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Rehabilitation of an Anophthalmic Socket Through Modification of an Existing Ocular Prosthesis: A Case Report

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Case Report

History

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ABSTRACT

Ocular prostheses play a crucial role in restoring both functional and esthetic outcomes for patients with anophthalmia. However, long-term complications such as iris discoloration are frequently encountered and often require clinical intervention. This case report describes the esthetic rehabilitation of a discolored ocular prosthesis in a 50-year-old male who had been wearing the prosthesis for three years. The discoloration, which compromised facial symmetry and patient confidence, was managed through a conservative and cost-effective approach. The procedure involved removal of the discolored iris, digital imaging of the contralateral eye, and fabrication of a new iris using high-resolution digital photography, followed by repolishing and reinsertion without altering the original scleral structure. The outcome demonstrated excellent esthetic integration and high patient satisfaction, eliminating the need for complete prosthesis replacement. This report highlights the clinical value of digital iris reproduction as a minimally invasive, time-efficient, and cost-effective technique for ocular prosthesis modification.

Keywords: Eye, artificial, iris, prosthesis coloring, photography

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Introduction

The eye is a vital organ and is part of the human senses that provide the ability to perceive our surroundings. The loss of a human eye is a traumatic process that has far-reaching effects on a person's mental, physical and social health.[1,2] Patients with eye loss or socket anophthalmia can result in devastating effects in the form of obvious physical abnormalities, not only impairment of visual function, but also psychological burden on the patient due to disfigurement, scarring, improper orbital bone development, and loss of facial symmetry if left untreated.[3] Ocular prostheses offer a viable solution by restoring the natural appearance of the eye, providing a sense of normalcy, as well as improving self-confidence, and quality of life.[4]

Ocular prosthesis manufacturing is a challenging and time-consuming procedure. Problems that may arise after several years of ocular prosthesis wear include a loose prosthesis or reduced retention, excessive mucoid secretion, decreased prosthesis motility, and discoloration of the iris that can affect aesthetics.[3,5-7] Loose-looking ocular prostheses may occur due to atrophic degeneration of the ophthalmic socket over several years.[6] Iris discoloration of ocular prostheses may result from exposure to ultraviolet radiation or other environmental factors.[8,9] Replacement of a new ocular prosthesis can be done after three to five years of wear. However, under certain conditions, replacement may be done earlier. Readjustment or repair of the old ocular prosthesis may also be required if there is discolorations or the shape of the prosthesis no longer fits the eye socket. In adults, the cause is usually atrophy or redistribution of the orbital soft tissues, while in children it is due to orbital growth and hence, prosthesis replacement may be sooner.[10]

This article describes a complete technique to repair a patient's existing acrylic ocular prosthesis without making a new one from scratch. The aim of this prosthetic rehabilitation is to return the patient to a normal cosmetic appearance as soon as possible while improving the patient's appearance and psychological outlook. This technique is expected to benefit the patient as it can save cost and time.

Case Report

The patient, a 50-year-old male construction worker, presented with a complaint of a discolored ocular prosthesis that was affecting his aesthetic appearance and causing embarrassment (Figure 1A). The patient had been using the prosthesis for three years. A thorough anamnesis and clinical examination led to the diagnosis of bulbus oculi sinistra loss due to trauma (Figure 1B). Patient consent has been obtained.

To evaluate the extent of discoloration in the ocular prosthesis, it was compared with the contralateral healthy eye (Figure 2). The discoloration was clearly visible, resulting in a mismatch with the color of the natural eye, which was the primary concern for the patient.

The patient's existing prosthesis was carefully molded to obtain the precise thickness, size, and volume of the original ocular prosthesis. This step ensures that the new iris fits accurately into the prosthesis, maintaining the original aesthetic and functional characteristics. A cuvette was used to mold the prosthesis to match the patient's eye socket dimensions (Figure 3).

Using a tungsten carbide bur, the clear acrylic covering the sclera and iris was carefully removed (Figure 4). A mark was placed at the midpoint of the pupil as a reference for positioning the new iris. This precision ensures the new iris aligns with the prosthesis' intended aesthetics and functionality.

