Modified sculpted composite resin iris pattern for customized ocular prosthesis

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ABSTRACT
Patient with loss of eye demands natural ocular prosthesis for self-esteem and social intercourse. Iris texture and coloring technique are crucial procedure to recreate natural iris like the remaining eye. The purpose of this paper is to explain sculpting method using composite-resin to achieve natural iris pattern. A 29-year-old male came to Dental Hospital Universitas Sumatera Utara with chief complaint of demanding new ocular prosthesis because old ocular prosthesis had been used for 12 years, iris position was not good and not aesthetically pleasing. The modification is the use of a 12 mm diameter iris base made from light-cured composite resin then a thin layer of composite resin is placed evenly and texture of iris is sculpted directly on composite resin according to the designed pattern and then being light-cured again. Then coloring with acrylic paint according to the color of patient's left iris. The technique for duplicating iris is highly dependent on the operator's ability, both in color selection and iris patterning. The use of composite resin make it easier to get a good texture of iris pattern so as to facilitate coloring process with the ultimate goal of achieving an aesthetically pleasing ocular prosthesis. Patient was satisfied with his new ocular prosthesis.
Keywords: ocular prosthesis, iris pattern, sculpting, composite resin
This title has been presented in The 12th Biennial Congress of Asian Academy of Prosthodontics, 21 August 2021

INTRODUCTION

The loss of an eyeball is a particularly distressing event in a person's life since the eye is such a vital organ for vision and facial emotion.[1] Socket anophthalmia is characterized by the absence of the eyeball in the orbital cavity, as well as the lack of ectodermal and mesodermal tissue.[2] The prevalence of anophthalmia is 0.3 per 100,000 births.[2]

A congenital flaw, severe trauma, tumor, sympapathetic ophthalmia, or the requirement for histological analysis to establish a specific diagnosis can all result in the loss or disappearance of an eye.[3] Evisceration, enucleation and exenteration are the 3 main surgical treatment options.[3,4] Evisceration is the removal of the contents of the eyeball while leaving the sclera and extraocular muscles. It can be caused by a congenital abnormality. Exenteration is the removal of the complete eyeball, including the orbital soft tissues, whereas enucleation is the removal of the entire eyeball while keeping other orbital structures (connective tissue, fat and muscles).[4] Enucleation is frequently recommended for patients with intraocular malignancies because it enables for histological investigation and the determination of whether the cancer has spread intraneural or extrascleral.[3] Only in situation of orbital malignant tumors that have spread to the eyelids is exenteration performed.[3]

Because eye loss has a psychological impact on the patient and his family, replacing an ocular prosthesis as soon as feasible is critical to aid the physical and psychological healing process, as well as increasing social acceptability.[5] An ocular prosthesis is an artificial substance that simulates the anatomy of the eye.[6] The major goal of this prosthesis thesis is to keep the eye socket's volume and generate a duplicate of the *normal healthy eye*.[6] The patient's morale will improve as a result of this prosthesis, as well as his or her psychological well-being. After the eye socket has healed, the ocular prosthesis can be made as soon as feasible.[3,6]

Many writers have recommended using watercolor, gouache, oil, automotive, or acrylic paint over card paper discs, and/or pure pigments in a monomer and polymer media over acetate discs or prefabricated ocular buttons for the artificial iris.[7] The iris' size ranges 11-13 mm, and the form of the visible iris is governed by the cornea's clarity. The iris seems somewhat oval in shape, which is covered by the limbus at the top and lower limits, despite its artificial anatomical structure.[8] The iris' surface is uneven, and when examined under a microscope, it seems to be a 3-D cloud.[8] Because of a variety of factors, such as a lack of technical expertise, characteristic and color of the ocular prosthesis are sometimes not perfectly matched with the remaining eye.[9] In the fabrication of ocular prosthesis, iris pattern and coloring is critical. This paper discusses about the modification of the iris button by sculpting the iris design before painting it with acrylic paint.

CASE

The major complaint of a 29-year-old male patient who came to the Department of Prosthodon-

DOI: 10.46934/ijp.v4i1.164

tics, Faculty Dental and Oral Hospital, North Sumatra University, was that the old ocular prosthesis did not fit in its place. According to the patient's anamnesis, he was shot in the right eye by an airgun 12 years ago, requiring an enucleation procedure and the placement of a stock eyes orbital prosthetic two weeks later. The orbital cavity looks to be in a deep distal defect, although the muscular mobility is still good, according to the examination.

In this case, a new ocular prosthetic with a favorable iris position is designed. Anatomical impression was done during the first meeting using a custom impression tray and hydrocolloid irreversible impression material (Fig.1). The anatomical sclera was waxed up after the impression was filled with type III dental stone.

Figure 1A Socket impression with hydrocolloid irreversible impression material, **B** the impression.

Figure 2A Final anatomical sclera wax up, **B** final impression with light body PVS material, **C** final impression result

Both convex and well-folded eyelids were visible after the anatomical sclera wax up was adjusted to the patient and slight adjustments were made until an acceptable shape was established. Following the final convexity established, a final impression tray was produced based on the findings of the final wax up. To get good detail, final impression was done with a light-body polyvinylsiloxane impression material (Fig.2). And then, type III dental stone is used to produce a mould.

The final scleral wax up was then matched again to the patient, and the IPD ruler was used to measure the midpoint of the patient's focus. Making the 12 mm diameter iris with 1 mm thickness from a composite resin (3 m, z350XT) material, light cure then a thin layer of composite resin is placed again and the pattern is created by sculpting the iris texture step by step directly on the composite resin material using LM-Arte Fissura. After the final pattern is sculpted, the composite is light cure again. And then coloring it with acrylic paint to match the color of the patient's iris in the left eye are the modifications done in this case (Fig.3).

