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An Innovative Technique for Fabrication of Custom Prosthetic Eye: A Case Report

[1]Dr. Chetan Pathak, [2]Dr. Vidushi Saxena, [3]Dr. Manisha Gulati, [4]Dr. Neha Jain, [5]Dr. Aparna Sharma, [6]Dr. Saumil Sampat

[1]Professor, Department of Prosthodontics, Crown and Bridges, Sudha Rustagi Dental College, Faridabad
[2]Senior Lecturer, Department of Prosthodontics, Crown and Bridges, Manav Rachna Dental College, Faridabad
[3]Professor, Department of Prosthodontics, Crown and Bridges, Sudha Rustagi Dental College, Faridabad
[4]Professor, Department of Prosthodontics, Crown and Bridges, Manav Rachna Dental College, Faridabad
[5]Senior Lecturer, Department of Prosthodontics, Crown and Bridges , Sudha Rustagi dental College, Faridabad
[6]Reader, Department of Prosthodontics, Crown and Bridges, YMT dental college, Navi Mumbai
Corresponding contributor: DR. VIDUSHI SAXENA
Senior Lecturer, Manav Rachna Dental College, Faridabad, Haryana
E-mail – vidushi.1992@gmail.com

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Artificial eye, eye prosthesis, maxillofacial, ocular prosthesis, scleral shell prosthesis

ABSTRACT:

Background: Fabrication of ocular prosthesis is a meticulous process involving specific armamentarium which makes it technique sensitive. Conventional impression techniques involve closed putty impressions in stock trays followed by special tray fabrication and final impression procedures. Iris positioning too, requires emaculate skills and affects the final outcome and esthetics of the prosthesis.

Technique: This case report uses an innovative technique for both, impression making and iris orientation, for fabricating custom scleral prosthesis. The impression for the prosthesis was made with irreversible hydrocolloid impression material, using an innovative method of tray fabrication. The wax pattern was made and iris positioning was done by developing a marking system on spectacles. This case report uses readily available material around us in an innovative way for the fabrication of custom eye prosthesis with a final outcome that is acceptable and appreciated by the patient.

Introduction

Loss of an eye has a far-reaching impact on an individual. Hence, prostheses should be provided as soon as possible for the psychological well-being of the patient.[1]

At present, three types of prosthesis are used; stock eyes, stock eyes modified by various methods, and custom-fitted eyes made from an impression of the socket.[2] While stock eyes are cost effective and easily available, custom made ocular prosthesis offer better adaptation to the tissues, mobility of muscles, enhanced aesthetics and facial contours[3]. Irreversible hydrocolloid has been the material of choice for making an impression of the socket. Its advantage is that it is easy to use, readily available and gives an accurate impression of the full functional anatomic space within the defect[4].

For iris positioning, use of a pupillometer, a plastic strip template, a millimeter rule, an ocular locator and fixed calliper, inverted anatomic tracings, a Boley's gauge, computer simulation approach with optical scanning technique, and computer aided design and a customized scale for assessing the position of the ocular prosthesis have been described in the literature[5]. But they all require expensive tools or a specific setup.

This case report discusses custom made eye prosthesis, fabricated for a patient with incomplete loss of an eye due to bullet injury employing an innovative technique developed for impression making and iris positioning.

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Case report

A 72 year old male patient reported with chief complaint of defect in right eye (Figure 1). He gave history of bullet injury in the same eye 30 years back and complained of irritation due to inversion of lashes in to the eye and persistent exposure to the external environment. Custom made eye prostheses was planned and patient consented for same.

Technique

1. **Impression Procedure**: An impression was made in stock tray made by the upper portion of an empty plastic saline bottle. Nozzle was cut in accordance with size of the patient's eye. (Figure 1) The margins were finished and tray was checked for comfortable insertion, relief holes were made and a disposable syringe was attached. Irreversible hydrocolloid (ALgitex, alginate) was mixed, loaded in the syringe and impression was made. (Figure 2) Patient was asked to make movements of the eye by looking in upwards, downwards and lateral directions, while the impression reached its final set.
2. **Wax pattern fabrication**: Putty consistency addition silicon impression material (Aquasil, Dentsply) was used to fabricate a mould over the impression. (Figure 2) The impression was removed and white carving wax melted and poured in mould to get the wax pattern. The wax pattern was retrieved, finished and its extensions checked in the patient's eye.
3. **Iris positioning:** A Pair of powerless spectacles was modified for developing a method of recording iris position.

The midline of the patient's face was marked on bridge of the spectacles. Transparent OHP sheet was cut to the shape of spectacles from lateral corner of one side to another. Midpoint of sheet was fixed at midline of the bridge of spects. Equidistant Points marked on top of the sheet on either side of the midline, at a distance of 2mm. A total of 8 vertical lines at a distance of 4mm were marked on both sides, with points at 2mm in between. This way the left and right sides were mirror images of each other. The wax pattern was inserted in the patient's eye and patient was instructed to look straight in an upright position. The position of the pupil of the left eye was recorded on the sheet. The same position for the pupil was marked on the right side, replicating markings on the left. Similarly, the size and position of iris of the left eye was recorded using an indelible pencil and was mirrored onto the right side. This position was then superimposed on the wax pattern and verified through the spectacles. The presence of markings made it easier to mirror the iris position on both sides. An acrylic button was fabricated and was fixed on the wax pattern, 10° medioinferiorly to the middle of the eye and its position verified with the modified spectacles in place. (Figure 3)

4. **Flasking and packing of wax patterns:** The finished wax pattern with acrylic button was flasked and acrylized using heat-cured tooth-colored polymethylmethacrylate.
5. **Iris button selection, placement, and characterization:** Stock Iris button of 11.5mm diameter and suitable shade was matched with patient's natural eye. The acrylic button was replaced with the iris button and position verified using modified spectacles. After final characterization, 3 layers of monopoly were applied for setting. (Figure 4)
6. **Finishing, polishing and insertion:** A layer of clear heat polymerising acrylic resin was added over the eye prosthesis followed by finishing and polishing. The contours were verified in the patient's eye. Patient was able to comfortably make all movements with prosthesis in place. Patient was trained to insert and remove the prosthesis and periodic recall appointments were scheduled. (Figure 5) No post operative complications were noted. Post insertion instructions were given to the patient.

