

## Fabrication of ocular prosthesis- A simplified technique

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### Abstract

Ocular defects result from tumor, congenital anomaly, external injury or the need for histologic confirmation of a suspected diagnosis not only lead to serious impairment of function and esthetics but also make the patient psychologically handicap. Prosthetic rehabilitation attempts to restore these disfigurements may improve esthetic, level of function, psychological condition of the patient and ultimately ameliorate the quality of life. This article describes clinical report of rehabilitation of a post ophthalmic enucleation patient with custom made prosthesis using stock eye shell that can create esthetically pleasing result. Although the patient cannot see with this prosthesis, it will definitely restore the patient's self-esteem and allow him or her to confidently face the world rather than hiding behind dark glasses

**Keywords:** Custom made, Enucleation, Rehabilitation.

### Introduction

The loss of an eye can have a physical, social, and psychological impact on the affected person.<sup>1</sup> Physical flaw due to an ocular defect compromises appearance and function, which prevents an individual from leading a normal life and usually prompt the individual to seek treatment that will reinstate acceptable normalcy.<sup>2</sup> The combined efforts of the ophthalmologist, plastic surgeon, the maxillofacial prosthodontist and dental technicians are needed to provide a satisfactory ocular prosthesis.

The loss or absence of an eye may be caused by a congenital defect, irreparable trauma, tumor, a painful blind eye, sympathetic ophthalmia, or the need for histologic confirmation of a suspected diagnosis. Depending on the severity of the situation, surgical management may include: evisceration, enucleation, or exenteration<sup>3</sup>. The minimal surgical procedure is evisceration which is removal of the contents of the globe, leaving the sclera (and at times the cornea) intact. Enucleation is removal of the entire eyeball after severing the muscles and optic nerve. Exenteration, the most radical, is removal of the entire contents of the orbit.<sup>4</sup> Enucleation or evisceration causes constriction of the tissues around the ocular cavity. A temporary conformer to prevent tissue contraction will maintain proper contours. The fabrication of a definitive ocular prosthesis should begin as soon as the socket has healed. Prosthetic rehabilitation is enhanced if an implant can be placed in the orbit to provide an attachment for the rectus muscles, which can impart motion coordinated with the natural eye.<sup>5</sup> However the placement of an ocular implant is not always possible or feasible. Patients in this situation can be treated with a stock prefabricated or custom-made ocular prostheses that have been adapted to accommodate specific situations.

This article describes a technique for fabricating a custom-made ocular prosthesis using conventional technique. The technique described in this article provides a cost-effective choice for optimal anophthalmic socket rehabilitation.

### Case Report

A 32 yrs old male patient reported to the department of Prosthodontics, Regional Dental College, Assam with the chief complaint of facial disfigurement due to faulty prosthesis of left eye. There was a long cut mark on his left upper palpebra. On his history it was found that the patient had serious injury to his left eye at the age of 8 years and the eye had to be enucleated at the ophthalmology department of Guwahati Medical College, Assam. After surgery healing was uneventful and the patient had sought prosthetic care from a private practitioner 6 yrs after surgery and the practitioner provided him a stock eye prosthesis. He was not satisfied with the esthetic of the stock eye prosthesis, so he came to the Prosthodontic department of Regional Dental College for the fabrication of an esthetically satisfying ocular prosthesis.

On examination there were no signs of adhesion or dehiscence of conjunctiva and tissue bed was free of inflammation so we decided to start with the impression procedure for fabrication of a modified custom made ocular prosthesis.



**Fig. 1: Patient with previous faulty prosthesis**



Fig. 2: Impression making with external tray



Fig. 3: Impression of the defect



Fig. 4: Iris positioning in Adobe photoshop



Fig. 5: Prosthesis try-in stage



Fig. 6: Characterized prosthesis



Fig. 7: Final prosthesis in the enucleated socket

**Treatment Plan**

Ocular prosthesis can be either custom made or readymade (stock). Because the mucosa is easily displaceable, some success can be obtained with a stock prosthesis; however, the patient will experience some type of discomfort, and the mucosal surface will not fit snugly enough to produce movement. Also, potentially irritating mucus and debris can collect in the gap between prosthesis and the tissue bed.<sup>4</sup> Since every socket differs in size and shape, it is obvious that an individually designed prosthesis, made from an impression of the socket, is needed to utilize the full movement potential of the eye and also to provide maximum comfort to the patient. So, considering all these benefits it was decided that a custom made ocular prosthesis would be the best prosthetic option to meet the needs of the patient. Also to get better esthetics and color matching without following the conventional, cumbersome and technique sensitive method of iris button painting, use of matching stock eye shell was planned for this particular case.

