

REVIEW

Quick Response Code



doi: 10.5866/3.4.687

## Nuances of Custom Ocular Prosthesis Fabrication

Hariharan Annapoorni<sup>1</sup>, Gaurav Gupta<sup>2</sup>, Sai Prasad S H<sup>3</sup>

**Professor and Head<sup>1</sup>**

**Post graduate<sup>3</sup>**

**Department of prosthodontics, crown and bridge and Implantology Meenakshi Ammal Dental College, Maduravoyal Chennai-95**

**Reader<sup>2</sup>**

**Department of prosthodontics, crown and bridge and Implantology Guru Nanak Dev dental college SUNAM, Punjab**

**Article Info**

**Received: July 10, 2011**

**Review Completed: August, 12, 2011**

**Accepted: September, 11, 2011**

**Available Online: January, 2012**

© NAD, 2011 - All rights reserved

**ABSTRACT:**

Patients requiring treatment with custom ocular prosthesis are those who have lost ocular structures through orbital evisceration or orbital enucleation which was necessary as a surgical intervention for a congenital defect, pathology or an accident.

The loss of an eye causes disfigurement of the face due to which the patient become emotionally weak and conscious and avoid taking part in social events, which in turn causes anxiety, stress and depression at an early age in life. Recovery after the loss of an eye requires an adjustment to mono-ocular vision and improvement of the appearance with the use of artificial eyes carefully prepared to match the remaining natural eye. This present article is a methodical approach for fabrication of artificial eye called ocular prosthesis. The custom made ocular prostheses are very comfortable and help one improve their appearances, which in turn, encourages them to build up their self-confidence to return back to their social life.

**Key words: Ocular Prosthesis, Orbital Prosthesis, Maxillofacial Prosthesis etc.**

**Introduction:**

Ambroise pare-a French man was the first to make glass and porcelain eye. Germany became the leading producer of glass eyes, but when the world war broke out, Germany stopped the supply of glass eye to the rest of the world. United States undertook a research to find an alternative and the result was an acrylic eye<sup>1</sup> The glass eye had number of disadvantages. They were a) Highly fragile, b) Explode spontaneously, c) Surface of the glass eye was affected by socket fluid and d) Adjustments were difficult.

So the plastic eyes were an instantaneous success. The advantage of plastic eyes were a) not

very fragile, b) adjustments could be easily accomplished, c) various features could be adopted to meet individual esthetic requirement like the determination of Corneal and pupil diameter, and painting of conjunctival vessels etc d) A 3D effect can be obtained and e) easy to teach. The fabrication of an artificial eye is necessary whenever an eye has been removed or missing.

Removal of eye may be done by Evisceration or Enucleation or Exenteration<sup>2</sup>

Evisceration is the removal of the eye and the intra ocular contents, having the sclera and the optic nerve intact, while Enucleation is the removal of eye in Total as in the case of malignant Neoplasm's or eyes extensively damaged by injury.

Email for correspondence:  
poo1962@gmail.com

Exenteration - is the most radical in which the entire contents of the orbit including the eyelids and the surrounding tissues are removed leaving a large exposed cavity

Evisceration has certain advantages over Enucleation, namely

- the orbital volume is preserved
- has better cosmetic results
- psychological acceptance is better

### Examination of the patient:

Like in any other prosthesis, before actually starting the procedure the patient must be evaluated and examined.

Evaluation consist of

- Physical
- Psychological
- Patient's expectation related to proposed prosthesis.

Presentation of the patient may be with the

- Conformer or existing prosthesis.

After removal of the conformer or existing prosthesis the socket must be thoroughly examined. Examination of the internal anatomy of the socket should be done in resting position and full excursive movement of the eye musculature. The socket reveals conjunctiva covering the posterior wall. Thorough check must be done for healing and presence of adhesions if any. The depth of the fornices must be checked. The Anaopthalmic socket is "Triangular is outline".

The most acute apex of the triangle is directed at the nasal aspect and resolves into the medial canthus. In this region there is a reddish elevation in the lacrimal caruncle. The next most acute apex is directed superiorly. The most rounded apex of the triangle is in the inferior lateral position.