Discussion

Customised eye prosthesis have become a predictable mode of treatment with advent of newer impression materials and processing techniques. In 2011 Jayaswal GP. Et al restored an atrophic eye socket; with custom made eye prosthesis utilizing digital photography.[2] Pathak C. Et al in 2017 rehabilitated a Completely Blind Subject with Bilateral Customised Ocular Prosthesis.[3] Lanzara R. Et al, in 2019 fabricated an ocular prosthesis with a digital customization technique.[6]

A well-made and properly planned ocular prosthesis maintains its orientation when patient performs movements of the eye. With the development of newer materials and altered impression techniques the socket can be recorded in full detail on which custom made

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ocular acrylic prosthesis can be fabricated with accurate fit and esthetics[4].

Various impression techniques have been reported in literature such as direct impression/external impression technique, using stock ocular tray, impression with custom ocular tray, impression with stock ocular prosthesis, and wax scleral blank technique[6]. This case report makes use of a saline bottle nozzle for the same which is readily available and can be altered according to the patient.

Prosthetic rehabilitation of ocular defects poses many challenges, and positioning of iris is a difficult phase. As asymmetry may result in a squint-eyed appearance leading to an unesthetic prosthesis, proper positioning of iris is vital. Hence, constant efforts are made to simplify these procedures and evolve better techniques for iris positioning using easily available materials. Gupta L. Et al in 2014 used a customized scale to measure the dimension and orientation of the natural iris 3 dimensionally.[7] Bhochhibhoya A. Et al in 2017 gave an Alternative Technique of Iris Orientation in a Custom-Made Ocular Prosthesis.[5] The orientation and mediolateral dimension of the iris of the natural eye was measured from the graduated scale on a PD ruler. Chamaria A. Et al in 2017 recorded Iris Positioning Using a Grid Attached to a Spring Bow for a Custom Ocular Prosthesis.[8] This case report uses a grid attached to zero power spectacles which can be oriented with the patient's midline thus making the iris positioning an easy process.

Conclusion

Custom-made prosthetic eye fabrication involves complex procedures in various stages and requires specific armamentarium. Customized ocular prosthesis was fabricated in this case report, using simple techniques for impression making and iris positioning involving quick and easy procedures.

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FIGURE 1

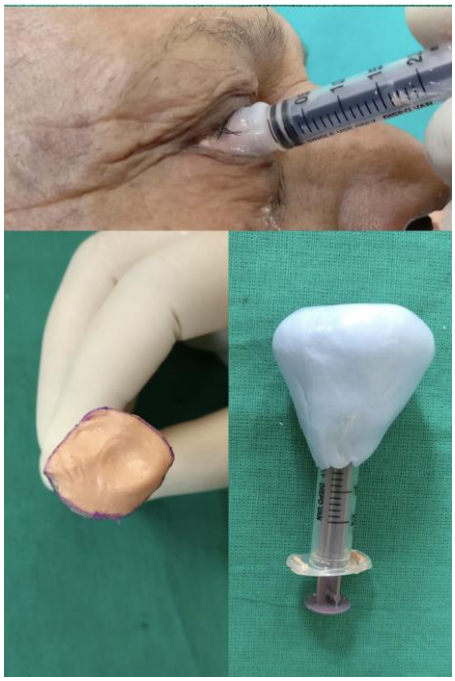

FIGURE 2

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FIGURE 3

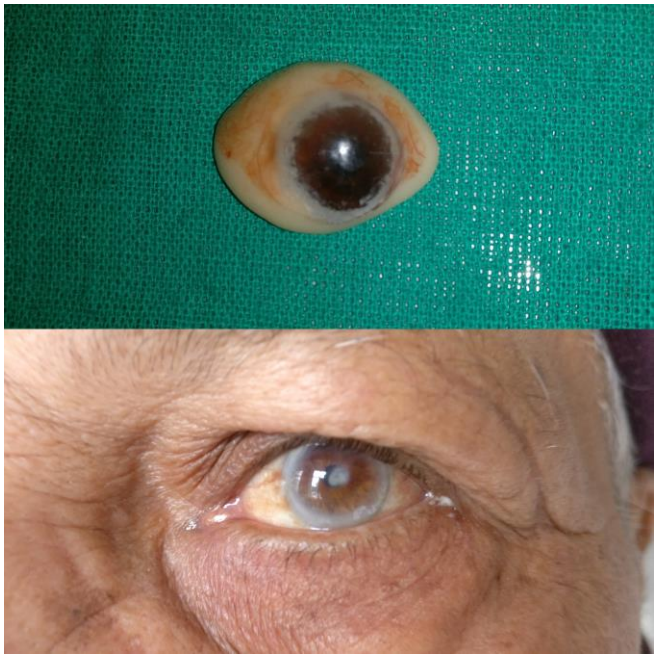

FIGURE 4

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FIGURE 5