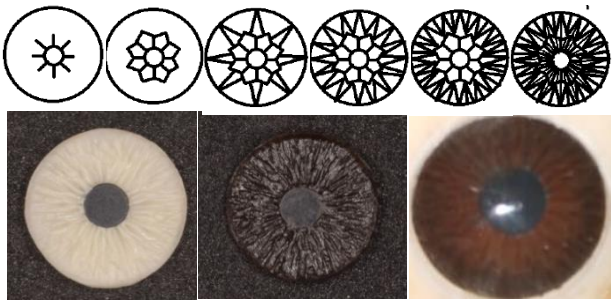

Figure 3A Step by step iris pattern sculpted with composite resin, **B** result of iris pattern, **C** coloring with acrylic paint, **D** iris button with sculpted composite resin

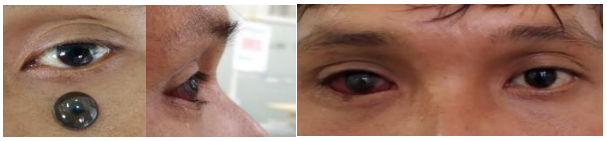

Figure 4A Iris button color matching the patient eye, **B** view from beside, **C** final check of sclera with iris button

Figure 5A Placement in cuvette, **B** dewaxing, **C** final ocular prosthesis after polishing

Figure 6 Comparison between **A** old ocular prosthesis, **B** before placement ocular prosthesis, and **C** final new ocular prosthesis

The iris button is compared to the left eye to determine the color. The color match the left eye. To confirm the position of the iris button and its convexity, the iris button was moved into the waxed final sclera with determined midline and transferred back into the eye socket. Then the waxed up final sclera with iris button is being evaluated as final check before packing procedure (Fig.4).

The waxed up sclera with iris button is then placed in a flask, and an acrylic rod is added above the iris button to keep it in place when compressed. After the dental stone is set, the dewaxing procedure is done to remove the wax and the cuvet was opened again and hot water was being poured to the mold to make sure no remaining wax is inside (Fig. 5). The first packing procedure was done with heat polymerized acrylic resin. After the packing, the 1.5

DOI: 10.46934/ijp.v4i1.164

mm thickness was removed from both clear acrylic on iris button site and acrylic from sclera site, then small red nerves were created on the acrylic sclera with red thread to mimic the blood vessels. Then, using the same flask, packing procedure was done once again with clear acrylic.

The finishing and polishing were done until the clear acrylic smooth and shine. During the insertion day, patient is subsequently instructed on how to correctly insert, remove, and clean his ocular prosthesis. To check adaptation, a recall was done one week, and a month later. The new ocular prosthesis had better aesthetic, good iris adaptation and position (Fig.6). Patient was satisfied with the final result.

DISCUSSION

The patient's psychological and physical issues would develop after the enucleation surgery. Enucleation should accomplish the following objectives: a comfortable socket can be placed on an ocular prosthesis that looks and moves like natural eye, a symmetrical appearance without superior palpebral sulcus deformity, no superior or inferior lid malposition; normal lid closure over the prosthesis.[10]

Both before and after surgery, making post-enucleation ocular prosthesis necessitates consideration. Conformer should be inserted as soon as possible following enucleation. The objective is to preserve the suture line, keep the fornix in place, avoid contractures, and make the patient as comfortable as possible.[10]

An ocular prosthesis is created after recovery, which normally takes 6-8 weeks following enucleation. The average duration of an ocular prosthesis is 5-7 years. The quality of the fitting will deteriorate as the prosthesis' lifespan increases, as will the soft tissue changes in the socket. When delamination, persistent inflammation, and significant mucus discharge develop, prosthesis should be replaced.[10]

Custom ocular prosthetic fabrication provides several advantages, better fit, retention, and the ability to match the color of the iris and sclera to other natural eye colors.[5] The color of the eye is usually not perfectly matched for a variety of reasons, including the variability of natural color and the ocularist's competence. As a result, the color of the eye must generally be colored in great detail, followed by the application of a clear acrylic coating.[9]

The iris coloring phase is a critical step in the creation of customized ocular prosthesis. The iris pattern, according to Prajwala, is extremely complex and one-of-a-kind.[11] The iris' surface is uneven, and when examined under a microscope, it seems to be a 3-D cloud.[8] The texture of the iris was achieved in this case by modifying the iris pattern with composite resin. The authors then adjusted the pattern based on these sources to make the texturing and coloring process easier. Composite resin used in this case is 3M, z350xt because composite resin was easy to be sculpted to precision detail before being light cure. The ocular prosthesis's ultimate result is good and aesthetic, and the work technique is simple to follow.

It is concluded that the goal of creating ocular prosthesis is to restore the patient's confidence, simplify things for them to socialize again, and maintain the socket health and from shrinking. To accomplish it, the ocular prosthesis must be same or similar to the other natural eye. The aesthetics of ocular prosthesis depend greatly on iris coloring. The fabrication of a thin, layered iris texture is one of the things that must be considered while coloring. As a result, changes were made to the iris pattern, which was sculpted using composite resin to create the iris texture and colored with acrylic paint in the color of the patient's iris. It is expected that this modification of the technique would make the texture and coloring of the iris easier to achieve.

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DOI: 10.46934/ijp.v4i1.164

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DOI: 10.46934/ijp.v4i1.164