### Technique

The patient's history, including the details of the loss of eye was taken. This is very important because if the eye loss was due to any malignancy then one has to be alert for any evidence of recurrence during initial and subsequent visits. The eye socket was then examined to check for complete healing of the surgical wound and also to see if any oedema and inflammation existed. As a first step in the fabrication of custom ocular prosthesis, 1-2 drops of 0.5% tetracaine hydrochloride was instilled in to the defect and allowed to take effect for 15 min (Fig1). Once the anesthesia had taken effect stock ocular tray of appropriate size was selected and positioned over the defect.



Fig1: Topical Anaesthesia

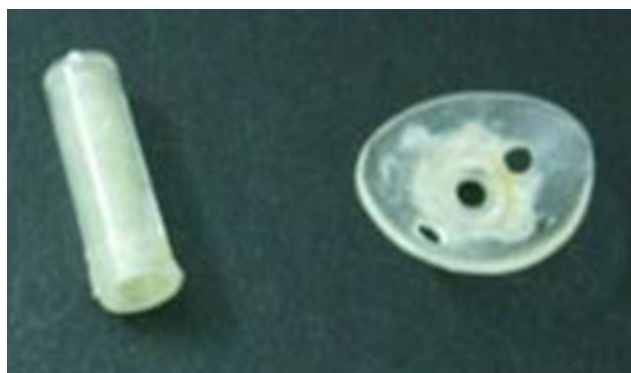


Fig 2a: Stock Ocular Tray



Fig 2b:

As is seen on the picture(fig 2a), the tray has two parts the ocular part (concave) and the stem with a through and through orifice in the centre. The tray in picture is broken on purpose to show the parts.

**Impression procedures:**

Before making the impression, the patient has to be seated upright, with the head supported in the head rest. This position allows natural positioning of the palpebrae and surrounding tissue relative to force of gravity.

Next the tray should be positioned in such the manner that it supports the lids. The stem of the tray should be parallel to the imaginary line drawn perpendicular to the pupils(fig 3).



Fig 3: Positioning of Tray Over Defect

Ophthalmic quality Hydrocolloid is mixed and loaded in a 10ml syringe and sufficient quantity is injected to elevate the lid contours similar to normal contours. The impression is carefully removed and checked for voids and defects and washed well. The impression is replaced in the defect, to check proper lid contours and the patient is asked to move to the left, right, up and down without moving the head. If the impression was properly oriented and extended in all available areas, **“the stem of the tray would follow the movement of the pupil of the natural eye”**.



Fig 4a: Reading The Impression



Fig 4b: Investing The Impression

Once an acceptable impression is obtained(fig 4a and b), it is invested in a thin mix of alginate in a small disposable tea cup. Syringe alginate can be used for this purpose.

The invested alginate is retrieved from the cup. An incision is made in the mold with a sharp scalpel extending from the superior aspect, along the stem of the impression through and through to the bottom of the mold. The mold is spread apart, the impression and tray is removed (fig 5a and b).



Fig 5a: Mould Spread Apart

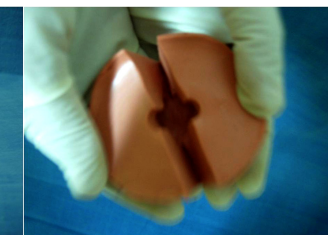


Fig5b: Impression And Tray Removed

**Preparation of wax pattern:**

The assembly is placed back in the cup. The resulting hole in the mold, formed by the stem of the tray is used as a sprue for filling the mold with molten wax. Tooth carving wax blocks are broken in to chips, melted and poured in to the mould(fig 6).



Fig 6: Mould filled with wax



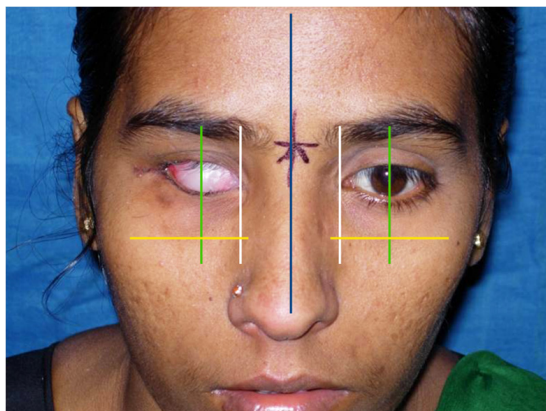
**Try in of the wax pattern:**

The wax pattern is now retrieved from the mould. This forms the wax sclera pattern. The scleral pattern is tried in the patients defect area(fig 7) and extensions in to the fornices are checked. Areas of under extensions are covered using modeling wax.



