

Custom-made ocular prosthesis: enhancing the iris position of post-evisceration patient

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Abstract

Individuals who have impaired vision as a result of illness or injury may have their appearance improved with the use of a prosthesis eye. To construct realism, symmetry, and a glance that appears natural, it is necessary to duplicate the size and arrangement of the iris with accurate pinpoint accuracy. This is crucial for developing a realistic-looking gaze. Eye loss has a profoundly debilitating impact on the mental state of the person who has suffered it. The ultimate goal of every ocular prosthesis procedure is to facilitate the patient's reintegration into society while preserving their healthy visage and self-esteem. This article provides a clinical report on the rehabilitation of a patient whose left eye had suffered intraocular foreign body damage following evisceration. A closer fit between the prosthesis and the ocular base tissue can be achieved with custom-made acrylic resin ocular prosthesis that are sized and shaped to fit the ocular socket of the patient. This close fit results in a more uniform distribution of pressure compared to factory stock eye prosthesis and is more cost-effective than stock eye prosthesis

Keywords: Ocular Prosthesis; Custom made; Evisceration; Artificial Eye

1. Introduction

The loss of an eye, whether due to trauma, cancer, or congenital defects, can have significant psychological and emotional impacts on an individual, affecting their quality of life and self-esteem [1,2]. This disfigurement can lead to aesthetic defects and noticeable deformities, resulting in the patient experiencing psychological challenges [3]. The emotional and psychological impact of such disfigurement can be substantial [4]. The use of ocular prosthesis has been shown to have a positive effect on patients' psychological well-being and confidence [5]. These prosthesis play a crucial role in aesthetic rehabilitation, addressing the physical and emotional problems associated with eye loss [1]. The use of ocular prosthesis is highly suggested, it can effectively replace the entire eye or a damaged part of the eye, such as the outer scleral portion, restoring the eye's appearance [3].

The procedure to make an ocular prosthesis needs a multidisciplinary approach [3]. Although the need of artificial eye can be fulfilled by some inexpensive stock prosthesis. The use of custom-made ocular prosthesis is particularly beneficial due to the individualized nature of each socket, requiring precise sizing and shaping of the prosthesis [4]. Custom-made ocular prosthesis allow for careful adjustment of iris positioning to match the patient's natural eye, thereby improving aesthetics and overall facial symmetry [6,4,7]

Various techniques regarding iris orientation in a custom-made ocular prosthesis have been advocated. The conventional use of visual assessment being subjective produces inaccurate results. A more precise means of

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measurement and recording is now available in an instrument called the pupillary distance ruler (PD ruler), which removes the operator bias that exists with conventional techniques [7]. The PD ruler is a precision instrument used to measure interpupillary distance in optometry for fitting eyeglasses. The instrument can effectively measure binocular pupillary distance as well as right and left individual pupillary distances. The method proposed in this article helps in accurate and predictable positioning of the iris in a custom-made ocular prosthesis using a PD meter [4].

In this case report will be explained the step of fabricating sinistra ocular prosthesis for a post-evisceration patient

2. Case Report

A 48-year-old female patient came to the Prosthodontic Department of RSKGM-P Universitas Airlangga, Surabaya, ask for a new left-eye prosthesis. She has been using the prosthesis since 2014. This is her second prosthesis (fig. 1). The initial prosthesis was utilized after the final surgical procedure, which took place in 2004. While at work, the patient experienced intraocular foreign body trauma. One week later, following a comprehensive evaluation by an ophthalmologist, the patient was diagnosed with endophthalmitis and orbital cellulitis. Antibiotic therapy was given for approximately 1 week but failed to produce the desired effect; consequently, evisceration was performed. The patient had no history of systemic disease.

