Custom Ocular Prosthesis with an Innovative Approach of Iris Positioning Using Bite Fork: A Case Report

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\textbf{ABSTRACT}
Loss of the eye can occur due to congenital defects, developmental agenesis, traumatic exposure, or tumors resulting in significant physical, psychological, and emotional problems. In such cases, prosthetic rehabilitation can be opted for using prefabricated eye shells or custom-made ocular prostheses. Adaptation of prefabricated eye shells usually does not match the patient’s anatomy of the socket well. Custom-made ocular prosthesis offers the best result as they allow recording and replicating of accurate details of eye socket enhancing the fit of the prosthesis and esthetics. The present case report describes the prosthetic rehabilitation using customized impressions, the custom three-dimensional (3D) orientation of wax pattern, and the characterization of the ocular prosthesis in a patient with a postevisceration ocular defect.

\textbf{Keywords:} Bite fork, Characterization, Eye evisceration, Iris positioning, Ocular prosthesis, Three-dimensional orientation.

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\section*{BACKGROUND}
Evisceration and enucleation are the most common postsurgical defects of the eye. In evisceration, the sclera and extraocular muscles are left intact while in case of enucleation, the surgeon removes the entire eyeball. A patient’s social life is significantly impacted by the loss of an eye. A person’s physical, psychological, emotional, and social well-being are all profoundly affected. A multidisciplinary strategy involving a prosthodontist, ophthalmologist, surgeon, and maxillofacial prosthetist should be used for an esthetically pleasing and retentive effect.\textsuperscript{1}

Prosthetic palliative rehabilitation after evisceration can be achieved using prefabricated eye shells or custom-made ocular prostheses.\textsuperscript{2} Adaptation of prefabricated eye shells usually does not match with the patient’s anatomy of the socket well. Custom-made ocular prosthesis offers the best result as they allow recording and replicating of accurate details of eye socket enhancing the fit of the prosthesis and esthetics.\textsuperscript{3} The present case report describes the prosthetic rehabilitation using a customized impression, the custom 3D orientation of wax pattern, and the characterization of the ocular prosthesis in a patient with a postevisceration ocular defect.

\section*{CASE DESCRIPTION}
A 60-year-old male patient reported a major complaint of loss of the left eye for 1 year. The patient gave a history of eye operations due to glaucoma 4 years back. Following the operation, his eye bed got infected and he went through surgical exploration several times but the wound did not heal and the patient lost his eye. A little undercut near the lateral canthus under the upper eyelid and a fully healed deep anaphylactic left eye socket were identified during the examination (Fig. 1A). There was no related pain, discomfort, or persistent edema upon palpation. The movements of the rudimentary eyeball were intact. After a clinical examination of the patient, a characterized custom-made ocular prosthesis was planned. Consent was obtained from the patient.

The defect was coated with petroleum jelly to make it simple to remove the impression material. A special tray was fabricated by modifying the light body impression mixing tip. A concave cup of self-cure acrylic material (DP-RR Cold Cure, Mumbai, Maharashtra, India) with multiple escape holes was attached at the tip of the mixing tip (Fig. 1B). Light body impression material was used to make the impression (Dentsply, Berlin, Germany) (Figs 1C and D). The patient was instructed to perform all the functional movements of the eyeball.

Plaster beading of the retrieved impression was done, and a master cast of type IV dental stone (Kalabhai, Mumbai, Maharashtra, India) was obtained. Superior, inferior lateral, and medial borders were marked on the cast for easy orientation of the wax pattern (Figs 2A and B). The wax pattern was fabricated on the master cast using carving wax (Pyrax dental carving wax, Uttarakhand, India) and carved to replicate the anatomy of the socket and modified according to the bulge of the unaffected eye (Fig. 2C). Size of the iris of the contralateral eye was measured using a vernier caliper. From the stock iris sizes that were available, one was selected that was of a similar size and color to that of the contralateral iris (Fig. 2D).

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Figs 1A to D: (A) Preoperative view showing left eye defect; (B) Customized mixing tip with acrylic capping; (C) Impression making; (D) Final Impression

Figs 2A to D: (A) Plaster boxing; (B) Final cast; (C) Wax pattern; (D) Determination of the size of the iris
Heat Cure, Mumbai, Maharashtra, India) was used for curing. After curing, acrylic stent was removed from the iris (Fig. 4B). For characterization, monopoly syrup was used along with a paintbrush, acrylic paint, and red silk fibers (Fig. 4C). By weight, 10 parts of heat-curable acrylic resin monomer were combined with one part of clear acrylic resin polymer to create monopoly syrup. A yellowish hue was given on the medial side according to the shade of the right eye. Red silk fibers were incorporated using monopoly syrup to duplicate blood vessels. The complete surface of the prosthesis was covered with a 0.5 mm layer of wax which will be replaced by clear heat cure acrylic material after the second curing (Fig. 4D). To stabilize the characterization of the prosthesis a thin layer of clear acrylic was secured by second curing (Figs 4E and F). The final prosthesis was polished using pumice (Neelkanth pumice powder, Rajasthan, India).

