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Ocular Prosthesis- Fabrication and Microbial Assessment

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Abstract:
The loss of the facial structures can have a physical, social and psychological impact on those affected .Maxillofacial prostheses which restore and replace stomatognathic and associated facial structures with artificial substitutes, aim to improve the patient aesthetics, restore and maintain health of the remaining structures and consequently provide physical and mental well being. Accurate impressions of these tissues facilitate a close adaptation of the custom prosthesis to the tissue bed resulting in better potential for movement by the patient. Treatment of such cases includes implants and acrylic eye prosthesis. Due to economic factors it may not be advisable in all patients. A custom-made ocular prosthesis is a good alternative. A case of a custom-made ocular acrylic prosthesis is presented here, which had acceptable fit, retention and esthetics.

Key Words: *Maxillofacial prosthesis, stomatognathic, anophthalmic cavity (AC), ocular prosthesis(OP).microbial assessment, PMMA (polymethyl methacrylate).*

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I. Introduction

The eye is a vital organ and one of the most important part of face.[1] Eyes are usually the first feature of the face to be noticed. The eye is important not only in respect to vision but also for facial expression. Loss of an eye creates a huge psychological effect on the patient as well as cause facial impairment.[2] In such cases maxillofacial prostheses act as a boon as it restores stomatognathic and associated facial structures with artificial substitutes. The primary objective is to construct a prosthesis that will restore the defect, improve esthetics,morale and social acceptance of the patient while maintaining the form of the anophthalmic cavity (AC), preserving the palpebral muscle tone, inhibiting palpebral collapse, directing tear drainage, preventing fluid accumulation in the socket.[1]

The reason for loss or absence of an eye can be due to congenital defect,tumor,trauma, sympathetic ophthalmia, painful blind eye,etc.[1,3] Surgical removal of an eye is classified in three types: **evisceration**: removal of contents of the globe leaving the sclera intact, **enucleation**: removal of entire eyeball after severing the muscles and the optic nerve, and **exenteration**: here entire contents of the orbit are removed including the eyelids and the surrounding tissues.[1,4,6]

Types of Ocular Prostheses

▶ Stock shells -These are readymade and available in the market with different corneal and scleral colour.

▶ Scleral cover shell prostheses -These are thin plastic prostheses used when an eye is congenitally malformed or becomes non-functioning following an injury or illness. A prosthesis can be moulded to fit between the lids and the blind eye.

▶ Scleral lens - It is a large contact lens that rests on the sclera. They are designed to treat a variety of eye conditions which do not respond to other forms of treatment.

▶ Custom made Prostheses - Custom made artificial eyes are made of high density medical grade PMMA which is highly compatible for the socket and has high resistance to breakage.

Before designing of the prosthesis, it is essential to assess the psychological status in order to gainthe confidence of the patient. In addition, a detailed medical history should be taken that includes the reason that led to the excision and enucleation in order to alert the possibility of recurrence.[5]

Ocular prosthesis wearers are prone to infections, inflammations and traumas of the anopthalmic cavity due to colonization by pathogenic microorganism, improper cleansing of prosthesis without removal from the socket for months and accumulation of secretion[6,7]

This article presents a simplified technique for fabricating an orbital prosthesis and to assess the levels of contamination of OP and AC in OP wearers.

II. Case Report

An18 years old male patient (Fig.1) reported to the Department of Prosthodontics and Crown and Bridge, Hazaribag College of Dental sciences and Hospital, Hazaribag, Jharkhand with chief complaint of missing left eye for about 17 years. The patient gave a history of trauma and enucleation of the eye. On clinical examination, the tissue bed was normal with no sign of inflammation (Fig.2). Evaluation of the relationship of palpebral fissure in both an open and closed condition was evaluated along with the muscle control of the palpebrae.After thorough examination, it was decided to fabricate a custom made ocular prosthesis with the consent of the patient.

A putty index was made around a conformer (Fig.3) and a perforated special tray was fabricated (Fig.4), and a final impression was made with light body addition silicone elastomeric impression material(Fig.5) (Reprosilvinylpolysiloxane impression material; Dentsply India). After the final impression was disinfected, again a putty index was made around this impression and white mockup wax was poured to get scleral wax pattern and tried in the patient's eye socket for fullness, retention, and stability (Fig.6).