**Fig 7:** Wax Scleral Blank Tried in the Patients Defect Area

The size of the cornea is determined using an Intra Pupillary Distance scale. The distance between the medial canthes of the normal eye and the periphery of the cornea is determined(fig 8). This is then transformed correspondingly to the scleral pattern. A horizontal line is drawn to indicate the lower border of cornea. The resulting "L" shaped line (green and yellow) gives the approximate size of the cornea.

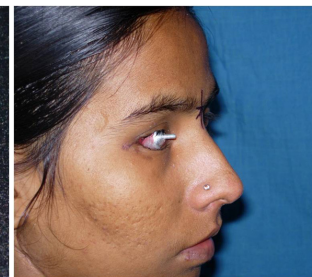


**Fig 8:** Determining Size of Cornea

We now attach the Aluminum corneal buttons on to the wax sclera. The patient is asked to gaze straight forward. The position of the stem should approximate the position of the pupil (fig 9a and b).



**Fig 9a:** Aluminium Corneal Buttons



**Fig 9b:** Aluminum-corneal Button Implanted

**Acrylisation:**

The entire assembly is invested in dental stone and then dewaxed(fig 10a and b).The Aluminium (Al) corneal button is removed after dewaxing.

Fabrication of cornea (IRIS) can be done by different methods.

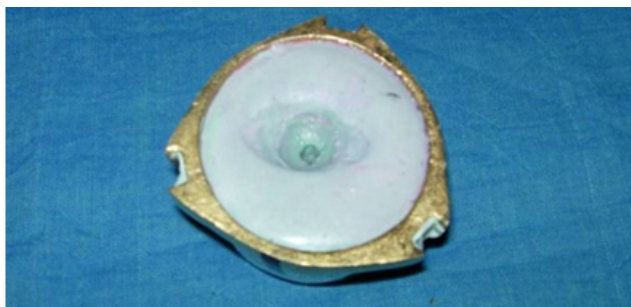
1. Direct painting tech
2. Cellulose disc tech
3. Paper disc tech

Here we are going to follow the direct painting technique. The next step is to the select a corneal button made of acrylic. The corneal portion of the button is painted black or dark brown.

For painting, artist's oil pigments of high quality can be used or dry powder colour can be used, The PMMA corneal buttons are placed in place of the Al.buttons (fig11a).



**Fig 10a:** Investing and Dewaxing



**Fig 10b**

Heat cure resin mixed with titanium white is packed in to the mould(fig11b). Resin is polymerized, Prosthesis retrieved and stem cut off (fig12). It is then tried in the patients defect. The surface is gently trimmed off(fig13).



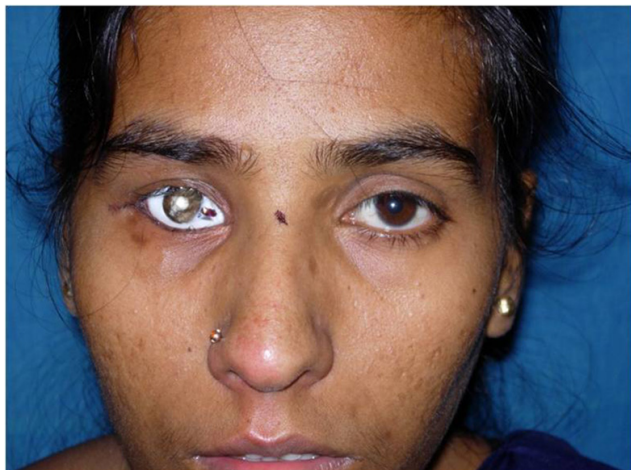
**Fig11a:** PMMA Corneal Button Placed.



