Rehabilitation of Phthisis Bulbi using Thick Scleral Shell Prosthesis

Abstract
The eyes are a vital organ that not only allows us to see but also allows us to express ourselves. The loss of an eye has a debilitating effect on a patient’s mentality. Due to injuries, pathology, or tumor, a natural eye is surgically removed through enucleation, evisceration, or exenteration. Implant-retained and acrylic eye prosthesis is used by a maxillofacial prosthodontist to restore the patient’s quality of life in such rehabilitation circumstances. A removable acrylic prosthesis is recommended over an implant-retained prosthesis due to various reasons such as remaining orbital rim, comorbidity associated with implant placement, healing time, and cost considerations. We present an instance of a bespoke acrylic scleral shell prosthesis that demonstrated outstanding retention and esthetics.

Keywords: Custom scleral prosthesis, phthisis of eye, scleral shell prosthesis

Introduction
Loss of an eye can be a life-altering experience for any person, it impacts the patient’s perception of their self-image, well-being,[1] and even causes a patient to become esthetically and psychologically handicapped.[2]

Phthisis bulbi is considered the most common appearance of end-stage blindness due to trauma,[3] it is a progressive entity ranging from mild to marked phthisis. Soft atrophied eye with disorganized intraocular structures is characteristic in such cases.[4,5] Surgical procedures are not preferred in these cases because even though they can be a very convenient option still the need for additional surgeries and pegging complications. Furthermore, damage or dehiscence of conjunctiva and granulomas are always present. Hence, prosthetic rehabilitation using ocular prosthesis provides a palliative approach and is a preferred choice. Various options are either an ocular prosthesis or a scleral shell prosthesis (SSP).[6] SSP is indicated for cases where the cornea is misshapen, where enlargement of the palpebral aperture needs to be done or when the disfigured eye is strabismic to correct the orientation of phthisis bulbi. This prosthesis can be of three different types according to Pine et al.[1] as -thin SSP – <1.5 mm in thickness; medium SSP – 1.5 mm in thickness; and thick SSP – 2.5 mm in thickness.

This case report describes the prosthetic rehabilitation of a phthisis bulbi using a thick SSP and digital photography technique for the replication of the iris.

Case Report
A 65-year-old male patient reported to the department of prosthodontics, for the fabrication of removable partial dentures to replace missing teeth. The patient was particularly concerned about the left eye’s unattractive appearance. Examination and history revealed that the patient’s eye had undergone trauma due to scratching of the eye with fingernails 10 years back. On examination, it was observed that inflammation was absent and motility of the eye was preserved. It was classified as a Class III phthisis defect [Figure 1].[6] After a comprehensive evaluation, the patient was explained the treatment option of SSP. The patient consented to the same and it was decided to fabricate a custom thick SSP for the patient’s left eye.

Procedure
Impression of the bulbi
A custom tray with an attached stem was fabricated to make an impression. Petroleum jelly was applied to the patient’s eyebrows, eyelashes, and surrounding areas. Impression of the bulbi was fabricated to make an impression. A custom tray with an attached stem was fabricated to make an impression. Petroleum jelly was applied to the patient’s eyebrows, eyelashes, and surrounding areas.
Following this, a thin mix of irreversible hydrocolloid (Zelgan 2002, Dentsply, India Pvt. Ltd., Gurgaon, India) was injected into the socket through the stem.[7] The patient was asked to move his eye in the left, right, up, and down positions to record the socket in a functional state. After retrieval, the impression was examined for defects or voids.

**Fabrication of wax pattern**

The impression was embedded into a mold fabricated using polyvinylsiloxane impression material of putty consistency (Aquasil, Soft putty, Dentsply India Pvt. Ltd.). After the putty had set the impression was retrieved from the mold and white carving wax (Carving wax, MDM Corporation, Delhi) was melted and flowed into the mold. This wax pattern was then recovered from the mold after setting and checked for comfort and extensions.

**Wax pattern trial with iris orientation**

The wax pattern was then smoothened, contoured, and tried according to the patient’s contralateral eye. For orientation of the iris, three lines were marked on the patient’s face, and two on the inner canthus of both eyes. The three lines included the facial midline of the patient and a line drawn parallel bisecting the pupil of the intact eye. An equidistant parallel line was drawn on the affected eye side. The patient was then advised to look straight and the orientation of the iris was checked and to check for strabismus of the disfigured globe. This step is important because the prosthesis has to correct any deviation that the patient might present with. The patient was also instructed to close both eyes to assess the symmetry of the eyelids. After both the patient and clinician were satisfied, shade matching and a close-up photograph of the contralateral eye were taken.

**Flasking and wax pattern curing**

The wax design as well as the iris button was invested in a flask using dental stone (Kalstone Type III, Kalabhai Karson, Mumbai, India). Dewaxing was done and tooth-colored heat cure polymethyl methacrylate (PMMA) (PMMA) (DPI-Heat Cure, Dental Products of India Ltd.) was packed and bench cured. After bench curing, the acrylic was processed using a long curing cycle (9 h at 165°F).

**Characterization and iris placement (using photography technique)**

The trial shell was then deflasked and reduced by 0.5 mm over the anterior scleral surface. The close-up image of the iris was printed on photo paper and attached to a stock curved iris disc. Photograph of the iris allows for easy and efficient replication of patients existing iris without human error.[9] After this, the sclera was characterized using acrylic paints (Kokuyo Camlin Industrial Ltd., Mumbai, India) for brown–yellow discoloration. Strands of red wool were used to replicate blood vessels. After packing the SSP into the prior mold, a layer of clear heat cure PMMA (DPI, India Dental Products of India Ltd.) was applied and cured as previously stated.

**Final finishing and polishing**

The SSP was retrieved from the flask after curing and any rough edges were trimmed and smoothed. To give the prosthesis a glossy natural surface, polishing burs, pumice, and buff were used in the final polishing [Figures 2 and 3].
The final prosthesis must be devoid of sharp corners or nodules which might irritate the patient.

**Postinsertion instructions**

The patient was instructed on the insertion and removal method of the SSP. The patient was further instructed to remove the prosthesis at least once a day and to clean the prosthesis on each removal daily with running water and wiping with a wet cloth. The patient was also instructed to store the prosthesis in water to avoid deformation.

**Discussion**

Although patients can use stock prostheses, they generally lack the customization and precise shapes that a personalized prosthesis provides.[9] As a result, fabricating a custom prosthesis for such patients is always the best option. The time spent painting the iris can be saved by taking photos using a digital camera. Digital photography can also aid in the perfect replication of the iris and, in some situations, the sclera.[7,8]

As previously established, phthisis is the last ocular response after an injury or severe disease. Initially, there is widespread atrophy and disorganization, followed by retinal atrophy and then globe atrophy, resulting in hypotonia and shrinkage of eye components.[10] They have been classified based on the type of defect and the method of treatment. SSPs have been recommended for the rehabilitation of such defects.[9]

Even though such a prosthesis can be beneficial, some patients find it difficult to adapt to it. Furthermore, if proper maintenance protocol is not followed the scleral shell might undergo plastic changes and might be rendered useless. Hence, a meticulous regimen should be followed for the usage of SSP.

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**Conflicts of interest**

There are no conflicts of interest.

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