After the try-in of the scleral wax pattern conventional flasking, dewaxing and curing was done (Fig.7).Then deflasking was done. Finising and polising of the scleral shell was made (Fig.8). During the trial of the scleral shell, certain guidelines were marked on the patient's face with an indelible pencil (Fig.9): a vertical midline was marked considering the stable anatomical landmarks and prominent points on the face.[8,9,10,11]. The distance from the right eye medial canthus to the midline and left eye medial canthus to the midline was measured. This distance standardized the midline marking and was used to reposition the grid template each time during the try-in visit. The patient was asked to gaze straight at infinity[12].The operator then marked the vertical lines coinciding with the medial and distal extremities of the iris of natural eye.Similarly, the horizontal lines referring to the center, inferior, and superior limits of the iris were marked.

The custom-made iris (made from a good quality digital photograph) was evaluated with the grid template. This confirmed the positioning of the customized iris in the scleral shell in comparison to the iris of the contra-lateral eye. The soft tissue contours and location of the iris were satisfactory. The scleral shell was again acrylized with iris in position and characterization by attaching artificial veins to simulate that of the natural eye.Finally the eye was recovered from the flask, finished, polished, and placed in the eye socket (Fig.10).

We used long curing cycle of 4-6 hours so as to prevent the presence of any residual monomer in the prosthesis which prevents any irritation or sensitivity and thereby rejection of the prosthesis by the patient. The eye socket is extremely sensitive and the residual conjuctiva and related structures react to any surface roughness and irregularities. Finished prosthesis requires a highly polished surface which would have a glass like finish to provide maximum adaptation and overall success of the prosthesis.

The final outcome of the prosthesis was ascertained from the satisfied look on the face of the patient (Fig.11). The patient was advised to wear spectacle to camouflage the artificial effect of prosthesis(Fig.12) and was given instruction for wearing the prosthesis and its home care protocol which is given below:

III. Post Insertion Instructions

- Prosthesis should be handled with care and with clean hands. Avoid removing the prosthesis unnecessarily. Removal of Acrylic prosthesis during night is ideal.
- Cleaning of eyelashes daily to keep them free from mucous build-up. Mucous gets dried on eyelashes and prosthesis and may irritate the eye socket and cause inflammation.
- Clean the prosthesis with soap water,0.12% chlorhexidine solution and rinse it with water, it should be soaked in an antibacterial solution to kill the surface bacteria.
- Use of lubricant solution like Refresh teardrops that helps the prosthesis to be kept moist and smooth.
- Advised follow up visits with ophthalmologist and dentist for follow-up.
- Routine polishing of prosthesis should be done every year to prevent deposition of protein and bacteria. [13,14]

