

Case Report

Fabrication of a Custom Ocular Prosthesis

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ABSTRACT

Defects of the eye may follow removal of a part of or the entire orbit. This results in the patient becoming visually, esthetically and psychologically handicapped. Restoring the defect with a silicone- or acrylic-based prosthesis not only restores esthetics but also gives back the lost confidence to the patient. This is a case report of a patient with a 'ptysical eye' and details the steps in fabrication of an ocular prosthesis. Particular attention has been given to the laboratory process in this technique to minimize the residual monomer content in the artificial eye.

Key words: Enucleation, Ocular, Prosthesis, Scleral Shell

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INTRODUCTION

Defects of the eye may include en bloc removal of the entire orbit - exenteration or enucleation of only the eyeball - scleral defects.¹⁻⁷

In the Indian subcontinent, trauma, tumors and congenital absence of orbit are the main causes of such defects.^{3,6,8} Besides suffering a loss of vision, these patients become esthetically and psychologically handicapped.^{2,9,10} They feel a lot of embarrassment and are not well accepted in society. Not all such defects are amenable to surgical correction. In such cases, a prosthetic eye can prove beneficial. This may involve replacing the entire eye or simply an indwelling eye that replaces the outer scleral portion.

A multidisciplinary approach including a prosthodontist, ophthalmologist, surgeon and maxillofacial prosthetist should be considered for an esthetic and stable outcome.^{2,4-6}

Indwelling eyes are made to fit precisely the confines of the ocular socket of the patient. They mainly comprise of the sclera and iris and are colored and polished to make the prosthesis look natural. They not only provide esthetics, but also protect the eye cavity, thereby preventing infections.

Techniques for making these ocular prostheses vary from simple

to complicated. These eyes can be prefabricated or custom made, the latter offering better fit and esthetics.^{2,4-6}

Presented here is a simple technique for ocular rehabilitation which takes but a few hours, yet is very effective and satisfactory resulting in prosthesis that is almost monomer free.

CASE REPORT

A 35-year-old female patient reported to the Department of Maxillofacial Rehabilitation with a defect in her right eye. The defect was caused by trauma due to a projectile injury during her childhood. On inspection, the sclera and iris were not completely present indicative of a pthysical eye which left behind only the socket with the eye lids intact [Figure 1a]. No inflammation was present. The muscle function of both the upper and lower eyelid seemed normal. Like many such situations encountered at our unit, the only option available for the patient was a prosthetic eye. Consent of the patient was taken for the procedure.

METHOD OF FABRICATION OF THE OCULAR PROSTHESIS

Impression tray selection

A stock acrylic ocular impression tray or old conformer was selected to fit into the confines of the socket. The patient

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needs to be in a relaxed position to provide a natural drape of tissues. Modifications were made to achieve the correct shape and contour of the eye reducing any overextensions. The margins were smoothed with the help of a finishing bur (Prisma Finishing Bur #T-6) to prevent any irritation to the tissues inside the socket [Figure 1b].

Impression

The patient was made to look straight and keep all facial muscles relaxed. A very runny consistency of alginate (one-third greater quantity of water than recommended, water powder ratio - 52 ml: 25 gm) was injected into the impression tray with a syringe through the inlet. It was slowly filled into the defect to prevent overfilling. A little amount flowing out through the inner canthus indicates adequate material filling of the socket [Figure 1c].

The impression was gently removed first by massaging the lower lid downwards and away from the nose first and then sliding the impression out from the upper eyelid in an arc like path. The impression was then washed and disinfected with Revita lens solution (Ocutec, UK).

Making a wax pattern

A silicone putty index was made of the impression. Once it set, it was cut open and a light yellow wax (Technovent Ltd, South Wales, and UK) was flown through it. On hardening, the wax pattern was gently retrieved, cooled in cold water and smoothed with the help of a carver and gauze [Figure 2a].

The tissue/fitting surface of the wax pattern was not manipulated at this stage. The wax pattern was then tried in the patient's

eye for fit, comfort, bulkiness of the pattern and drape and mobility of the eyelids. Necessary adjustments were made. Corneal prominence was checked for by standing behind the patient, retracting her eyelids and making her look downward. Mild blepharospasm was experienced and the patient was given a few minutes to adjust to it.

Attaching the iris

An iris coinciding with the size of the adjacent eye (range 11-13 mm with an average of 12 mm) was adjusted in the wax pattern to replicate the 'normal gaze position'. The patient was made to look slightly medial and downward at this stage. The position of the iris can be checked and verified by observing the point of the iris by standing behind the patient and in front, about 9 feet away [Figure 2b].

Fabrication of base sclera shell

The wax pattern was then flaked in a two-part flask using dental plaster. Once it set, the wax pattern was removed and the flask was packed with Scleral Polymer (J-510, heat-cured acrylic resin mixed with J 570 monomer (Technovent Ltd, South Wales, UK). A separating medium Unifol (Perident, Italy) was used to facilitate easy removal.

Curing protocol: A modified curing protocol, referred to as 'reverse curing' as has been reported by Jorge and co-workers¹¹ was followed to minimize monomer content from the acrylic eye. In this technique, the flask is placed in



Figure 1a: Pre-treatment presentation



Figure 1c: Ocular impression making



Figure 1b: Ocular impression trays



Figure 2a: Fabrication of the trial wax shell

water at 95°C for 20 minutes and thereafter in boiling water for an additional 20 minutes. The flask was then held under running water to cool it. The acrylic was retrieved and about 1mm of the acrylic surface was trimmed down and the black iris was reduced to make it almost flat corresponding to the level of the iris plane of the natural eye. The margins of the acrylic prosthesis were rounded off and the entire prosthesis was smoothed out.

