

# Customized Ocular Prosthesis Simplified Using Pupillary Distance Ruler - A Case Report

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**Abstract:** *The purpose of rehabilitation of a lost eye is to restore the esthetics and self-esteem of the patient. The success depends on proper orientation of iris and proper shade and fit of the prosthesis. Various methods had been proposed for the same. This article shows light on a simple and inexpensive method for positioning the iris with a pupillary distance ruler in a patient with enucleated eye along with simplifying the complex painting procedures by selecting iris from stock eye and characterizing sclera with help of putty index.*

**Keywords:** Pupillary Distance Ruler, Putty Index, Customized, Ocular Prosthesis

## 1. Introduction

The unfortunate loss or absence of an eye could be caused by a congenital defect, irreparable trauma, tumor, a painful blind eye, sympathetic ophthalmia or the need for histological confirmation of a suspected diagnosis leading to surgical removal [1]. In the Indian subcontinent, trauma, tumors and congenital absence of orbit are the main causes of such defects [2].

Surgical procedures in the removal of an eye can be broadly classified as: evisceration (the contents of the globe are removed leaving the sclera intact), enucleation (the complete removal of the eyeball severing the muscles and the optic nerve) and exenteration (the entire contents of the orbit including the eyelids and the surrounding tissues are removed) [3]. Facial features and expressions are the most important non-verbal means of communication. Loss of any part of the face especially eye can cause severe mental trauma, affecting the patient's social and professional life [4]. Psychological distress and social stigma can be reduced effectively by timely replacement with an artificial ocular prosthesis. The ocular prosthesis can be initiated ten to fourteen days following surgery [5].

The iris should be bilaterally symmetrical; therefore, accurate placement of the iris modified from stock eye on the scleral wax pattern is critical as it is a technique-sensitive procedure hence visual assessment alone may not be adequate. An easy and accurate method to accurately position the iris can be done with a pupillary distance ruler (PD). The PD ruler is used to make prescription glasses and it measures the distance in millimeters between the centers of the pupils in each eye. The purpose of this case report is to document an easy method in fabrication of a customized ocular prosthesis and a simpler and inexpensive method in iris positioning using a PD ruler.

## 2. Case Report

A 65 year old male patient reported to department of prosthodontics, government dental college

Thiruvananthapuram with a complaint of missing right eye. Patient lost his eye due to trauma, after which eye was enucleated a year back. On examination it was found that the healing was complete with absence of any inflammation, the ocular muscle functions were also found to be normal for both eyelids. A custom made eye prosthesis was planned and treatment procedure was explained to the patient.

## 3. Method of Fabrication of the Ocular Prosthesis

### 3.1 Impression tray fabrication

A stock tray was made of acrylic by using a mould made in die stone from a stock eye (Figure 1). Needle cap with a patent opening was attached on to its surface which acted as the handle and a channel for injecting the light body elastomeric impression material into the socket. The impression tray was tried in and over extensions removed to prevent abrasions of the anophthalmic socket tissues as well (Figure 2).



**Figure 1:** Die stone mould.



**Figure 2:** Acrylic stock tray

### 3.2 Impression with addition silicone

After confirming the proper seating of the impression tray, poly vinyl siloxane light body material was injected through the inlet made on the needle cap into the socket. During the process of setting the patient was instructed to fix his gaze on a predetermined object placed at a distance and subsequently instructed to perform eye movements (Figure 3).



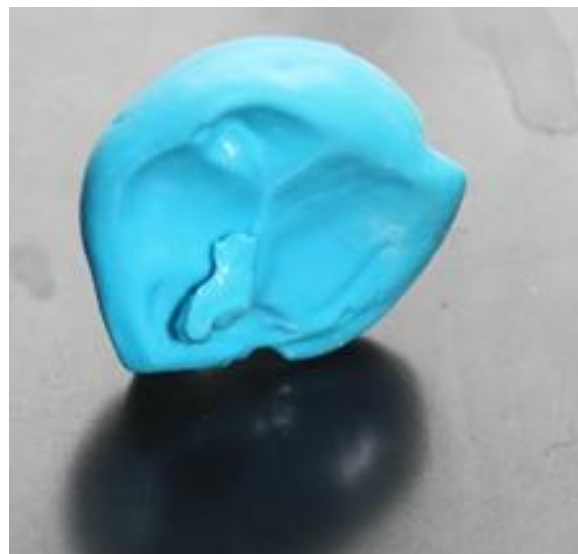
**Figure 3:** Impression procedure

Once the impression material was set, the patient was instructed to look up, then the lower eyelid was drawn downwards and the impression tray is lifted up with handle, the lower border of impression comes out of the socket so that air is allowed to enter behind the impression to make the impression removal easier and safe. Simultaneously the patient was instructed to look down and the tray was removed from the superior fornix while applying some controlled finger pressure against the upper eyelid. The removed impression was checked for any voids or under extended impression borders (Figure 4).

