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Fabrication of Ocular Prosthesis - A Case Series

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Abstract

Loss of an eye impairs vision along with causing facial disfigurement leading to psychological distress among patients. An ocular prosthesis restores the facial esthetics and improves mental wellbeing of the patient. Custom made ocular prosthesis provide a better fit and are therefore preferred over stock eye shells. This case series describes different iris positioning techniques for fabricating a custom-made ocular prosthesis.

Keywords: Ocular defect, Ocular prosthesis, Enucleation, Iris positioning.

Introduction

The first feature to be noticed in the face are the eyes[1]. The eye, apart from being a vital sensory organ, is an essential element of facial expression. Loss of one or both eyes may occur secondary to trauma, congenital defect, tumor, or sympathetic opthalmia[2].The management of ocular defects may include one of these approaches: Evisceration, enucleation or exenteration[3]. Enucleation involves the removal of the entire globe, including the sclera, intraocular contents, and the cornea. The stump of the optic nerve as well as the extraocular muscles are left behind. Evisceration is the removal of intraocular contents including the lens, uvea, retina, vitreous humor, and in some cases the cornea. Only the sclera and extraocular muscles remain intact. Exenteration is the removal of the globe and all of the orbital contents[4].

Facial disfigurement due to loss of an eye has a great psychological impact on the patient[5]. Rehabilitation of such a patient with an ocular prosthesis helps to provide socially acceptable esthetics along with improving the psychological well-being of the patient[6]. This case series describes the fabrication of a customized ocular prosthesis with different techniques for iris centering.

Case reports

Case 1

A 19-year-old female, reported to the Department of Prosthodontics with chief complaint of missing right eye for 2 years. History revealed that the patient suffered a burn injury to her right eye from crackers 2 years back, followed by enucleation and placement of an ocular implant. Examination of the defect revealed a healthy mucosa with no signs of infection or inflammation covering the posterior wall of the ophthalmic socket and showing synchronous movements. The ocular bed was moist with adequate volume and sulcus depth to retain and support the prosthesis. A customised acrylic resin ocular prosthesis was planned for the patient.

Steps for fabrication of ocular prosthesis

A customized ocular impression tray with a hollow extension (Fig 1) was fabricated by duplicating patients con former in polymethyl methacrylate (DPI, India). The tray was finished, polished and tried in the patient to check its alignment and extensions. Petroleum jelly was applied on the eyelashes to facilitate removal of impression material. Impression was made using Light body addition silicone (Neo sil Corporation, Korea) impression material. The material was dispensed through the automixing tip via the hollow stem of the ocular tray in sufficient quantity to lift the eyelids to their normal contour. The tray stem was then aligned with the central direction of gaze and held steady in this position until the impression material was set. After the material had set, the assembly was removed and the impression was examined for defects and voids (Fig 3).

Fig 1 : Ocular Impression

The impression was poured in dental stone (Kala Bhai, India) in two sections to obtain a two-piece mold (Fig 2).

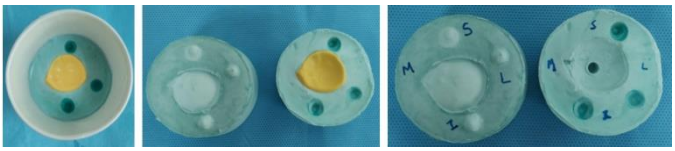

Fig 2: Fabrication of master cast.

Polymethyl methacrylate acrylic resin (DPI tooth molding powder, DPI India) was mixed and placed into mold, and the molds were approximated to fabricate the sclera shell. Once the material had set it was retrieved, finished and polished to act as a template for fabrication of the final prosthesis. The sclera shell was tried in and adjusted to simulate the contours of the normal eye. A prefabricated stock eye, whose iris shade and diameter matched with the normal eye of the patient, was selected and its iris retrieved. The size and position of the iris was finalized in accordance with the contralateral eye using Naes ruler (fig 3). The stock iris was positioned on the trial sclera shell using modelling wax. Shade selection for the sclera was done using the natural eye as a guide.

Fig 3: Iris centring

An acrylic stump was attached at the centre of the iris to help in orientation of the iris in the flask. The first pour was done using dental plaster (Kal dent, Kala Bhai, India) in the lower half of the ocular flask (fig 4). Once the material was set, separating medium (Cold mould seal, DPI, India) was applied. Then the second pour of dental plaster was added and the flask was closed.

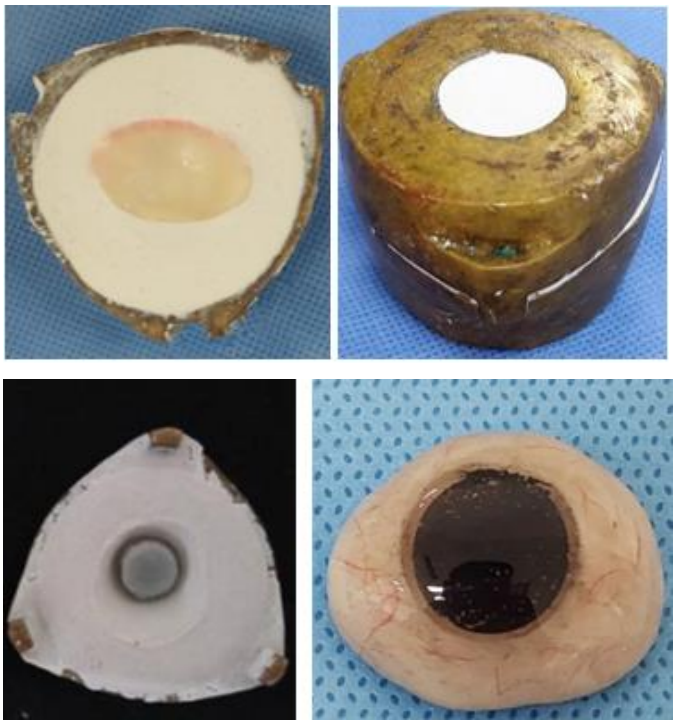

Fig 4: Flasking in ocular flask; Final prosthesis

Dewaxing was done to remove the wax which attached the iris to trial sclera shell. The flask was opened and the trial sclera shell was removed (Fig 4). Sclera white polymer (NAES, India) was mixed as per manufacturer's instructions and packed in the flask in dough stage. After bench curing for 1 hour it was acrylised and the prosthesis was retrieved.