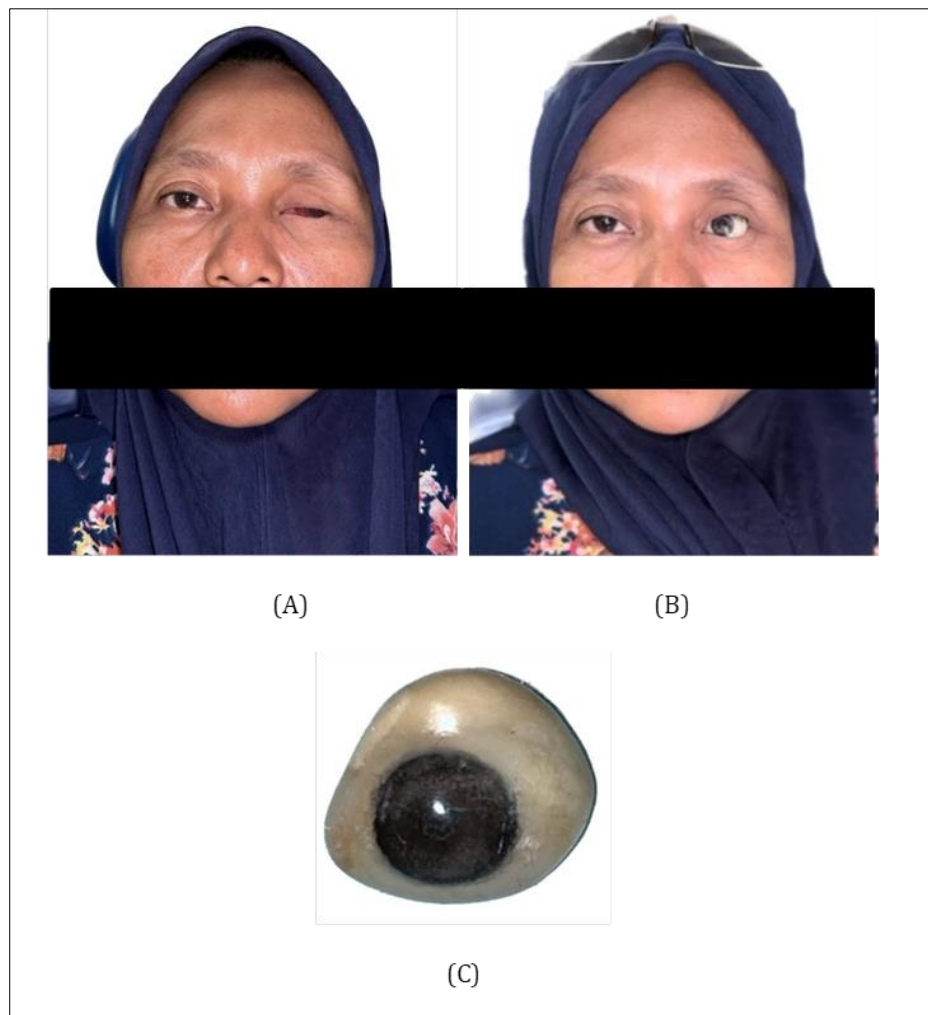


Figure 1 (A) Patient profile without wearing eye prosthesis, (B) Patient profile wearing old eye prosthesis; (C) Old eye prosthesis

2.1. Fabrication Method

First, the individual tray was checked for fitting in the eye socket of the patient (fig. 2). An impression of the eye sockets were taken using irreversible hydrocolloid material (alginate). The impression material was applied using a syringe until it was evenly distributed throughout the socket and the patient was instructed to close her eyes (Fig. 3)

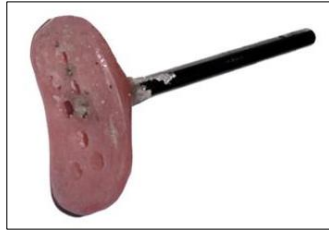


Figure 2 Individual tray to perform impression in eye socket

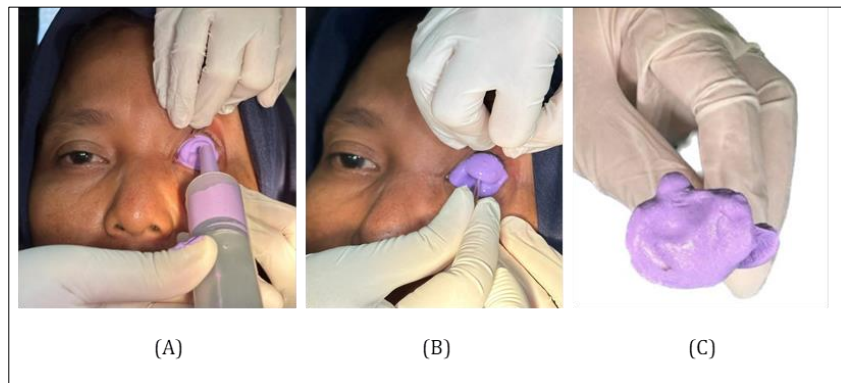


Figure 3 (A, B) The impression of eye socket, (C)The result of impression

The eye sockets were implanted into type II gypsum to obtain a mold to make a wax pattern. After the setting time, a mold was obtained that fit the eye socket of the patient (Fig. 4). The mold obtained was filled using the melted modeling wax (Cavex, Holland BV) and waited until it hardened. The wax pattern was then polished (Fig. 5).



