

Fabrication of ocular prosthesis with a digital customization technique – A case report

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ABSTRACT

Loss of an eye can be caused by cancer, trauma, or congenital defects. A loss of eye creates functional, esthetic, and psychological lacunae in individual's personal and professional life. Rehabilitation of ocular defect can be done by a custom ocular prosthesis fabricated with heat cure polymethylmethacrylate. The custom-made prosthesis provides a better fit, is more comfortable to use and gives better cosmetic results than a stock prosthesis. The main objective of this article is to describe a new technique of customization using digital photograph of the patient's iris made using a digital camera to give excellent cosmetic results to the patient.

Keywords: Custom made artificial eye, maxillofacial prosthesis, ocular defect, ocular prosthesis

Introduction

“Eyes” are said to be “mirror of the soul”. They are an organ of vision, center of facial expressions and an epitome of cosmetic appearance in human beings. Loss of an eye can be a consequence of carcinoma, trauma, sympathetic ophthalmia, painful blind eye, or congenital defects.^[1] The surgical management to cure such diseases involve one of the approaches depending on the severity of situation which includes evisceration, enucleation, or exenteration.^[2]

Ocular defect created post surgery makes an individual functionally and aesthetically challenged.^[3] Rehabilitation of ocular defect with a custom-made ocular prosthesis improves social acceptance, psychology, and self-confidence in the individual. Reproduction of natural color, size, contour, and orientation in an ocular prosthesis that gives a life like appearance is a challenge to a prosthodontist. This case report describes a digital technique of fabricating custom-made ocular prosthesis

closely matching the natural eye to give excellent cosmetic results.

Case Report

A 35-year-old male patient reported to the dental OPD with a complain of unaesthetic appearance of face and missing right eye. Medical history revealed enucleation of right eye 6 months back subsequent to gunshot injury. [Figure 1] On examination, the anophthalmic socket has healed completely, it retains muscle activity of surrounding muscles, it was planned to fabricate a custom-made ocular prosthesis.

a. Impression making

First, glycerine application was done onto the eyelashes and the lining of anophthalmic socket. A custom tray was fabricated with autopolymerizing Polymethyl Methacrylate (DPI, India) using the contours of a stock eye. [Figure 2a] The tray was finished, polished, and tried in the patient to check for extensions. An impression of the anophthalmic socket was made using light body consistency addition silicone elastomeric impression

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material, (Affinis, Coltene, India). The patient was asked to look straight when the impression was made [Figure 2b]. Once the material sets the impression was retrieved with syringe and was evaluated for any defects [Figure 2c].

b. Fabrication of scleral wax pattern

An index of the impression was made using addition silicone impression material putty consistency (Affinis, Coltene) [Figure 3a, b]. The index was used to fabricate the scleral wax pattern. Modelling wax (DPI, India) was heated over flame to a molten consistency which was poured in the index. The wax pattern was retrieved and tried in the patient [Figure 3c]. The patient was asked to perform all movements of eye ball [Figure 4a]. Modification of wax pattern was done until satisfactory contours of the eyelids were achieved in open and

closed positions. Centering of pupil was done by making markings on patients face using electronic Vernier calliper and transferring them on to the wax pattern [Figure 4b].

c. Acrylization of scleral blank

The finished wax pattern was invested in a flask using type III dental stone (Kalabhai, India) and flasking was done in a conventional manner. The flask was then placed in a dewaxing water bath for 20 minutes. After dewaxing the flask was reopened and packed with heat cure clear PMMA (Factor II, Lakeside, USA). The powder and the liquid were mixed as per manufacturers guidelines. Few drops of white intrinsic stains (Technovent ltd) was added to clear PMMA to give white color of sclera to the prosthesis. The PMMA was packed into the dewaxed portion of the flask and cured using manufacturer guidelines.