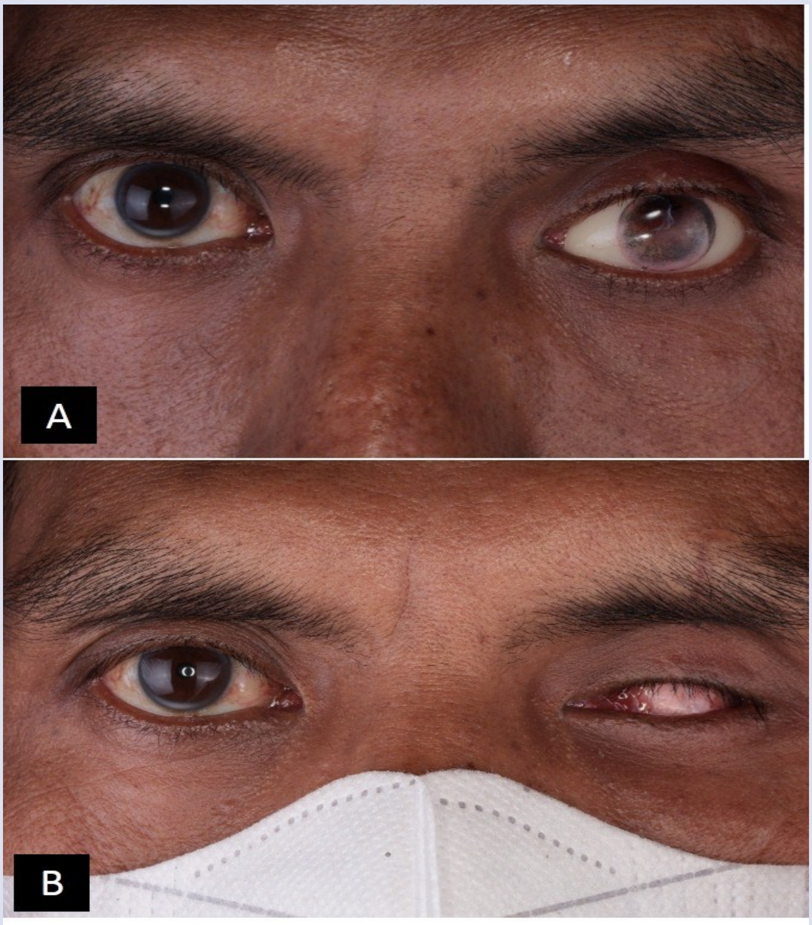

Figure 1. A. The patient's left eye with a discoloured ocular prosthesis. B. The patient with bulbus oculi of the left eye.

Figure 2. Ocular prosthesis with noticeable iris discoloration.

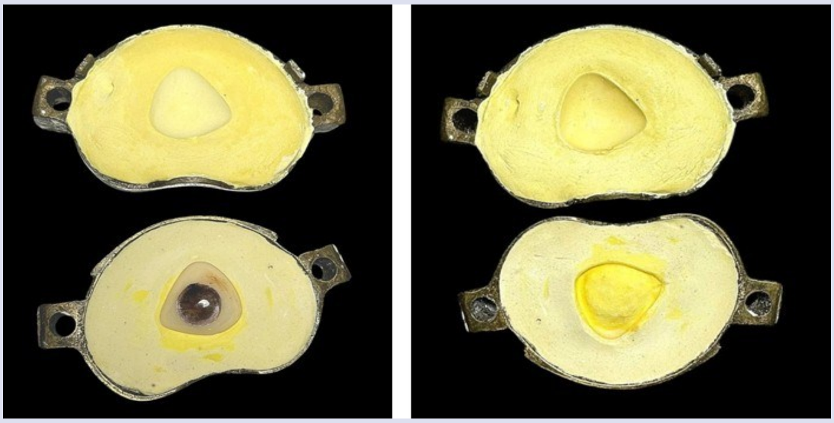

Figure 3. A. Molding of the old ocular prosthesis on the cuvette. B. resulting mold chamber.

Figure 4. Clear acrylic removed and the midpoint of the pupil marked for new iris placement.