### 3.3 Wax pattern fabrication

A silicone putty index was made of the impression. Once it sets, it was cut open in such a way so as to remove the impression while the putty index borders could be retained properly (Figure 5). Molten modelling wax was then poured

into the putty index mould. On hardening, the wax pattern was gently retrieved, cooled and smoothed with the help of a lecron carver and gauze (Figure 6). The wax pattern was then tried in the patient's eye for its fit, comfort, fullness of the pattern and movement of the eyelids.



**Figure 4:** Light body impression

The support of eyelids was also checked from the lateral aspect and the projection of the eye was compared to the normal eye from a lateral view. Necessary corrections were done after the evaluations



**Figure 5:** Putty index of impression



**Figure 6:** Wax pattern





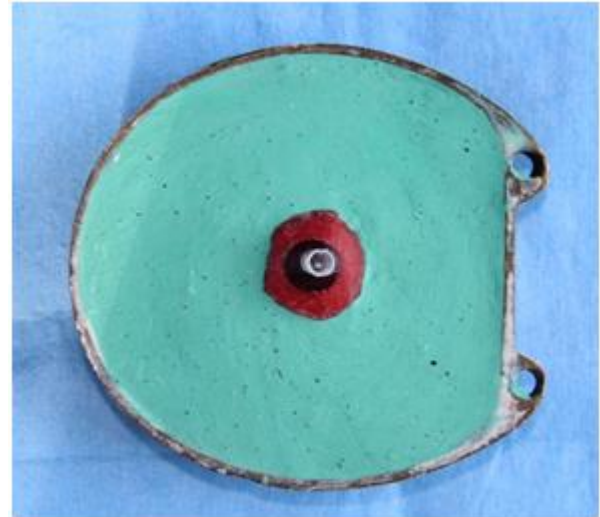
**Figure 7:** Iris positioning using PD ruler



**Figure 8:** Final trial with iris position

### 3.4 Iris positioning with PD ruler

A matching iris disk in size and color was taken from a stock eye by trimming off the scleral portion. Positioning the iris disk was done with the help of a PD ruler. It has got graduated scales in millimeters situated at the horizontal plane, relative to the axis of the patient's nose. Position the instrument on the patient by resting the notch on bridge of nose and adjust to accommodate the eye within the ocular aperture. The patient is asked to hold the position of the eye in a normal conversational gaze. Measure the orientation, pupillary distance, and medio-lateral dimension of the iris of natural eye from the graduated scale. Then take multiple readings until a consistent measurement is achieved. Later the measurements are transferred onto the sculpted scleral wax pattern (Figure 7). Finally orient the iris button in the marked area and evaluate the symmetry, and a natural-appearing gaze of the patient (Figure 8).



**Figure 9:** Orientation of iris while investing

### 3.5 Dewaxing and processing

A needle cap was attached to the iris disc of wax pattern. It was invested in dental stone in three piece dental flask using dental stone. Here the needle cap will help in the exact orientation of the iris disk after the dewaxing procedure (Figure 9). A clear heat cure acrylic resin powder was mixed with tooth coloured acrylic in different proportions to match the color of eye ball sclera of contralateral side. The resin shade is confirmed only after it is cured and then the same shade is finally used for ocular prosthesis fabrication procedure. The custom fabricated eye was retrieved and excess was removed for its accurate and comfortable fit (Figure 10).

