Characterization of an eye prosthesis using monopoly syrup

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ABSTRACT

The eye is a vital organ and an important component of facial expression. Loss of an eye has a crippling effect on the psychology of the patient. Maxillofacial prostheses restore and replace stomatognathic and associated facial structures with artificial substitutes. The objectives of eye prosthesis is to improve the patient esthetics, restore and maintain the health of the remaining associated structures, consequently provide physical and mental well-being. The primary purpose of an ocular prosthesis is to maintain the volume of eye socket and create the illusion of a healthy eye and surrounding tissue. A custom ocular prosthesis is a good option when reconstruction is done by plastic surgery, and osseointegrated implants are either not possible or not desired. A case of a custom-made ocular acrylic prosthesis is presented with acceptable fit, good retention, and esthetics.

Key words: Enucleation, maxillofacial eye prosthesis, monopoly syrup, stock iris

Eyes are generally the first feature of the face to be noticed. The eye is a vital organ not only in terms of vision but also being an important component of facial expression. Loss of eye creates a psychological effect on the patient. Hence, prostheses should be provided as soon as possible for the psychological well-being of the patient. The loss or absence of an eye can be caused due to congenital defect, irreparable trauma, tumor, painful blind eye, sympathetic ophthalmia, and histological confirmation of a suspected diagnosis. Surgical procedures in the removal of an eye can be broadly classified as: evisceration: contents of the globe are removed leaving the sclera intact, enucleation: entire eyeball is removed after severing the muscles and the optic nerve, and exenteration: Entire contents of the orbit including the eyelids and the surrounding tissues are removed. Most patients do experience significant stress, primarily to adjusting with a functional disability caused by the eye loss and to societal reactions to the facial impairment. Custom eyes have several advantages including better eyelid movements, even distribution of pressure due to equal movement, thereby reducing the incidence of ulceration, improved fit, comfort, and adaptation improved facial contours and enhanced esthetics gained from the control over the size of the iris, pupil, and color of the iris and sclera. The current presentation is a review article and case report of providing the subject with an eye prosthesis. A prefabricated, stock iris was planned along with characterization using monopoly syrup and special silk thread.

CASE REPORT

A 58-year-old male patient reported to the Department of Prosthodontics of the Institute of Dental Sciences, Bareilly, UP, with chief complaint of missing right eye for 10 years. The patient gave a history of trauma at the age of 48 and the eye was enucleated. On clinical examination, the tissue bed was normal with no sign of inflammation. Evaluation of the relationship of palpebral fissure in both an open and closed condition was evaluated along with the muscle control of the palpebrae and the internal anatomy of the socket in resting and in full excursion [Figure 1]. The treatment plan...
was to replace the missing eye with a custom-made ocular prosthesis. The entire procedure was explained to the patient and his consent was obtained.

**Impression procedures**

An ophthalmic topical anesthesia was applied to increase the comfort of the patient while recording the impression. The direct impression or external impression technique was used with low-viscosity alginate for making the impression of the socket with the help of 5-ml syringe [Figure 2]. The impression was evaluated for proper extension and smooth surfaces. Pouring of primary cast was done with dental stone. A spacer was adapted and customized impression tray was fabricated from the autopolymerizing acrylic resin. The approximate pupil location on the resin tray was assessed and a perforation of 3–4 mm diameter hole is made. A 5-ml disposable syringe was used for supporting the tray and to carry the final impression material. Sides of the tip were roughened and wedged into the pupil perforation hole and sealed from the external surface with autopolymerizing acrylic resin [Figure 3].

For final impression, the extension of the tray was checked in the socket and additional silicon light-bodied impression material was mixed homogeneously and injected into the socket [Figure 4]. The patient was asked to perform his normal eye movements in all directions to allow the material to flow into all areas of the enucleated socket as well as onto the tray’s outer surface to record lid movements. The patient was instructed to sit erect and asked to stare at a distant spot and instructed to hold his gaze in a straight forward position with eyes open while the impression was being made. After setting the material, it was carefully removed from the socket and evaluated for proper border extension to ensure that all the surfaces were recorded correctly. A two-piece dental stone mold was planned. First, the lower part of impression was poured in Type IV dental stone. After the stone had set, the four-side indexing was done for proper orientation followed by the application of separating medium on the surface. A second layer was then poured with Type III dental stone. The markings were made on all four sides of the cast for proper reorientation [Figure 5].
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Fabrication and fitting of the sclera wax pattern
The wax pattern was fabricated by pouring the molten wax into the cast. The wax was properly contoured and carved to give it a simulation of the lost eye. Try-in wax pattern was done. The wax pattern was checked for the size, support from tissue, simulation of eye movement, and eyelid coverage.

Position of the iris-lens assembly on the scleral wax pattern
The position of the iris was located with the help of a millimeter grid placed on the patient’s face. The patient was instructed to fix the gaze of the natural eye on an object at least 3 feet in front and at eye level. The position of the iris-pupil area of the natural eye in relation to the inner and outer canthus and upper and lower lids was marked on the grid. The same markings were transferred on the defect side [Figure 6]. The stock eye was selected with iris closely matching to patient’s natural eye. That iris portion of the stock eye was carefully removed from the scleral shell and fixed on the wax pattern according to the transferred markings and again try-in done [Figure 7].