Creation of a New Iris Using Digital Photography

- Step 1: A high-quality digital photograph of the patient's natural iris was captured using a Canon EOS RP Mirrorless Camera with a Canon Macro 100 mm Lens and a ring flash (Canon Macro Ring Lite Flash MR-14EX; Canon Inc) attached.
- Step 2: The patient was instructed to look directly at the camera and an assistant helped expose the iris by gently separating the eyelid. Activate the incandescent focusing lamps of the flash and position yourself in front of the patient. Capture the image and verify that the color is accurate. If the color needs to be adjusted, adjust the ISO number or the flash exposure compensation.
- Step 3: The photograph was edited in Adobe Photoshop 2022 to eliminate any reflections from the flash and to adjust color, brightness, contrast, and hue. The flash reflections were removed using the paint tool. To accommodate for pupil dilation caused by the patient being in low light prior to photography, the pupil size was reduced to a normal pupil range of 3 mm using the liquify tool. Slight colour and brightness adjustments were made to accommodate for colour shift during the manufacture process, with 10–30% desaturation and 0.5–0.9 decrease in midtones being applied (Figure 5A). The image was then ready for printing.
- Step 4: The iris image was printed using Decal USA 150g Transparent Sublimation Paper on an Epson L310 laser printer. Multiple iris prints were created, each slightly varying in color, contrast, brightness to establish a custom ocular shade guide and match the patient natural iris.
- Step 5: The printed iris was carefully compared with the patient's natural iris. The most suitable match was selected, cut to size, and attached to the marked iris section of the prosthesis. This ensured the new iris blended seamlessly with the patient's natural eye. Once complete, the new digital iris was sent to the dental and maxillofacial lab.

After some adjustments to ensure proper fit and alignment, a final layer was added to the prosthesis. A thin red silk thread was inserted into the prosthesis to simulate blood vessels, enhancing its natural appearance and adding realistic detail. A protective coating (G-Coat Plus, GC America Inc.) was applied over the sticker to protect the color. The next step involved packing the ocular prosthesis with clear methyl methacrylate resin. The flask containing the prosthesis was then placed in a water bath at 100°C for polymerization for 1 hour. This ensures that the acrylic hardens properly, providing durability and a natural aesthetic finish. Once polymerized, the excess material was carefully removed, and the prosthesis was polished to achieve a smooth, glossy finish. This final step is crucial for ensuring that the prosthesis not only looks natural but is comfortable for the patient to wear (Figure 5B).

The repaired prosthesis was carefully inserted into the patient's eye socket (Figure 6A). A comparison was made between the condition before and after the iris discoloration repair (Figure 6B). The results were highly satisfactory, and the patient was pleased with the improved appearance of the prosthesis.

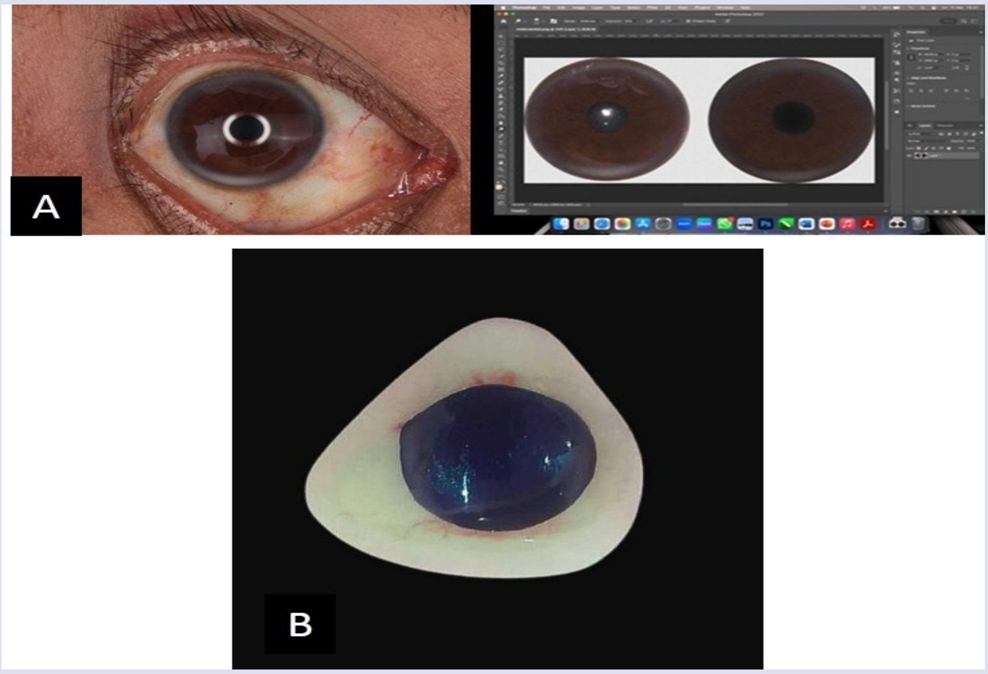

Figure 5. A. Left, photograph of the patient's normal iris on the contralateral side. Right, the edited photo result. B. Ocular prosthesis with the newly created iris after repair and polishing.

Figure 6. A. Insertion of the new ocular prosthesis. B. Comparison of the prosthesis before and after iris discoloration repair.