The prosthesis was trimmed uniformly to a depth of around 1 mm. Over the reduced surface scleral painting was done using soft color tones to match the sclera of the contralateral natural eye. Rayon fibers were placed to simulate the blood vessels. Once the characterization was satisfactory, trimmed sclera was replaced by packing clear heat cured polymerizing acrylic resin (DPI, India), followed by curing, deflasking, finishing, and polishing of the prosthesis (Fig 4). Final ocular prosthesis was inserted into the socket and evaluated for fit, esthetics, and coordinated movements with the contralateral eye (Fig 5). Post insertion care instructions were given to the patient.

Fig 5: Pre-op and Post Op Photographs

Case 2

A 58-year-old female reported for rehabilitation of right eye which was surgically enucleated due to development of uveitis secondary to Sjogren's syndrome. On examination there were no signs of any adhesion or dehiscence of conjunctiva and tissue bed was free of inflammation.

The ocular impression was made and the cast retrieved in a similar way as described for case 1. Modelling wax (DPI, India) was poured in the casts to fabricate trial sclera shell.

The wax sclera shell was tried in and adjusted to simulate the contours of the normal eye.

A graph grid method was used for the positioning of the stock iris. A grid was made on a transparent sheet by superimposing it on a graph and horizontal and vertical lines were marked at a distance of 0.5cm. Patients facial midline was marked and she was asked to gaze straight. Vertical lines coinciding with the medial and distal extremities of the iris of the natural eye were marked on the face using the grid. Similarly, the horizontal lines on the grid were used to determine the superior and inferior limits of the iris.

The position of the iris was verified during try in using the grid (Fig. 6).

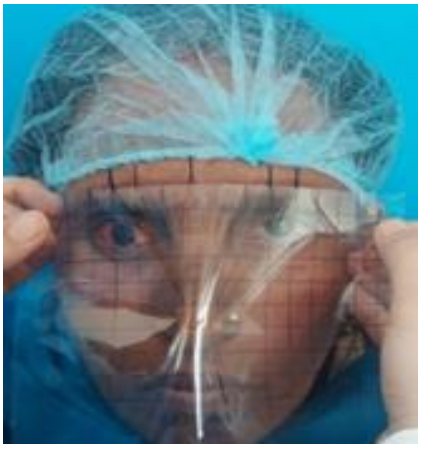

Fig 6: Iris positioning

Fig 7: Pre and Post Op Photograph

After the try in was found to be satisfactory, the final prosthesis was fabricated using the steps as mentioned in Case 1 and delivered to the patient (Fig. 7).

Case report 3 (CR3)

A 63-year-old female reported with a complaint of facial disfigurement due to loss of right eye. History revealed that enucletion of the right eye was carried due to a traumatic injury. Examination revealed healthy conjunctival lining and absence of infection. The impression was made and cast retrieved in a similar way as described for Case 1.

Fig 8: Case 3 Iris centring.

Iris Positioning

Distance from the medial canthus to the medial limbus of iris of normal eye was determined using a digital vernier calliper (E-COSMOS, India) and used as a guide to position the iris on the sclera wax (Fig 9). The iris was marked and evaluated for its orientation and symmetry. The remaining steps for the fabrication of the ocular prosthesis were similar to the steps carried out for CR1.

Fig 9: Case 3 Pre and Post op photograph

Discussion

Customized ocular prosthesis has many advantages over stock eyes like better contouring, color matching and co-

ordinated movements with the contralateral eye[7]. Selection of iris color and size along with fixation of gaze is the most critical step in successful rehabilitation of an ocular defect. Customizing the iris demands extra skill and time from the operator[8]. This can be avoided if stock iris matching with the contralateral natural eye is available. For the ocular prosthesis to appear bilaterally symmetrical to the natural eye, accurate placement of the iris on the trial sclera shell or sclera wax pattern is critical. Semi-customizing the prosthesis using the stock iris and customized sclera has the advantages of both stock and custom prosthesis.

The techniques for iris centering used in this case series are easy to use, do not require extensive armamentarium and provide excellent esthetics. The NAES ruler serves the dual purpose of selecting the iris diameter as well as iris centering. The grid method helps in medio-lateral as well as superior-inferior positioning of the iris. Digital vernier calliper provides objective measurement for assessing iris position as compared to the other two methods which are subjective. Using Digital vernier calliper, the diameter of the iris can be accurately measured and iris centering can be done by measuring the distance between medial canthus and medial limbus as well as the lateral limbus and lateral canthus.

Conclusion

Success of the ocular prosthesis largely depends on the precise laboratory technique and artistic skills of the operator. The techniques described here are simple, economical and user friendly. Through these techniques, the demand for the artistic skill and consumption of time are reduced by the use of precisely selected stock iris, yet esthetic and functional requirements are met by the customized sclera.

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