The following case series describes two different methods to rehabilitate patients with an exenterated eye due to mucormycosis with individually designed implant with magnetic attachment and mechanical undercut-retained orbital prosthesis.

CASE REPORTS

Case 1

A 36-year-old male patient came to the department with the chief complaint of poor looks due to a missing left eye. On examination, there were defects in the orbital region on the left side. The patient had undergone exenteration of the left orbital contents due to mucormycosis [Figure 1a].

A diagnostic impression of the orbital defect was made with irreversible hydrocolloid and strips of plaster-impregnated gauge. Impression was poured with type III gypsum product.

Due to the inflammatory potential of adhesive and the risk of opportunistic infection around adhesive-retained margins, it was planned to rehabilitate with the implant-supported prosthesis in this case. Moreover, due to hot and humid tropical conditions in our country adhesives turn ineffective. A radiographic template was fabricated on the diagnostic cast with self-cure acrylic and radiopaque markers in predetermined implant positions in the supraorbital rim, lateral orbital rim, and floor of the orbit [Figure 1b]. A computed tomography (CT) scan was performed to evaluate the available bone and soft tissue thickness in the region.

According to the available bone height and tissue thickness of around 8–9 mm, customized implants were made in the departmental workshop. Two 4.2 mm diameter and 8 mm length (threaded 8 mm) and two 3.5 mm diameter and 6 mm length (threaded 6 mm) implants were fabricated with a single unit design and an abutment height of 8 mm.

The screw-shaped implants were made up of commercially pure (CP) titanium with V-shaped threads, a pitch of 0.9 mm, and a thread depth of 0.75 mm. Above the threaded portion, 7 mm of plain implant body was used for transition through soft tissue. The surface of the implant was thermally oxidized and nanocrystallized.

Surgery was performed under local anesthesia in the oral surgery department, and four implants were placed in the supraorbital, lateral orbital, and infra-orbital regions. Good primary stability with an insertion torque of 40 to 45 N-cm was achieved in all the implants [Figure 1c].

The peri-implant skin showed a healthy appearance and minor inflammation after a two-week healing period. Abutments were prepared, and the impression was taken with light body addition of silicone backed with plaster-impregnated gauge pieces.

The model was poured with type IV gypsum product, a bar was fabricated with inlay wax, and several depressions were created on the pattern to give space for magnets. Casting was done, and the passivity of the fit was checked [Figure 2a].

Neodymium magnets were attached to the bar with metal primer and adhesive resin cement. The magnet-incorporated bar was then cemented on the abutments. The finish line of the abutments was given 2 mm superior to the abutment skin interface to prevent irritation from residual cement. Another impression was made of the region after the cementation of bar with irreversible hydrocolloid and plaster-soaked gauge pieces. A wax pattern was made on the final model, and a prefabricated eye shell was customized in accordance with the contralateral eye.

A wax pattern trial was conducted on the patient, and a customized eye shell was placed in the pattern in a

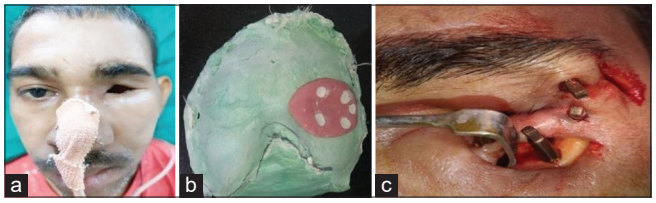

Figure 1: (a) Preoperative view, (b) radiographic template fabricated on the diagnostic cast with self-cure acrylic and radiopaque markers, (c) three 3.6*8 mm single-piece implants with customized abutment length of 12 mm

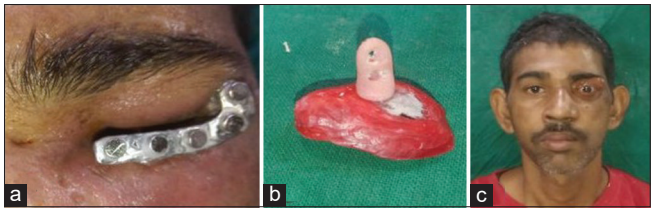

Figure 2: (a) Casted bar magnet assembly with a passive fit, (b) flasking of orbital prosthesis with the anterior indexing method, (c) final prosthesis

symmetrical position according to the contralateral eye. Another four pieces of magnets were placed over-the-counter magnets on the bar, and pickup of magnets was done with acrylic resin. The wax pattern was modified to place the acrylic substructure containing magnets in the proper region.

Flasking of the orbital prosthesis was done with the anterior indexing method [Figure 2b], and before packing of room-temperature-vulcanizing (RTV) silicone primer was applied on the eye shell and acrylic substructure to bond with silicone. Deflasking was done after the completion of curing of silicone, and finishing was done. Intrinsic stains were applied during the mixing of silicone, and external stains with sealant were applied after finishing and matching the patient's skin color [Figure 2c].

Case 2

A 67-year-old male patient came to the department with a similar chief complaint and presented with missing orbital contents and left maxilla. A large orbital defect was present on the left side with a sufficient bony undercut to aid in the retention of the orbital prosthesis [Figure 3a]. The treatment aim was to reconstruct the orbital defect using a conventional method using medical-grade silicone with mechanical undercut in the left orbital region.

The diagnostic impression of the orbital defect was made with alginate and gauze pieces dipped in plaster of Paris [Figure 3b]. The impression was poured with dental stone [Figure 3c].