Coloring of the sclera shell

The iris was colored using pigments (Grumbacher Oil Paints, Technovent Ltd, South Wales, UK) or acrylic paints and clear light cure material (Optiglaze, GC, Europe). It was done with the patient sitting in front of the clinician so that the color of the contralateral eye can be matched accurately. Coloring of the shell is generally done in natural daylight. The pupil was added as a small black dot in the center of the iris. The base color was applied first and then other highlights were applied layer by layer with fine strokes, resembling the spokes in a wheel. Optiglaze (GC, Europe) was mixed as a medium with the paints and cured by a dental composite resin curing LED (3M ESPE). The colors were artistically painted and cured layer by layer preventing the mixing of shades. A fine line merging the iris into the sclera was indicated by painting the limbus. The color of the sclera was

matched to the adjacent eye and veins (red nylon fiber) were added replicating blood vessels to give it a natural look. A thin layer of Optiglaze was added as a final coating and light cured to seal the paint [Figure 3a].

Overlaying clear resin and finishing

A layer of clear resin (J-600 Clear Polymer -powder with J-570 Acrylic Monomer (Technovent Ltd, South Wales, UK) was added onto the painted eye by packing it back into the original mold. The clear resin filled the portion between the iris and mold which was trimmed back earlier thus giving a depth to the prosthesis making it look natural. This was subsequently cured again following the same curing cycle as mentioned above. Reverse curing in this fashion helps eliminate excess monomer, thereby preventing any of its documented side effects [Figure 3b].

Rough edges of the prosthesis were trimmed off. It was polished with the help of polishing burs, pumice and a buff to give the prosthesis a natural glossy finish [Figure 3c].

The patient was taught how to place and remove the prosthesis. Instructions regarding the care and hygiene were very simple

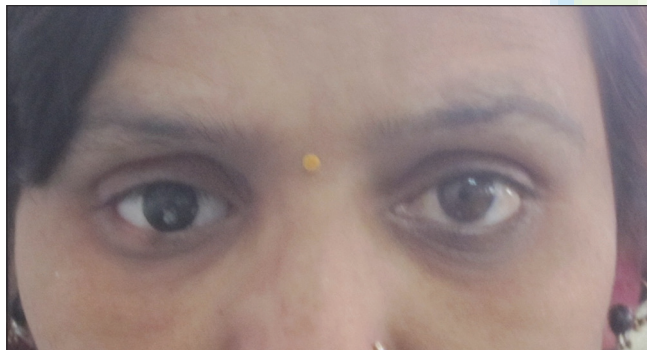


Figure 2b: Iris adjustment by making the patient gaze ahead

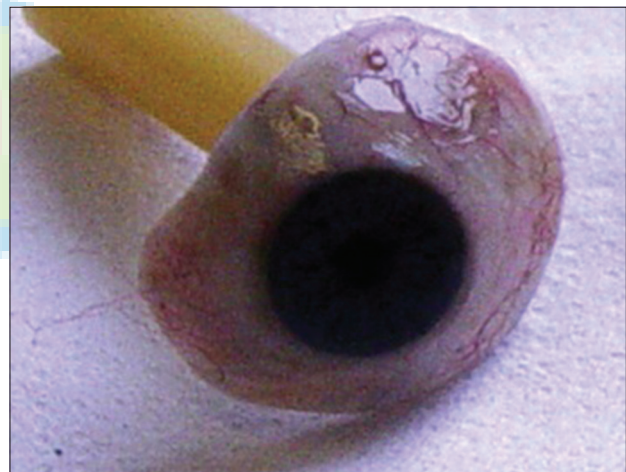


Figure 3a: Coloring of iris and sclera



Figure 3b: Ocular prosthesis (layer of clear acrylic resin added)



Figure 3c: Custom ocular prosthesis *in situ*

to follow and can be executed by the patients. Repolishing of the prosthesis may be required on a timely basis and this was explained to the patient.

DISCUSSION

The prosthesis, though not functional, is a very suitable esthetic replacement for such patients. It restores self-confidence in patients and prevents social embarrassment. This technique describes the fabrication of a prosthesis with materials that are easy available and regularly used by Maxillofacial Prosthetic personnel and Ocularists. The procedure ensures a good fit of the artificial eye and a good natural esthetic outcome. The `reverse curing` protocol ensures elimination of the residual monomer by curing at an increased temperature, compared to previously documented techniques.¹² The double curing procedure followed involves curing the base eye shell initially and then a second curing cycle for the thin clear superficial layer. Jorge *et al.*¹¹ have demonstrated the superiority of the reverse curing procedure in its application for denture fabrication. The ocular prosthesis being a significantly smaller prosthesis would naturally be more completely cured, with minimal free monomer. The authors have not had a single case of allergic reaction to the constituents of the eye, despite treating many patients in India, other Asian countries and many parts of North and Central Africa. 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.

It must be remembered that it is not possible to make prosthesis in all cases. Other treatment options like surgery or sometimes performing no treatment may be chosen in some cases.

CONCLUSION

A prosthetic eye is useful in patients with scleral defects and helps restore esthetics. It also goes a long way in completing

psychological rehabilitation in situations where loss of vision is permanent.

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