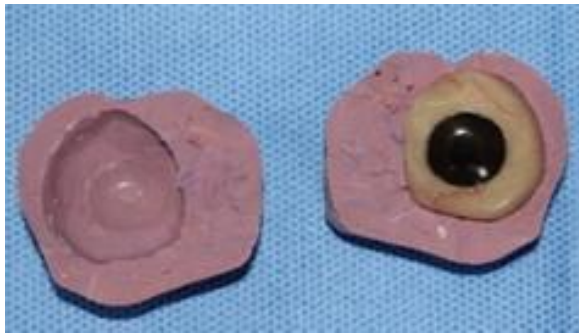


**Figure 10:** After processing

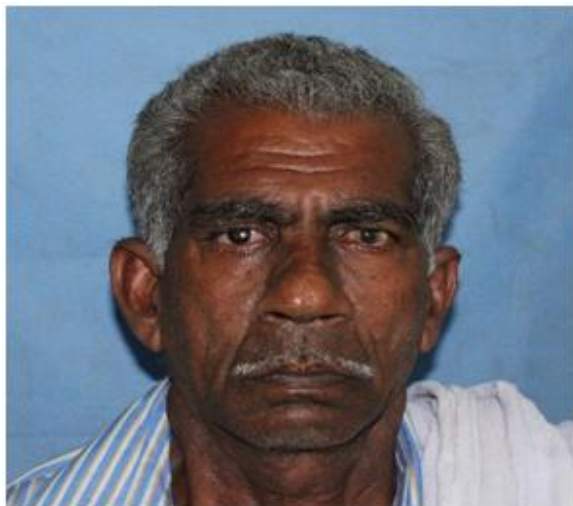
### 3.6. Characterization

Characterization was done by means of adding acrylic veins over the scleral portion. A putty index of the processed eye was made, and then a small thickness of scleral portion was trimmed off. Acrylic veins were mixed with self cure clear acrylic and applied on the scleral portion and placed inside the putty index and hand pressure was applied. Since only required amount of material was added there was no excess on the surface of the iris (Figure 11). Rough edges of the prosthesis were smoothed and then polished with the help of polishing burs, pumice and a buff to give the prosthesis a natural glossy finish.

The patient was taught how to place and remove the prosthesis (Figure 12). Removal of prosthesis is done by pulling the lower eyelid down, gazing overhead, and engaging the lower margin of the prosthesis with one finger, so that it is expelled downward into the hand. The prosthesis should be wetted prior to insertion with clean water every time. It is mandatory to remove and wash the prosthesis with soap and tepid water once a day to remove accumulated mucins and debris [4]. Repolishing of the prosthesis may be required on a timely basis and this was explained to the patient. Initial review was planned for few weeks or monthly basis appointments and later on after an year.



**Figure 11:** Characterization with help of putty index



**Figure 12:** Final prosthesis

#### 4. Discussion

Two options are available for artificial eye prosthesis, one is a pre-fabricated ocular prosthesis and the other is a custom-made one. Pre-fabricated prosthesis carries potential disadvantages of poor fit, esthetics and eye movements making the custom made prosthesis superior [6]. A custom-made ocular prosthesis replicates the orientation, natural color, contour, and size of the pupil and iris, providing symmetry and realistic appearance to the patient's face. It also improves the fit of the prosthesis by gaining the intimate tissue adaptation [7].

The most challenging step is the alignment of the iris in the artificial eye to achieve the correct inter-pupillary distance. The accurate recording of this measurement will influence the final esthetic outcome of the restoration. McArthur described use of an ocular locator and fixed caliper [8]. Benson suggested visual judgment, Pai et al proposed the

mounted graph grid for positioning the iris disk [9]. Roberts suggested the use of a pupillometer for precise alignment of the pupil in the eye prosthesis [10].

In this article a simple and easy way to position the iris with help of PD ruler has been presented along with an easy way to characterize the sclera with self cure acrylic with help of a putty index so that there is negligible or nil dimensional change in the final prosthesis. The PD ruler has markings from 20 to 40 millimeter which helped in the proper accurate alignment of the iris, requires less chair side time and armamentarium, less skill, easily available and inexpensive device. It is truly advantageous over the visual judgements, can be considered easy over the graph grid method as the graph cut outs and positioning is difficult and needs time; Customized scale for pupillary distance measurement is also time consuming and a relatively difficult procedure. The stock eye iris and characterization with putty indexing helped in overcoming the complex tedious painting procedures and techniques. The limitation is that in cases of facial asymmetry and nasal deformities this particular method cannot be used; the matching availability of the iris from stock eye is also found to be difficult.

#### 5. Conclusion

The custom-made ocular prosthesis of appropriate contour, accurate fit, adaptation, size, colour and comfort can provide good aesthetics resulting in restoring all functional movement of ocular muscles of the lost eye. Hence the fabrication steps were made simple and accurate with help of a PD ruler by characterizing using putty index.

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