Fig.1. Pre- Operative Frontal View

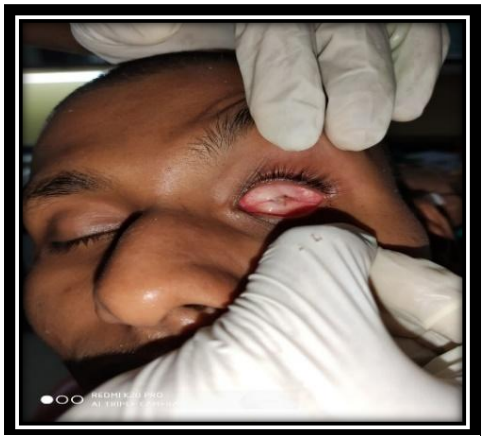

Fig.2 Tissue Bed Evaluation

Fig.3 Putty Index Around Conformer

Fig.4.Custom Tray

Fig.5 Impression

Fig.6 Wax Blank

Fig.7 Flasking

Fig.8 Finished Acrylic Shell

Fig. 9 Acrylic Shell Try-In and Irisorientation

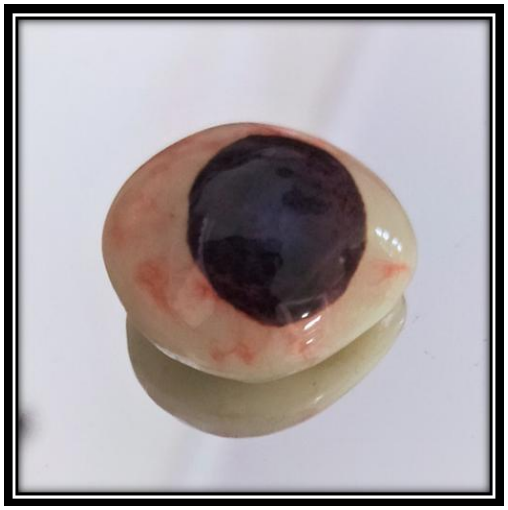

Fig.10 Final Prosthesis

Fig. 12 Post-Operative with Spectacle Fig. 11 Post-Operative

IV. Follow-Up Visits And Microbial Assessment

Patients attended three visits (0, 15 and 30 days), in which swab was collected from the internal surface of the ocular prosthesis as well as from the AC. For collection of material on day 0 (I – Initial), patients did not receive any hygiene instruction. After collection, the patients received cleansing solutions for the ocular prosthesis and were advised how to clean it 2 times a day, during 15 days. The first solution used, after the initial material collection, was a soap water solution . The second solution used a 0.12% chlorhexidine solution [Periogard, Colgate]. The cleansing instructions were similar to those given to soap water. Material was collected from the ocular prosthesis and anopthalmic cavity after 15 days of use of each solution.[6,15]

In this study several microorganisms were isolated from the samples. The study was conducted at RIMS, Ranchi. Isolates were identified by microscopy, culture methods and bio-chemical tests. Samples were

streaked on culture plate media of Nutrient agar, Mac Conkey agar, Blood agar,Mannitolsalt agar,Sabouraud's dextrose agar, selective and differential media depending upon the organism suspected and the culture plate were incubated at 37℃ for 24 to 48 hours. After the prescribed incubation period, the identification of isolate was carried out by gram's staining, microscopy and biochemical reactions.[6,15,16,17]

V. Result

Aerobic microorganisms, S.*aureus*, Gram-negative bacilli, and Candida albicans were detected in the ocular prosthesis and in the anopthalmic cavity.

VI. Discussion

Absence or loss of an eye constitute an important maxillofacial deficiency, which requires prosthetic replacement. A custom-made ocular prosthesis replicates the natural color, contour, orientation and size of the pupil and iris, improve esthetics and providing realism to the patient's face. In addition, it improves the fit of the prosthesis by gaining the intimate tissue adaptation. Although the prosthetic rehabilitation may be enhanced with the use of implants and can coordinate the movements with natural eye but they are not always feasible.[1,21]

Ocular prostheses patients are at increased risk for microbial infection and colonization. The presence of an ocular prosthesis carries a lifetime risk of infection and is associated with ocular surface. Deposits on PMMA prosthetic eyes may be similar in form to deposits on denture and artificial teeth.[6,15,17]In this study, samples were obtained after 1 day,15 days and one month of prosthesis use and then streaked and cultured in different media and exposed to different biochemical tests.[6]

Pure cultures of different microorganisms were obtained and observed in prosthetic eye swab and the common isolates were S. *aureus*,Gram-negative bacilliand Candida albicans. The presence of these microorganisms in the ocular prosthesis and anophthalmic cavity are consistent with previous literature.[6,115,19,20]Ophthalmologists and Specialists in maxillofacial prosthetics should be aware of the inherent risks and diversity of microbial colonization and infections associated with the placement of ocular prostheses. Wearing a prosthetic eye for a long time and neglecting to clean and wash and not remove the prothesis for long periods of time increase the risk of microbial infection.[6,15]

Along with overt infection, an additional consequence of microbial colonization by these different microorganisms would be frictional irritation of the conjunctiva and eyelid. Consequently, it is recommended that removing the prosthetic eye from the anophthalmic cavity and cleaning the prosthesis regularly will diminish the risk of these complications.[6]

VII. Conclusions

The custom-made ocular prosthesis of appropriate contour, size and colour can provide an acceptable aesthetic result. The close adaptation of the custom-made ocular prosthesis to the tissue bed provides comfort and restores physiologic function of the eye. Maxillofacial prosthodontics and ophthalmologists should be aware of the inherent diversity of microbial colonization and infections associated with the placement of ocular prostheses.

DECLARATION OF PATIENT CONSENT

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given his consent for his images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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