Figure 4 The result of the implanting eye socket impression to make a mold



Figure 5 The result of wax pattern

The next step was try-in of the wax pattern. Minor corrections were made for the volume and convexity of the prosthesis, as well as the comfort of the patient when using the wax pattern. Once the patient was comfortable, the focal point and diameter of the iris was marked on the wax pattern according to the right healthy eye, along with the determination of the iris' colors (Fig. 6). The wax pattern was then invested into a cuvette containing type III gypsum and wax was removed to obtain a mold for making the sclera.



Figure 6 (A) Try-in process of wax pattern on patient, (B) measure the diameter of iris and determine the iris focal point

A scleral pattern was created based on the previous mold using self-cure acrylic material (Stellon) (Fig. 7). When performing a trial of the scleral pattern, corrections were made to the size and convexity of the prosthesis, as well as patient comfort when using the scleral pattern. Adjustments of the focal point and iris's diameter had also been made (Fig. 8). The scleral pattern was then cut according to the predetermined iris diameter width (Fig. 9).



Figure 7 The process of making sclera pattern



Figure 8 Try - in sclera pattern



Figure 9 Perforated the sclera pattern according to the width of the iris diameter

The scleral pattern then covered with a thin layer of modeling wax for the future heat-cured clear acrylic resin (Fig. 10). The wax-coated scleral pattern was invested into cuvette filled with gypsum. After the gypsum setting, the cuvette was opened and the wax was removed (Fig. 11). The blood vessels-like were added to the scleral pattern using a red thread (Fig. 12).

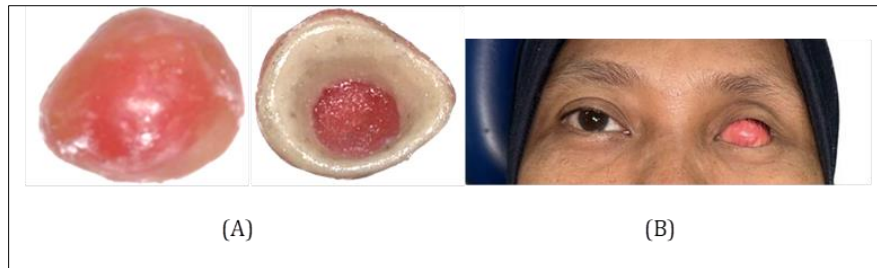


Figure 10 (A) Sclera pattern that has been coated with a thin layer of wax, (B) Patient try-in



Figure 11 The result of sclera implanting

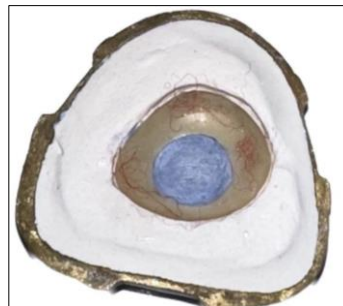


Figure 12 Making the looks of blood-vessels-like in the scleral pattern

The next step was covered the scleral pattern with clear acrylic. Cold mold seal (CMS) was first applied on the gypsum surface. The clear acrylic layer was using heat-cured acrylic from Probase Hot, Ivoclar Vivadent. Powder and liquid acrylic were mixed in a ratio of 22.5:10. After reaching the dough phase, the acrylic was applied to the cuvette and coated with a layer of wet cellophane plastic. The cuvette was closed and pressed until the excess acrylic came out, then the cuvette was re-opened and the excess acrylic was cleaned. Then the cuvette was closed again and pressing was carried out without a cellophane plastic layer. Subsequently, heat polymerization was carried out in the water at a temperature of 100°C for 45 minutes. After cooling, the cuvette was opened and the prosthesis was removed (fig 13 and 14).



Figure 13 Covering scleral pattern with clear acrylic into the pressed

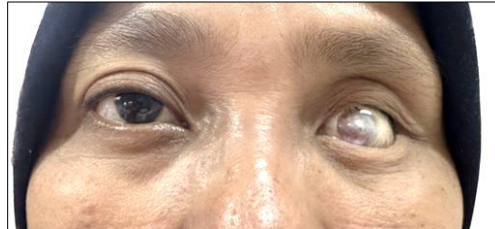


Figure 14 Patient try in

The staining step was started with perforating the pupil as much as 1 mm according to the patient's focal point. Staining of the iris was performed using oil paints and referred to the normal eye color of the patient (Fig. 15). The posterior part of the prosthesis was covered using self-cure acrylic and the prosthesis was re-polished to a glossy finish (Fig. 16). Once all the surface was smooth, the prosthesis was inserted into the eye socket. At the time of insertion, an evaluation of the stability of the prosthesis and the comfort of the patient when using the prosthesis were carried out. The patient said he felt comfortable. In daily use, patients were trained on how to remove and insert the prosthesis, along with instruction to remove the prosthesis only when it is cleaned. The prosthesis should be cleaned at least once a week using liquid soap and running water. Patients were instructed for routine follow-up every 3-6 months (fig.17).