After disinfection and lubrication with artificial tear, (Carboxymethylcellulose 0.5% W/V) final prosthesis was delivered (Figs 5A and B). The patient was given postinsertion instructions on how to moisten the prosthesis before insertion, remove it and wash it with soap and warm water once per day, and maintain socket hygiene. The patient was happy and satisfied with the prosthetic outcome.

Orientation of the iris is the most sensitive step which affects the final esthetic outcome of the prosthesis. Positioning of the iris was done using a millimeter measurement grid that was stabilized on a spectacle. The patient was asked to wear the spectacle and vertical reference markings were made on the forehead on the glabella, outer canthus of both the eyes, and center of the iris on the unaffected aye. A bite fork (Xtend analyzer York division, York, PA) was used for the extraoral orientation of the iris. A bite fork is not indicated in cases of the canted occlusal plane. Generally, the fox plane is meant for complete denture fabrication, however, it was utilized to orient the extraoral plane with the interpupillary line. A vertical reference marking was made on the horizontal bar of the bite fork corresponding to the center of the contralateral eye to locate the position of the iris of the missing eye. The horizontal bar was rotated 180° and corresponding to that vertical line, a central dot was placed on the scleral wax pattern and the iris was positioned according to that (Fig. 3). This permits an accurate iris positioning in a 3D orthogonal plane.

The first curing of the processed prosthesis was done. The acrylic stent was placed on the iris so that, after dewaxing, iris should not displace (Fig. 4A). After dewaxing clear heat cure acrylic (DPI-RR

Figs 3A to C: (A) Millimeter measurement grid; (B) Apparatus used for iris positioning; (C) Orientation of the iris using bite fork

Figs 4A to F: (A) Acrylic stent; (B) Prosthesis obtained after first curing; (C) Apparatus used for characterization; (D) Surface covered with 0.5 mm thickness of wax; (E and F) Flasking and dewaxing
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The patient was followed up after 1 week, 1 month, and regularly after every 6 months to evaluate any irritation or pressure spots.

**Discussion**

Prosthetic treatment aims at keeping the patient's appearance normal. Custom-made ocular prostheses have been created using materials like scleral polymer, IPS emax press scleral veneer and light-cured materials. In the present case, polymethylmethacrylate (PMMA) was used for the fabrication of prosthesis as it is easily available, cost-effective, and characterization results in great cosmetic appearance. The double curing method, which entails first curing the base of the eye shell and then a second cycle for the thin, clear surface layer, was used. A customized ocular prosthesis constructed of PMMA has a variety of benefits, including the fact that it is nonbrittle, more comfortable, better at adapting, more esthetically pleasing, longer-lasting, and simple to repair or polish.

Different impression methods, including direct impression and external impression, impression with stock, modified stock, or customized ocular tray, impression with a stock ocular prosthesis, ocular prosthesis modification, and the wax scleral blank technique, have all been employed in the literature. Hydrocolloids, polyvinyl siloxane, dental impression waxes, and tissue conditioners are examples of the many impression materials that can be employed. In the present case a custom tray was fabricated by modifying the light body dispensing mixing tip, which is easily available and cost-effective the impression was made using light body impression material which has the advantages of pleasant odor, less irritation, fast setting time, and excellent reproduction of surface details.

Characterization is a crucial component of prosthetic rehabilitation that restores the cosmetic gaze to levels that are close to nature. In our case characterization was achieved by a painting of the scleral part according to the unaffected right eye and by incorporating red silk fibers using monopoly syrup which duplicates blood vessels.

The accurate positioning of the iris is key to the esthetics of ocular prosthesis. A strip of plastic template, a Boley's gauge, a millimeter ruler, a pupillometer, a window light, an ocular locator with a fixed caliper, inverted anatomic tracings, and a transparent graph grid can all be used for positioning the irises. In the present case, a transparent millimeter measurement grid that was stabilized on a spectacle glass and a horizontal bite fork was used for iris positioning. Fox plane analyzer has a horizontal bar, which can rotate at 180° angle and thus enhances 3D orientation in three orthogonal planes namely mediolateral, superoinferior, and anteroposterior planes. Dual verification of the position of the iris can be done utilizing this technique as it allows alignment on the graph grid placed on the eyewear as well as the corresponding vertical reference line marked on the forehead. This method of iris orientation is simple and requires an easily available armamentarium and short chair side time. However, the limitation of the present technique is that it cannot be used in facial asymmetry and in patients with bilateral orbital or ocular defects.

**Conclusion**

A crucial step in the fabrication of an ocular and orbital prosthesis is the positioning of the iris. Bilateral symmetry is very important, otherwise, it results in the appearance of squinted eyes. The described technique of iris positioning is simple, cost-effective, practical, time efficient, and allows 3D orientation using commonly available material in the dental operatory.

**Declaration of Patient Consent**

We declare that informed consent regarding the use of images and clinical information was obtained from the patient for publication in this journal. The patient was informed that his name will not be published and due efforts will be made to conceal his identity but anonymity cannot be guaranteed.

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