d. Customization

A digital photograph of the patient's iris of the contralateral healthy eye was made using a digital camera (Canon d1300) [Figure 5a]. The photograph was transferred to photoshop software (Photoshop 7.0; Adobe system Inc.) where it was remastered into various shades and sizes to get a real iris form [Figure 5b], images were printed on a good quality photopaper [Figure 5c]. Then the photopaper was coated with a 100 micrometer laminating pouch (PVC coating, Delhi, India) to prevent any color flowing due to the effect of acrylic resin. In the next appointment the scleral blank prepared was reduced 2 mm anteriorly and 1 mm posteriorly for adaptation of iris and clear acrylic resin. After consideration, most closely matching iris was cut [Figure 6a] and inserted in the center position using self-cure acrylic resin (DPI,

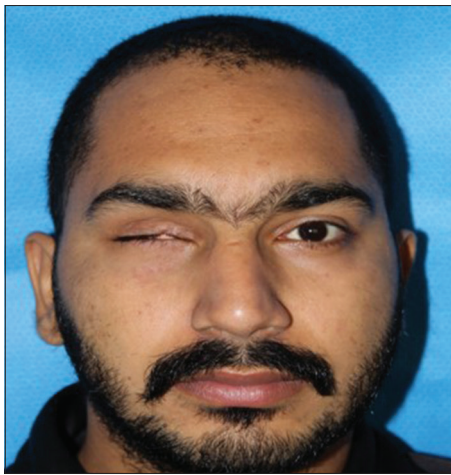


Figure 1: Enucleated right eye



Figure 2: Impression making



Figure 3: Wax pattern fabrication

India) [Figure 6b]. Veining fibers were adhered to scleral blank using cyanoacrylate adhesive liquid to give a natural appearance [Figure 6c]. The prosthesis was repositioned in the previous flask [Figure 7a], packed with clear PMMA (Factor II, Lakeside, USA) and processed as described in the 1st curing cycle [Figure 7b]. The prosthesis was retrieved, finished and polished [Figure 7c].

e. Insertion and post care

The prosthesis was inserted and checked for any discomfort while closing or opening the eyes. The instructions for removal and insertion of prosthesis were given to the patient. The patient was recalled and followed up at 24 h, 48 h, 1 week, 1 month, and 6 months thereafter. The post op result showed a successful, time efficient, and esthetic rehabilitation of ocular defect with a near normal appearance of the patient [Figure 8].

Discussion

Eyes are an organ of interest not only to ophthalmologist but also to psychologists, painters, poet, and in this modern era even personal identification via computer analysis of iris. The management of an anophthalmic socket requires the

combined effort of surgeon and prosthodontist. A thorough knowledge of the anatomy is necessary for successful treatment. The goal of any prosthetic treatment is to return the patient to society with a normal appearance. Till 1940s glass was the material of choice for fabrication of ocular prosthesis.^[4] With the invention and development of polymers PMMA (Polymethylmethacrylate) it became material of choice. Custom made Ocular prosthesis using PMMA has various advantages such as—non brittle, better adaptation, more comfortable, better esthetics, longer serviceability, and easy to repair or polish.^[5]

Various impression techniques have been reported in literature such as Direct impression/external impression technique, using stock ocular tray, impression with custom ocular tray, impression with stock ocular prosthesis, and wax scleral blank technique.^[6] Various impression materials like irreversible hydrocolloid, ophthalmic alginate, polyvinyl siloxane, tissue conditioners, and dental impression waxes can be used.^[7] In this case report impression was made with a custom made ocular tray using addition silicone impression material, light body consistency. Customization is an important aspect of prosthetic rehabilitation which brings the cosmetic appearance to near normal levels. In an ocular prosthesis the challenge is to reproduce the iris color in the prosthesis. Various techniques have been used by various authors such as Iris painting,^[8] using most closely matching iris button from a stock eye^[9] or making a digital image of iris of the contralateral natural eye.^[10] In our case report a digital image of the iris of the patients natural eye was made, which was later printed on a high gloss paper and was attached to scleral blank to fabricate the prosthesis. The described technique is a simple, practical, and time efficient method of fabricating ocular prosthesis. The rehabilitation of ocular defect gave the patient self-confidence and greatly improved the social acceptance.