**Procedure**

An external tray impression technique was employed to make the impression of the defect. At first an impression of the facial area corresponding to the defect eye was registered with help of putty elastomeric impression material (Haraeus Variotime, Easy Putty by Kulzer). This impression was used as a template for the fabrication of custom external tray. A double thickness wax spacer was put over the template and tray was made up of pink autopolymerizing resin (DPI-RR Cold Cure, DPI, Mumbai, India). Multiple perforations were made in the tray so that extra impression material can escape and get mechanically

locked within it. Tray extension was again checked in defect eye.

After the tray gets ready, 2% lignocaine topical gel is applied on the ocular tissue to reduce the irritability during impression and to make the patient comfortable. Socket was cleaned by irrigating with saline water and dried with cotton pallet. Eyelashes and eyebrow on the defect side was lubricated with white petroleum jelly to avoid sticking of the impression material.

Now polyvinylsiloxane light body impression material (Haraeus Variotime, Light Flow, Light Body by Kulzer) is slowly injected into socket and simultaneously extra material is loaded in the custom external tray and placed over the previously injected impression material in the defect. Patient is directed to move the normal eye into various directions by moving a figure in front of the patient for his easy understanding. This causes functional movement of the defect eye and impression was recorded under functional state.

Once set, impression was carefully removed and beading is done with the help of dental plaster and pumice mixture followed by boxing with modelling wax (DPI modeling wax, DPI, India). Impression was poured in two sections in type IV gypsum product (Die stone, Kalrock, Kalabhai Karson Pvt Ltd, Mumbai, India). First part was poured to fill the undercut created by the depth of the fornices. After the material completely set, three keyways were made by scrapping little amount of stone from the surface. After applying separating media (DPI heat cure cold mould seal, DPI, India) on the surface the remaining part was completely poured.

The two-piece mold made from the ocular impression was separated, and the impression material and tray were removed. The mold was coated with a separating medium and melted modeling wax (DPI modeling wax, DPI, India) is poured into the cavity through the opening. When the wax cooled, the mold was opened and the wax was removed. Sharp ridges and undesirable irregularities are eliminated carefully with help of a wax carver and the surfaces of the wax pattern were made smooth. The wax pattern was tried in the socket and evaluation was done for proper fullness of the eyelids and contoured to simulate the contra lateral normal eye. Modification and contouring was further done to improve the esthetic result. While contouring, the tissue surface of the wax pattern was supported by putty index in order to avoid distortion of the pattern. When the soft tissue contours in the wax pattern were judged to be satisfactory, the pattern was finalized for the next step of iris positioning. Size selection of the iris and its positioning was done with help of Adobe photoshop, CS version 8 matching the contra lateral normal eye. Iris was obtained from a stock eye shell which closely resembled the color and size of the right eye's iris part. Finally iris is positioned in the wax pattern by removing wax and pattern is tried in the socket. While positioning the iris three key dents were made in the iris surface that will face the wax pattern so that elevation corresponding to the key dents of iris comes into the wax pattern which will help in future repositioning of the iris.

After that, the wax pattern was invested in type IV gypsum product (Die stone, Kalrock, Kalabhai Karson Pvt. Ltd, Mumbai, India) in two sections. First part was poured till the height of contour of the wax pattern. Once the stone was set, iris was carefully removed and remaining part was poured in type IV gypsum product after applying separating medium. After dewaxing stone mould was packed with tooth colored heat cured acrylic resin (DPI Heat Cure, DPI, Mumbai, India) which simulate the color of the scleral portion of the normal eye. After curing, the prosthesis was removed carefully. Prosthesis was finished and polished and iris was repositioned in the prosthesis and then it was tried in the patient's socket. About 1mm of acrylic was removed from the anterior surface of the prosthesis leaving the iris intact and again re-contoured with modeling wax (DPI modeling wax, DPI, India). Prosthesis was reinvested like it was previously done and dewaxed. After dewaxing was completed, mold was opened and characterization of the prosthesis was executed. Characterization was done with help of camel oil based water colour and red colored streaks of veined heat cure material (DPI, India) to simulate the minute detailing of the contralateral normal eye. Once characterization was found to be satisfactory, the mold with the prosthesis was trial packed with heat cure clear acrylic resin (DPI Heat Cure, DPI, Mumbai, India) which will give a natural shiny surface and life like appearance to the prosthesis afterwards. Before final packing extra resin that flowed over the iris due to pressure of trial closer was carefully removed with help of a sharp scalpel; the mold was closed tightly and allowed to cure slowly over 1 hour. Once curing was done, prosthesis was carefully removed. After final finishing and polishing prosthesis was fitted in the patients' socket to check the esthetic, comfort and proper function. Easy steps of insertion and removal as well as instructions regarding cleanliness were given to the patient which includes-

1. Removal and insertion of the prosthesis, either digitally or with a rubber suction cup. Generally, patients can use the digital method better, while a parent or therapist can use the cup more easily.<sup>4</sup>
2. Wearing the prosthesis day and night, removing and washing it once a day--or more often if mucus accumulates. Generally, mucus is no more of a problem than with a natural eye, except when the prosthesis is scratched or pitted. This may cause the same sensation as a foreign particle in a natural eye, and the prosthesis should be repolished immediately.<sup>4</sup>
3. Washing the prosthesis only with pure (Ivory) soap and tepid water, scrubbing it well between thumb and fingers and rinsing it well before reinsertion. Warn the patient that shaving lotion, cologne, and other preparations containing alcohol or other solvents will damage the prosthesis.<sup>4</sup>

