Application of UV-resin in the fabrication of iris button to improve ocular prosthetic aesthetic

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ABSTRACT
Several methods for creating artificial iris are the use of iris from stock eyes, photo paper printing, painting with oil paints, and by implanting electronic components (dynamic iris). The oil painting method can produce an aesthetic 3D iris. However, when utilizing heat-cured acrylic resin to integrate the iris into the sclera, the use of a pressing machine when packing can distort the oil paint. This article is aimed to discuss the use of UV-resin material for iris fabrication can reduce the risk of distortion, reduce laboratory procedures, and produce an aesthetic iris. A 28-years-old male came to Universitas Sumatera Utara dental hospital with complaint of the previous ocular prosthesis felt loose and unaesthetic. Patient has been wearing the prosthesis for ±10 years and wants a new ocular prosthesis to replace the old prosthesis. Iris coloring is done with painting paper and oil paint, iris button is made with UV-resin using a pre-fabricated mold, then the iris is implanted into the sclera. The use of UV-resin for creating an iris requires only a few basic equipment and materials, has a quick-curing period, and facilitates iris position determination. It is concluded that fabricating ocular prosthetic with iris buttons made from UV-resin reduces the risk of laboratory failure and produces better esthetics.
Keywords: ocular prosthesis, iris fabrication, UV-resin

INTRODUCTION

The loss of an eye can cause functional and aesthetic impairment, followed by significant physical and emotional problems. The eye defects can be caused by congenital defects, trauma, or tumors.[1] Common surgical procedures of the eyes are evisceration, which removes the contents of the eyeball, leaving the sclera and cornea, and enucleation, where the entire eyeball is removed.[2] The presence of facial defects can cause significant stress to the patient. Therefore, rehabilitation of the eye defect with an ocular prosthetic should be started as soon as the healing is complete.[1] The resemblance between the ocular prosthetic and the original eye will increase patient satisfaction and help reduce impact on the patient's mental health after undergoing an enucleation or evisceration procedure. To achieve imperceptibility, when manufacturing the ocular prosthetic, the color of the iris and scleral vasculature must match the patient's original eye.[3]

Iris buttons can be obtained using several methods: using iris from stock eyes; using photo paper printing; hand painting with oil paints; and by using electronic components (dynamic iris).[1–7] The most popular and frequently used method in the manufacturing of iris is hand painting with oil paint. This technique is performed at the National Artificial Eye Service (NAES) and maxillofacial prosthetic centers by skilled ophthalmologists. The method of coloring by hand painting is still used because of its ease of adaptation and the ability to control color through color mixing when painting, but the result and quality depend on the skill of the ocularist.[3] Hand painting using oil paints can produce more aesthetic 3D irises compared to the stock eye methods, photo paper printing methods, and dynamic irises. However, the process of incorporating the hand-painted iris into the sclera using heat-cured acrylic resin (HCAR) requires the use of a pressing machine in the packing procedure, which can cause distortion to the oil paint on the iris. Therefore, UV-resin is used in the fabrication of the iris button to prevent distortion of the iris color.

CASE

A 29-year-old male comes to Universitas Sumatera Utara dental hospital with complaints that the old ocular prosthetic he is using feels loose and is not aesthetically pleasing because the ocular prosthetic looks inward, hence he wanted to make a new ocular prosthesis to replace the old prosthesis (Fig.1A). At the age of 3 years old, the patient's right eye was stabbed with a knife due to an accident, and has only been patched up without any surgical treatment. The surgical treatment, evisceration, was carried out when the patient was 19 years old (in 2021) due to the large protrusion in the patient's eye. Evisceration treatment was carried out at Adam Malik Hospital, then followed by the use of a conformer for 1 week before being referred to an ophthalmologist. The ocular prosthetic is done in one or two visits using stock eyes. The patient had used the prosthetic from 2011–2021 (10 years). From clinical examination, it was seen that the orbital socket mucosa was in good health.

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There was a deepening of the superior sulcus accompanied by ptosis, enophthalmos, and lower lid laxity. The patient's diagnosis was post-evisceration socket syndrome.

Figure 1 Patient profile; **B** primary impression

MANAGEMENT

Primary impression is taken by using a pre-fabricated-tray, made from self-cured acrylic and light-body polyvinyl siloxane material. Before the impression is made, the tray is inserted into the ocular socket to ensure the fit of the tray. Then, the patient is instructed to sit in an upright position with the head supported by the headrest. Petroleum jelly is applied to the patient's eyelashes to assist the separation from the impression material when set. The tray is then inserted into the eye socket and the PVS impression material is then injected in a slow manner. The patient is instructed to make ocular movements to capture the functional movement (Fig.1B).[8,9]

The impression is filled using the two-pour technique using a type IV dental stone. The first filling is done at the bottom of the mold, to the outermost point. After the bottom mold hardens, apply petroleum jelly on the surface of the dental stone and make orientation grooves, then proceed with the upper mold using type IV dental stone (Fig.2A). The wax pattern is obtained by pouring liquid wax into the mold. The wax pattern will then be sculpted according to the patient's original eye until a wax pattern that resembles the original eye shape and contour is obtained (Fig.2B).[8]