Figure 15 The result of iris coloring



Figure 16 The final result of ocular prosthesis



Figure 17 (A) Patient profile without wearing eye prosthesis, (B) Patient profile wearing old eye prosthesis; (C) Patient profile wearing new eye prosthesis

3. Discussion

Making an ocular prosthesis that is made by duplicating according to the exact size, color, and natural contour of the ocular socket will result in the shape and color of the prosthesis that looks more natural and symmetrical to the patient [6,4,8]. An aesthetically pleasing artificial eye should replicate the alignment of the existing natural appearance, presenting difficulties in achieving a lifelike look, especially in placing the iris accurately, which is seen as the most challenging aspect [6,2]. The correct placement of the iris is crucial for the success of an ocular prosthesis as asymmetry can lead to a misaligned appearance [6,5,4]. The use of a PD meter for accurate registration of the alignment of an ocular prosthesis is advantageous due to decreased armamentarium and chairside time, reducing the inconvenience of lengthy clinical appointments and removing operator bias associated with conventional techniques [9]. This technique also requires minimal skill and is cost-effective, making it a practical choice for ocular prosthesis fabrication. The use of anatomical retention obtained from soft tissue structures around the eyes and eyelids contributes to the accurate duplication of the size, color, and natural contour of the ocular socket, resulting in a more natural and symmetrical appearance of the prosthesis [10,11]. The fabrication of custom ocular prosthesis requires careful consideration and follow-up to ensure proper fitting and orientation, emphasizing the need for ongoing monitoring and adjustment to meet the patient's needs [6,4,5]. The proper fit of ocular prosthesis is crucial for patient comfort and psychological well-being. Custom-made acrylic resin ocular prosthesis, tailored to the shape and size of the patient's ocular socket, provide a close adaptation between the prosthesis and the ocular base tissue, leading to a more even distribution of pressure compared to factory-stock eye prosthesis [8]. The use of custom-made ocular prosthesis not only enhances aesthetics and tissue health but also eliminates potential stagnation spaces on the tissue surface of the prosthesis base, which can lead to fluid accumulation, prosthesis instability, tissue irritation, and bacterial growth. This emphasizes the importance of custom-made prosthesis in promoting tissue health and reducing the risk of associated complications [12]. Additionally, the meticulous polishing and regular inspections of ocular prosthesis are essential to ensure a smooth surface, the absence of texture irregularities or scratches, and the prevention of discomfort, deterioration, and bacterial build-up [4]. Regular inspections of the prosthesis are essential during each visit to ensure its smooth surface and the absence of texture irregularities or scratches [8]. Additionally, evaluating the fit and comfort of the ocular prosthesis within the socket is important, involving an assessment of stability, discomfort, pressure points, and movement of the prosthesis [6]. Subjective feedback and objective measures, such as alignment, should be used to assess the patient's satisfaction with the ocular prosthesis [1]. Ocular prosthesis that precisely fitted and acceptable has several characteristics: preserves the shape of the damaged part or socket, prevents collapse or loss of eyelid shape, provides proper eyelid muscle action, prevents accumulation of fluid in the cavity, maintains the lid opening similar to the real eyes, mimic the looks, colors and proportions of real eyes. These characteristics make patient comfortable and satisfied with the result of prosthesis [13] Thus, the work of a prosthodontist is not only limited to making prosthesis mechanically but also requires skills in interacting and increasing sensitivity towards patients to form interpersonal interaction, a good interaction can make patients more cooperative in receiving treatments [11].

4. Conclusion

Loss of an eye affects emotions and psychology and even worse affects the quality of life. Proper use of ocular prosthesis is needed to increase self-confidence, quality of life and reduce psychological issues. Making ocular prosthesis according

to the sizes, shapes and looks of the real eye can be challenging. This article explores a simplified technique using a PD ruler for accurate and easy placement of the iris. This method is cost-effective, requires minimal skill and equipment, and reduces operator bias compared to conventional techniques.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participant included in the study.

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