In the follow up visits with the prosthesis removed, the soft tissues of the socket are rinsed with an ophthalmic irrigation solution and examined for irritation or infection. The presence of an infection that does not respond to simple irrigation should be referred to an ophthalmologist for

evaluation and treatment. The prosthesis should be repolished periodically during routine follow-up examinations to eliminate undetectable scratches which often leads to mucous accumulation and cause irritation.

### Discussion

Physical attractiveness is an important factor in an individual's life. Psychologically the impact of self-image extends across a wide range of social and interpersonal situations. The prosthetic eye can not provide vision but it is a very suitable esthetic replacement for the patients with ocular defect. It restores self-confidence in patients and helps him or her to resocialize. A correctly placed ocular prosthesis should maintain its orientation when the patient is looking straight ahead. The prosthesis should restore the normal opening of the eye, support the eyelids, restore a degree of movement, and be adequately retained and esthetically pleasing.<sup>6</sup>

There are many techniques for fabrication of ocular prosthesis among them stock eye shell, relining a stock shell or custom ocular prosthesis are currently in use. Stock or prefabricated eye prosthesis has certain disadvantages of improper adaptation, compromised esthetic and limited eye movements where as custom made prosthesis advantages include improved adaptation to underlying tissues, increased mobility of the prosthesis, improved facial contours, and enhanced esthetics gained from control over the size of the iris and pupil, color of the iris and sclera and a gaze similar to the natural eye<sup>5</sup>. It also involves technical sensitive procedures in various steps of fabrication which are quite difficult and based purely on artistic maneuverability of the maxillo-facial prosthodontist. However, a custom prosthesis is more expensive than a stock prosthesis, and several steps are required for its fabrication. In our case, we have used prefabricated iris shell or iris button matched with patient contralateral eye and artificial custom made sclera was developed by heat-cure tooth color acrylic resin making it inexpensive and less time consuming. This combined approach for the development of ocular prosthesis surmounts the problem of prefabricated prosthesis and include the advantages of custom ocular prosthesis. The double curing procedure followed in our technique involves curing the base eye shell initially and then a second curing cycle for the thin clear superficial layer. By this process the ocular prosthesis being a significantly smaller prosthesis would naturally be more completely cured, with minimal free monomer which will ultimately decrease the tissue irritation and allergic reactions. It must be emphasized that besides the curing cycle followed, the polish of the eye is also critical in preventing conjunctival irritation and must be done with due diligence under magnification.

Limitations of the technique are that the clinician is dependent on the availability of a pre-fabricated eye with properly matching iris and pupillary part.

An accurate impression is necessary for the development of an accurately fitting extraoral prosthesis. Various ocular impression techniques described in the literatures and each has its own integral advantages and

disadvantages. Most can be placed into one of several broad categories - external impression, impression with a stock or modified stock ocular tray, impression using a stock ocular prosthesis, and the wax scleral blank technique. In this case, we have used impression with custom external tray, as detailed and accurate impression of the anophthalmic socket tissue bed can be obtained with this technique and it is an easy procedure to execute.

Now regarding retention of extraoral prostheses, various methods have been described in the literature; they include tissue undercuts, magnets and osseointegrated implants. Although osseointegrated implant may provide the most reliable prosthesis retention; inadequate bone, additional surgeries and expenses may contraindicate this type of treatment. In present case, retention was primarily achieved through anatomic tissue undercut.

Material mostly used in fabrication of prosthetic eye are glass, poly methyl methacrylate (PMMA) and ceramics. Glass was once the preferred prosthetic material, but owing to difficulty in molding and its fragile nature it is seldom used today. Modern ocular prosthesis are fabricated using either poly methyl methacrylate (PMMA) or ceramics. Ease of molding into any desired shape and its intrinsically inert nature makes PMMA the material of choice in fabricating ocular prosthesis in our case.

### Conclusion

The method described in this article is undemanding and can be carried out in a small clinical set-up. The use of modified stock ocular prosthesis has been a boon to the patients who cannot afford implant replacements or custom made ocular prosthesis. The esthetic and functional outcome of the prosthesis is almost similar to that of the custom ocular prosthesis, if proper shade selection of iris and sclera is done. Although the prosthesis cannot provide vision to the patient, it will definitely restore patient's self-esteem and allow him to confidently face the world.

**Conflict of Interest:** None.

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**How to cite this article:** Barman J, Paul N, Goswami B, Agarwal KK. Fabrication of ocular prosthesis- a simplified technique. *Int J Oral Health Dent* 2019;5(1):47-50.