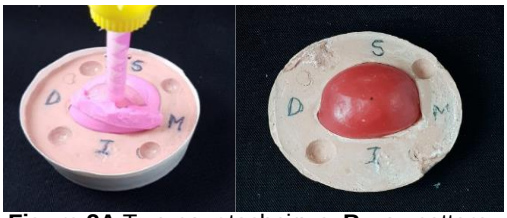

Figure 2A Two-pour technique, **B** wax pattern

After obtaining a wax pattern with the shape and contour that matches the patient's original eye, a duplicate of the wax/sclera from self-cured acrylic material is made and vacuumed in order to obtain a custom ocular tray that has the size and convexity that matches the patient's original eye (Fig.3).[8]

Final impression is made using the custom ocular conformer fabricated from the vacuum former

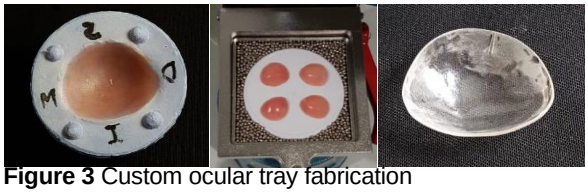

Figure 3 Custom ocular tray fabrication

Figure 4 Final impression procedure

Figure 5 Final impression mold

and light body PVS impression material. After insertion of the custom tray into the eye socket, the impression material is then slowly injected and the patient is instructed to perform functional eye movements, the acquired impression will be the final sclera shape (Fig.4). The impression is filled using the two-pour technique, using dental stone type IV. The mold is then filled with liquid wax to get the wax pattern (Fig.5).

The color of the iris and sclera is determined by using references from the original eye. The iris button is then made according to the color that has been determined, using painting paper and oil paint, and the iris button will then be made using UV-resin material using a pre-fabricated mold made using a vacuum former. The UV-resin is then cured using a UV lamp (Fig.6).

The wax pattern is then tried in the patient's eye socket to evaluate size, superior and inferior lid support, eye movement, and eyelid closure. Iris position was evaluated using the inter-pupillary distance ruler. For marking the position of the iris, the patient is instructed to look straight forward. The iris button is then embedded into the wax pattern and reinserted into the eye socket to confirm the iris position (Fig.7).[8,9]

The HCAR with a shade color that matched the patient's natural sclera was used to cast the wax pattern along with the iris button. After completion, the sclera and iris button are then reduced by approximately 2 mm in convexity. Sclera characterization was carried out by using red dacron fibers to simulate blood vessels to resemble the original eye.[9,10] A second casting was carried out to restore the convexity of the sclera using clear HCAR. The resulting ocular prosthetic is then polished, disin-

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Figure 6 Iris button fabrication using UV-resin

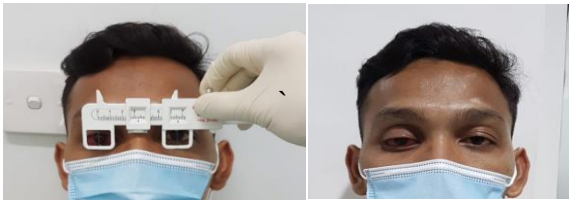

Figure 7 Iris positioning procedure

fected, and inserted into the patient's eye socket (Fig.10). The prostheses were evaluated in terms of esthetics, functionality, and comfort. Instructions were given for the maintenance and methods for insertion and removal of the ocular prosthetic.

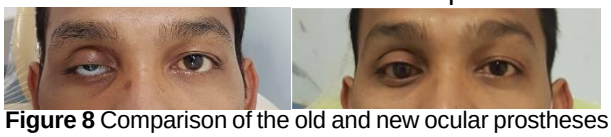

Figure 8 Comparison of the old and new ocular prostheses

DISCUSSION

In fabricating iris button, the stock eyes method, photo paper printing method, and electronic components (dynamic iris) methods will produce an iris without texture, making it less natural. In terms of function, the dynamic iris method is superior because the iris can dilate and constrict according to the ambient light. However, this electronic compoponent is still in the development stage.[4] The use of UV-resin in the fabrication of iris buttons in conjunction with the hand painting method can produce an aesthetic 3D iris button with a short curing time so a more natural and textured iris button.

Due to the UV lamp curing process and the absence of a press machine, which is often required when creating iris buttons from HCAR, UV-resin can be used to minimize the risk of distortion of the oil-painted iris. An additional advantage of using UV-resin is that it can simplify and reduce the laboratory processes required to fabricate an ocular prosthesis.

Due to its advantages, such as fast curing time, solvent-free formula, and low energy consumption, UV-resin base material has been widely used in various industrial fields such as coatings, printing inks, adhesives, dental composites, and photoresist. In this case report, the basic component in the UV-resin used is polyurethane acrylate (PUA) prepolymer. The PUA is one of the most widely used acrylic resins in the UV curing method due to its good abrasion resistance, flexibility, and hardness, as well as its solvent resistance.[11] The method for using UV-resin in the fabrication of an ocular prosthetic is safe to use because the iris button is sealed within the clear HCAR, and does not come into contact with the eye socket.

It is concluded that fabricating ocular prosthetic with iris buttons made from UV-resin will produce a more natural and textured iris button, reducing the risk of laboratory failure, simplified the laboratory process, and produces better esthetics.

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