**Fig 11b:** Heat Cure Resin Packed



**Fig 12:** Resin Is Polimerised Prosthesis Retrived And Stem Cut Off



**Fig13:** Prosthesis Tried In The Patients Defect

**Finishing of prosthesis:**

The final painting is done with a variety of colors. The choice of colors being:

- Titanium white
- Ivory black
- Yellow ochre
- Burnt umber
- Crimson Red
- Cerullean Blue

The normal eye is studied, under natural light (fig14) and painting is started from the periphery of the iris.

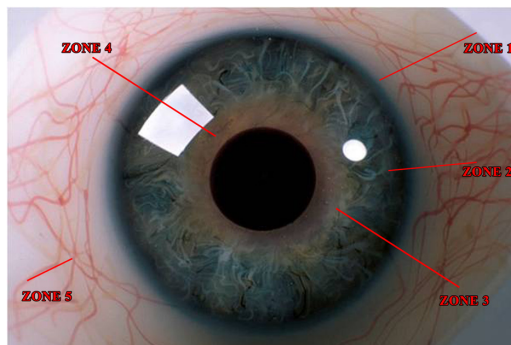
Zone 1: Colour within the limbus and is called the background.

Zone 2: Zone around the pupil which is immediately next to zone1

Zone 3: Radiating delicate structures of the iris-see normal eye with torch.

Zone 4: Immediately surrounds the pupil looks like halo of the pupil.

Zone 5: scleral painting.



**Fig 14:** Painting Zones



**Fig 15:** Study Normal Eye Under Natural Light



The painted eye is compared with natural eye under normal light(fig15). Further scleral painting is carried out(fig16).



**Fig 16:** Scleral Painting

The painted prosthesis is allowed to dry for 1/2hr-1hr and boiled in hot water. It is then removed and replaced on the lid of the flask. The counter where the corneal button was placed is scraped gently to allow placement of clear acrylic resin layer.



**Fig17:** Painted prosthesis placed on the lid

Heat cure is mixed in the ratio 3:1(do not mix with any instrument-allow powder to settle gradually in to liquid and let excess powder stay on top. Allow the mixture to stand a little more than dough stage and then pack over cellophane sheet to avoid paint from smudging after 5-10min remove the cellophane sheet, and allow polymerization by gradual rise of temperature and final boiling). The prosthesis is removed trimmed and polished. The prosthesis is inserted in to the patients defect(fig 18).



**Fig 18:** Prosthesis Inserted

### Instructions to the patients:

The patient should be instructed well regarding handling and care.

- a) During insertion, the patient must look at himself in a mirror and evert the lower eyelid and insert the lower part the prosthesis well in to the fornices.
- b) Holding the prosthesis, patient should be instructed to lift the upper eyelid and complete insertion of prosthesis. The patient is instructed to blink gently to ensure complete seating.
- c) Sometimes the eyes may become dry and this may result in irritation. The patient is asked to use the artificial tears-refresh tears-prior to insertion of prosthesis. The prosthesis should be removed everting the lower lid first.
- d) A great deal of subtractive adjustments is contra indicated for the first few days after placement unless obvious irritation are detected.
- e) The patient should return in 1 day, 3 days and one week for follow up.
- f) There is no need for the patient to remove the prosthesis except for cleaning. Once a week the prosthesis should be removed by the patient and cleaned with mild soap and rinsed well.
- g) The prosthesis should be inspected for scratches or deposits, if any are noted the patient should return to have the prosthesis repolished.
- h) The patient should return at about six month's interval to have the defect and the prosthesis evaluated and adjusted if necessary.

### Summary

Rehabilitation of patients who have suffered the psychological trauma of an ocular loss require a prosthesis that will provide the optimum cosmetic and functional result as early in life as possible. The custom made ocular prosthesis is recommended as an effective alternative form of treatment. Ocular prostheses produced by this method are the most aesthetic and comfortable and they should be provided for all patients who require such prostheses.

### References:

1. BeumerJ, Curtis TA. Maxillofacial Rehabilitation. Prosthodontic and Surgical Considerations; 431-449.
2. Satyabodh S. Guttal et al: A Simple Method of Positioning the Iris Disk on a Custom-Made Ocular Prosthesis. Journal of Prosthodontics 2008; **17**:223-227.