A wax pattern was made on the model using modeling wax, and a prefabricated eye shell was customized according to the patient's natural eye. The patient was asked to stare at a distant object, and markings were made from the center of the pupil to the midline of the face and the nasal bridge, according to which the eye shell was fitted in the wax pattern [Figure 4a].

The upper and lower eyelids were sculpted with wax, and the final carving was done [Figure 4b]. A wax pattern trial was conducted on the patient to match the symmetry with the opposite eye [Figure 4c].

Flasking and anterior indexing with self-cure acrylic resin were done. The flask was transferred to boiling water, and a dewaxing procedure was conducted [Figure 5a].

Packing was done using medical-grade silicone and left for curing for 24 hours. Deflasking was done after the silicone was completely set [Figure 5b]. The extrinsic stains were applied, and color matching was done. The color of the prosthesis was secured with the sealant and left for 2 hours [Figure 5c].

Figure 3: (a) Preoperative view, (b) diagnostic impression taken with alginate, (c) diagnostic model

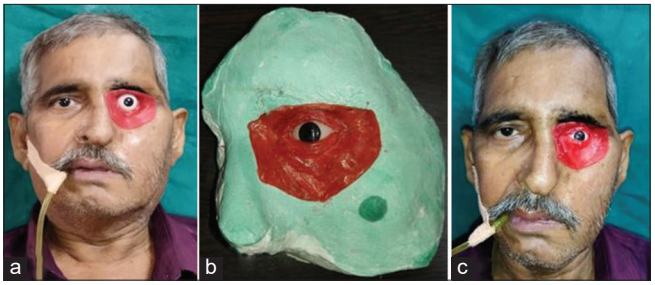

Figure 4: (a) Placement of prefabricated eye, (b) waxup and carving, (c) trial of the prosthesis

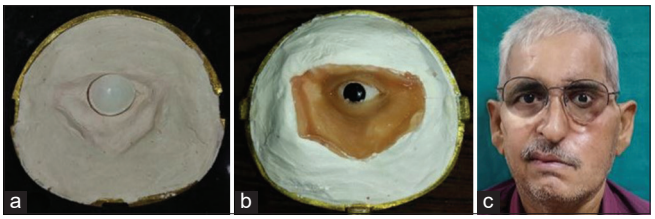

Figure 5: (a) Anterior indexing and dewaxing, (b) packing and deflasking, (c) final prosthesis after extrinsic staining

The eyeglass frame was selected to camouflage the borders of the prosthesis. The patient was educated about the application and removal of the adhesive. A follow-up of one month was done with no complication reported.

DISCUSSION

Orbital defects have been classified by Peymann *et al.* into three types—evisceration (removal of intraocular contents of the globe), enucleation (removal of the globe and parts of the optic nerve), and exenteration (removal of the entire orbital contents, primarily for the eradication of malignant orbital tumors).[7] Therefore, the present case is of exenteration according to the above classification. There are different types of attachment systems available for implant-supported maxillofacial prosthesis such as bar clip, magnet, and locator attachments. The magnet-retained prosthesis is more commonly used in orbital defects compared with the bar clip

mechanism due to the different angulation of implants in this region. Magnets have other advantages such as less manual dexterity needed during insertion or removal and better maintenance of hygiene[8] Implants in the orbital region are generally inserted in the supra-, infra-, and lateral orbital rims involving the zygomatic bone and maxilla. Implants are not generally placed on the medial surface of the orbital region because of the presence of delicate anatomical structures and a thin rim of bone. In this report, due to the high availability of bone four implants were placed in different anatomical regions to gain better prosthetic support. The emergence of implants and implant skin interface was improved by planning single-unit implants in the departmental workshop. Single-stage surgery was performed as there was no need to attach healing abutments in this case. The implant abutment interface is also a critical region of interest in this type of prosthesis. Microbial organisms, specks of dust, and secretion of adjacent glands can accumulate in this junction, and there may be a chance of peri-implantitis around the implants. Single-unit implants were designed to reduce the chance of peri-implantitis and any complications of screw loosening in future appointments. The limitations of this case were that a cement-retained bar was used instead of screw-retained attachments. However, the margin of the bar was kept 2 mm away from the soft tissue margin for easy removal of excess cement and hygiene maintenance. Screw-retained attachments have added advantages such as retrievability in case of implant failure and complications and less tissue irritation. As neodymium magnets are easily available and can be reused in case of any dislodgement from the bar surface, magnetic attachments can be safely used in these types of cases.

Due to the presence of the implant, abutment, cast bars, and magnets, the prosthesis became bulky and bulging in the first case. Retention and marginal fit were good and esthetics achieved was acceptable by the patient, with good hygiene maintenance observed at the follow-up. Cobein *et al*.[9] have also observed that bar magnet-retained prosthesis showed good acceptance and hygiene by the patient. The only contraindication to this prosthesis is systemic ailments and irradiated bone.

In the second case, the margins were discernible due to not being flushed with the tissues. Recurrent application and removal of the prosthesis lead to tissue irritation. Jain *et al*.[10] have mentioned in their report that adhesive-retained prosthesis is economical and has no contraindication, although chemical adhesive leads to tissue irritation and margin deterioration, and retention is poor, so it carries poor patient compliance.

In summary, these two different techniques of fabricating orbital prosthesis seem to be a useful approach to deal with orbital defects. Rehabilitation of orbital defects can lead to improved appearance, form, and esthetics of patients, which can also improve their quality of life.

Declaration of patient consent

The authors declare that they have obtained consent from patients. Patients have given their consent for their images and other clinical information to be reported in the journal. Patients understand that their names will not be published and due efforts will be made to conceal their identity but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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