Flasking of the pattern
The adjusted and modified wax pattern [Figure 8] was flaked and dewaxing was done. To secure the position of iris, a small stick of autopolymerizing resin was attached to the iris [Figure 9]. Flasking was done taking care that the iris was secured to one counter of the flask and remaining part in the other portion of the flask [Figure 10]. Packing was done with the customized heat-cure tooth-colored acrylic (DPI Mumbai – Shade D). A long curing cycle (9 h at 165°F) was carried out for acrylization.

Characterization of prosthesis
The stalk of the ocular button, flash, and irregularities were removed from the surface. The prosthesis was finished and polished with the flour of pumice [Figure 11]. The characterization was done using acrylic paints and special red silk fibers to simulate the veins [Figure 12]. These fibers were secured in place with monopoly syrup.

The syrup was made by combining 10 parts of Type I-Class I (heat cure) acrylic resin monomer to 1 part of Type I-Class I clear acrylic resin polymer by weight. The monomer was poured into a beaker and placed in a pan of boiling water. When the monomer was warm, the polymer was added slowly...
into the monomer along with stirring continuously with a glass rod. After 10 min, the solution obtained the viscosity of light oil. After it cooled down to room temperature, it was poured into a dark bottle and refrigerated.

The characterization was made by taking the left normal eye as the standard option and guide. First, the basic color of the sclera and the characterization around the iris with the acrylic paint mixed with monopoly syrup was attained. The following step was done in the presence of the patient and final try-in was done [Figure 13]. After the final approval by the patient, a thin sheet of double pink-colored spacer wax -0.2 mm was adapted over the final try-in prosthesis [Figure 14]. It was further flaked and dewaxing was done followed by application of clear heat-cure acrylic over it and finally curing was done with short curing cycle (74°C for 1½ h followed by 100°C for 1 h).

The final prosthesis was properly finished and polished [Figure 15] and inserted in the socket after being disinfected and lubricated with an ophthalmic lubricant (Ecotears, Intas Pharmaceuticals Ltd, Ahmedabad, India) to maintain a tear film over the prosthesis and to improve eye movements. Minor adjustments were made at the time of delivery as per the patient’s comfort and esthetics. Necessary instructions for cleaning, placement, and removal of the prosthesis were given and the need for regular recall appointments was emphasized [Figure 16].

DISCUSSION

The ocular prosthesis is an artificial replacement for the bulb of the eye. After the surgeon enucleates the eye, the prosthodontist comes into the act of to provide the patient with an artificial eye to overcome the agony of losing an eye. A well-made and properly made ocular prosthesis maintains its orientation when the patient performs various movements. A multidisciplinary management and team approach are taken to provide an accurate and effective rehabilitation and follow-up care for the betterment of patients. Except for ocular implants, two other options are available for artificial eye prosthesis: One is a prefabricated ocular prosthesis and the other is custom-made. Prefabricated prosthesis carries potential disadvantages of poor fit (which endangers the eye to granuloma formation), poor esthetics, and poor eye movements. Several techniques have been used in fabricating and fitting artificial eyes. Empirically fitting a stock eye, modifying a stock eye by making
an impression of the ocular defect, and the custom eye technique are the most commonly used techniques.\(^6\)

According to Beumer et al., intimate contact between the ocular prosthesis and the tissue bed is needed to distribute even pressure, so a prefabricated prosthesis should be avoided. Moreover, the voids in the prefabricated prosthesis collect mucus and debris, which can irritate mucosa and act as a potential source of infection, which are minimized in the custom-made prosthesis. Hence, we decided to fabricate a custom-made eye prosthesis.\(^5\)

Various techniques for making ocular impression have been proposed such as direct/external, impression stock ocular tray impression, stock ocular tray modification, custom ocular tray impression, impression with stock ocular prosthesis, ocular prosthesis modification, and wax scleral blank technique. Effectiveness and desirability often depends on patients presentation, operator experience, materials, and equipment available.\(^10\) Thus, of all the techniques, direct/external impression with low viscosity as primary and custom tray impression as secondary impression were used.

Traditionally, ocular prosthesis incorporated the hand-painted iris into the prosthesis. Fernandes had concluded in her study of 40 paint samples, that all paints underwent alteration over time, with oil paint presenting the highest resistance to accelerated aging. Hence, oil paints were used for the characterization.\(^11\) The monopoly syrup is an alternative to cyanoacrylate for characterization and more eco-friendly, economical, and self-laboratory made. The authors advocate that it has a better manipulative quality for veined characterization of used silk fibers.

**CONCLUSION**

The described, monopoly syrup fabricated custom-made ocular prosthesis permits an equal distribution of pressure and intimate adaptation to the tissue bed. A properly finished and polished custom-made prosthesis enhances the patient’s comfort and confidence by increased...
adaptiveness and natural appearance and also maintains its orientation when the patient performs various eye movements. The optimum cosmetic and functional results of a custom-made ocular prosthesis enhance the patient’s rehabilitation to a normal lifestyle. Moreover, the characterization made here gave the prosthesis life-like appearance.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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