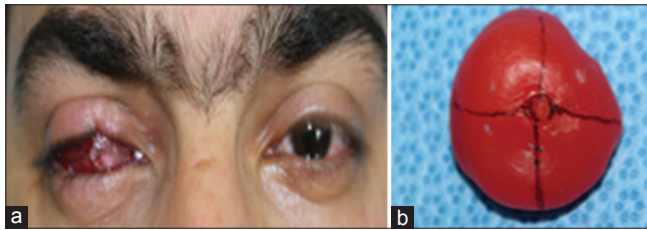


Figure 4: Wax pattern try-in

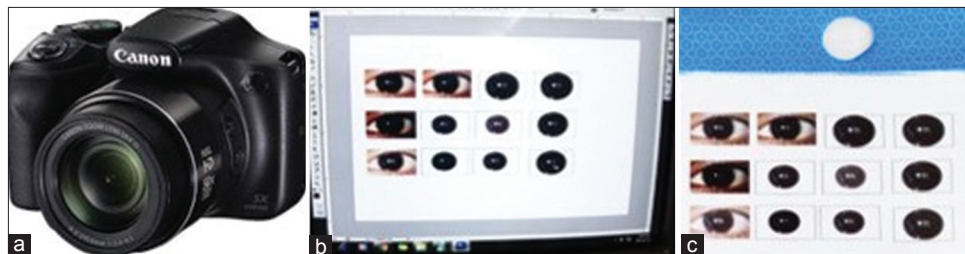


Figure 5: Digital printing of iris

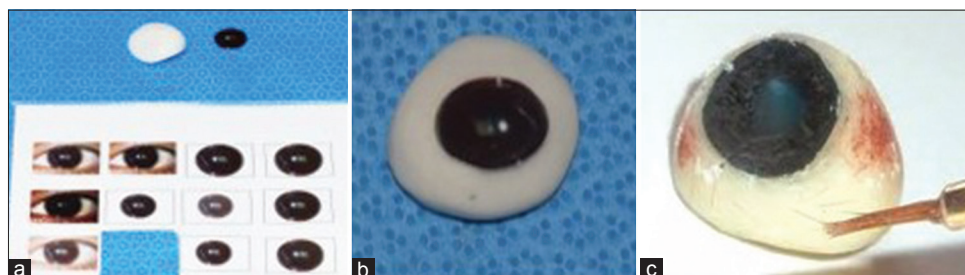


Figure 6: Customization of prosthesis

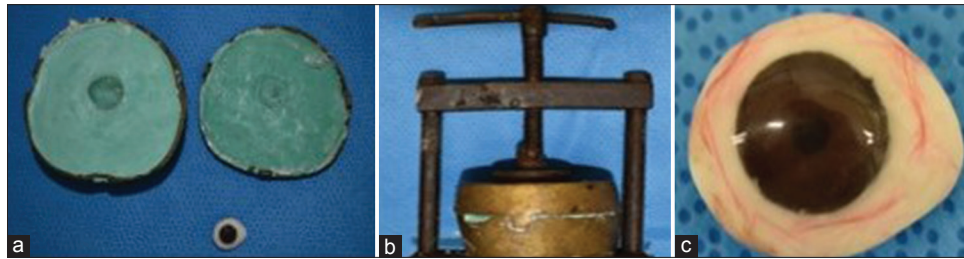


Figure 7: Curing of prosthesis

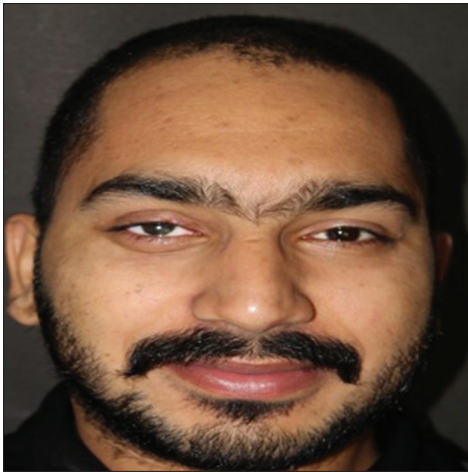


Figure 8: Post op result

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their 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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Conflicts of interest

There are no conflicts of interest.

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