Discussion

Modifications to an existing eye prosthesis may be required due to tissue changes within the empty eye socket or discoloration of the prosthesis itself. Such modifications can be a practical alternative to fabricating a new prosthesis, with advantages in terms of time and cost efficiency. Several previous studies have reported approaches to modifying existing eye prostheses without the need to make new ones, such as resurfacing the scleral surface of the prosthesis, as described by Hippargi et al.,[6] Smith et al.,[11] and Al-Oulabia et al.[12]

In this case, the ocular prosthesis remained comfortable for the patient, however, noticeable iris discoloration resulted in a mismatch with the contralateral eye. Although no functional discomfort was reported, the esthetic discrepancy warranted corrective intervention. Traditionally, such situations often lead to complete fabrication of a new prosthesis, involving custom impression making, pattern development, and waxing procedures. A more efficient alternative, however, is to specifically address the discolored iris while preserving the existing scleral structure, thereby minimizing the need for extensive remanufacturing.[6] Goutam *et al*. previously reported a modification of an existing ocular prosthesis by removing only the clear acrylic layer overlying the iris to address iris discoloration.[7] In the present case, however, the entire clear acrylic layer over the sclera, rather than solely the iris region, was removed. This approach was undertaken to minimize color discrepancies between the old and newly applied acrylic, providing an effective alternative to the previously described method.

In this case, iris discoloration was likely associated with the patient's occupational exposure to sunlight. Ultraviolet (UV) radiation is recognized as a major contributor to the photodegradation of ocular prosthesis materials, particularly the pigments responsible for iris coloration. Prolonged UV exposure induces chemical bond breakdown within these pigments, accelerating degradation of both the iris pigment and the acrylic resin, thereby compromising esthetics and reducing prosthesis longevity.[9] The incorporation of UV-protective materials in prosthesis fabrication has been suggested as a potential preventive measure; however, its effectiveness in extending prosthesis lifespan requires further investigation.[13,14] Typically, ocular prostheses have a lifespan of three to five years, after which replacement or significant repairs may be needed. This period is often shortened by issues such as iris discoloration, which significantly impacts the aesthetic quality of the prosthesis. The discoloration observed in this case may also be exacerbated by environmental exposure and the acrylic resin polymerization process used to create the prosthesis, which can cause subtle changes in the iris color over time.[14,15]

Digital photography was employed for iris color correction, offering a rapid and precise reproduction of natural iris patterns while minimizing reliance on artistic skill and reducing fabrication time compared to conventional hand-painting techniques.[13,16] Advances in imaging technology have considerably enhanced the precision of aesthetic rehabilitation.

Currently, digital photography has become an integral component of maxillofacial rehabilitation due to its ability to replicate natural patient conditions and to facilitate accurate communication with the laboratory technician not only through written descriptions but also through objective visual documentation.[17] This approach is consistent with other techniques reported in the literature, such as the digital printing method for iris color reproduction, which has been successfully applied to correct iris color changes.[7] Although digital photography facilitates iris reproduction, the final color outcome may be influenced by factors such as printer quality, paper type, editing processes, lighting conditions, and camera resolution. Meticulous adjustment and the use of high-quality materials are therefore required to achieve the closest match to the natural iris.[7,16]

Modifying an existing ocular prosthesis can be a practical, decreases treatment time, and cost-effective option for anophthalmic socket rehabilitation, especially where resources are limited. This approach significantly reduces several clinical and laboratory procedures that are typically required when fabricating a new ocular prosthesis from the beginning, thereby directly decreasing the number of patient visits to the clinic. Conventional steps such as impression making, fabrication of the scleral wax pattern, and acrylization of the scleral blank—procedures that usually necessitate approximately three separate appointments—were completely eliminated in the present technique. The present technique also reduces material consumption, as impression materials, wax patterns, and a newly fabricated scleral blank are no longer required. Preservation of the existing prosthesis further contributes to cost efficiency, making this approach particularly advantageous in resource-limited clinical settings. Further studies are needed to assess long-term outcomes and to evaluate the potential of digital technologies, such as CAD (computer-aided design) and 3D (three-dimensional) printing, in improving precision, standardization, and overall results.

Conclusions

This case report demonstrates that modification of an existing ocular prosthesis can provide a clinically viable and economically efficient approach for the rehabilitation of an anophthalmic socket. The intervention not only restored esthetics and functional harmony but also improved patient comfort and psychosocial well-being. While this technique offers a valuable alternative in situations where fabrication of a new prosthesis is not feasible, its long-term effectiveness and broader applicability require further systematic evaluation.

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Conflicts of Interest Statement

The authors declare no competing interests.

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