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Case Report

Prosthetic rehabilitation of a serving soldier with custom made ocular prosthesis

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Introduction

Eyes are the prominent organs of the facial structure and first feature to be noticed during interactions. Loss of an eye can be because of various reasons like congenital defects, traumatic injury, road traffic accidents, gun shot wounds, or malignant tumors.¹ Gun shot wounds or blast injuries are the most common causes for the loss of eyes in armed forces personnel. The disfigurement associated with the loss of an eye can cause significant physical, psychological and emotional problems.² Prosthetic rehabilitation of such patients with ocular prosthesis will improve patient's quality of life and increase their confidence. This kind of rehabilitation is more challenging because we try to replace mobile ocular tissue with a non-mobile prosthesis.

Ocular prostheses are either ready-made or custom made. Ready-made ocular prosthesis does not fit properly to the

ocular bed and movement of the prosthesis does not correspond to the movement of the ocular bed. The close adaptation of the ocular prosthesis to the soft tissues of the ocular bed enhances comfort of the patient and results in physiological movement of prosthesis corresponding to the movement of the ocular bed. Intimate contact of the prosthesis to the ocular bed prevents the collection of the mucus and debris below the prosthesis. This kind of contact of the prosthesis with the ocular bed can be achieved only with the custom ocular prosthesis.³

A clinical report of a serving soldier who had sustained gun shot wound in counter insurgency operation, rehabilitated with custom made ocular prosthesis is presented. The improvised technique of fabrication of the prosthesis using addition silicone elastomeric impression material is also described.

Case report

Twenty-five years old serving soldier was referred to our OPD for rehabilitation of the ocular defect (Fig. 1). History revealed that he had sustained gun shot wound during counter insurgency operation. His multiple panfacial traumatic injury was treated with mini-plate fixation and right eye was eviscerated. Ophthalmological evaluation was done for satisfactory healing of the ocular bed. It was found that ocular bed had healed satisfactorily, with no pain, discharge, residual edema or periorbital tenderness. There was no restriction of movement of the ocular bed. The patient was diagnosed as an operated case of panfacial trauma with eviscerated right eye. NC CT image of the head and maxillofacial region demonstrated

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Fig. 1 – Eviscerated right eye of a serving soldier who had sustained gun shot wound.

multiple cranio-facial fractures with mini-plate fixation. The condition of the left eye was evaluated and no abnormality was detected.

The appropriate treatment plan was made and we decided to rehabilitate the patient with a custom made ocular prosthesis. The whole procedure regarding the fabrication of the prosthesis including its limitations was explained to the patient.

Closely matching stock eye was selected and used as a tray for recording impression of the ocular bed. The impression of the defect was made with a light body addition silicone elastomeric impression material (Aquaseal, Ivoclar Vivadent). Before making the impression, a thin layer of petroleum jelly was applied to the eyelashes and around the ocular bed to prevent the impression material from sticking to the eye lashes. The material was mixed in an auto-mixing gun, then injected slowly onto the ocular bed and the fitting surface of the stock eye, after that stock eye was inserted in the socket and patient was asked to perform various eye and eyelid movements to facilitate the flow of the impression material into all aspects of the defect. The impression was carefully removed from the socket once the material had set and examined for accuracy.

Two-piece putty addition silicone mold was made in suitable sized PVC ring with impression in between (Fig. 2). Mold had a channel for flow of the molten wax into the mold space. This technique of fabricating silicone mold was improvised to

Fig. 2 – Addition silicone mold.

eliminate the need for use of conventional gypsum molds. This technique is simpler, less time consuming and can be used for both fabrication of wax pattern as well as acrylization.

Molten wax was then flown into the mold space through the channel and allowed to set. Once the wax hardened, the mold was opened and the wax pattern was removed. Sharp ridges and undesirable irregularities were eliminated and the portion of the wax that represented the vestibular fornix was contoured to form a smooth convex surface.

The wax pattern was tried into the patient's socket to check for proper fit, contour and bulk. Necessary recontourings were done, re-polished and again inserted into the patient's eye. This procedure was repeated until the soft tissue contour and the palpebral tissue resembled the patient's contra-lateral eye. Once the fit and contour are verified position of the iris was marked over the wax pattern (Fig. 3). The patient was then made to look straight ahead at a distant point and iris position was marked on the wax pattern. Stock eye whose iris closely matched with the contra-lateral natural eye was selected and ground to separate iris button from the shell (Fig. 4). Then a space for iris button was created on the wax pattern and prefabricated iris button separated from the shell was placed and the wax was again smoothened. The wax pattern was again placed in the socket and compared with the patient's natural eye. Once the soft tissue contour and the location of the iris were satisfactory, the pattern was removed and the shade for the scleral portion of the prosthesis was selected to match with contra-lateral sclera.

Prefabricated iris button was separated from the wax pattern. Two-piece silicone mold of the tried wax pattern was made in a same PVC ring. Wax pattern was taken out from the silicone mold and acrylization was done with heat polymerizing tooth colored acrylic resin of appropriate shade. Stains and veins were added to the resin to give a more natural appearance of the artificial eye. Silicone mold in a PVC ring fixed to the denture clamp was processed in digital acrylizer using slow curing cycle. After recovering the prosthesis, it was finished and prefabricated iris button was fixed into its position using autopolymerising acrylic resin. A thin layer of clear acrylic resin was added over the iris and sclera, which brings the depth and magnifies the detail of the iris. Final polishing was done with buff and pumice to get a smooth and shiny surface.

Fig. 3 – Tri-in of the wax pattern and centering of the iris.

Fig. 4 – Closely matching iris cut from the stock eye being attached to the tried wax pattern.

The prosthesis was inserted into the patient's eye (Fig. 5) and proper method of removal and insertion were taught. The patient was instructed to wear the prosthesis throughout the day and remove it at night while sleeping; he was instructed to wash the prosthesis with mild soap solution.

Discussion

Surgical removal of the ocular structures can be carried out by three means. Evisceration, this is the minimal surgical procedure where the contents of the globe is removed leaving the sclera (and at times the cornea) intact. Enucleation is the procedure where the entire eyeball is removed after severing the muscles and the optic nerve. Exenteration is the most radical in which the entire contents of the orbit including the eyelids and the surrounding tissues are removed leaving a large exposed cavity.⁴

The history of use of artificial eyes dates back to the fourth dynasty in Egypt (1613–2494 BC), Romans, Greeks, early Hebrews, Peruvians and the Ethiopians. Artificial eyes were made of various materials such as gold, rock crystal, shell and colored stones.⁵ Ambrose Pare (1510–1590) a Frenchman, the pioneer of modern artificial eyes in 1575, fabricated artificial eyes made of glass as well as porcelain.⁶ In 1944, Murphy and Nirroren fabricated physiologic ocular prosthesis for the first time in the United States Navy Dental Corps.⁷

The ocular prostheses are produced from either glass or methyl methacrylate resin. Glass was used previously before the use of acrylic resins and it is not the material of choice as it is heavy, fabrication is cumbersome it is prone for damage and surface deterioration from contact with orbital fluids.⁸ Methyl methacrylate resin is widely used and material of choice for fabrication of the ocular prosthesis.³

The ocular prostheses are either ready-made or custom made. Custom made ocular prosthesis have advantage of better adaptation to the underlying ocular bed, improved contour of the eyelids, better color match with the contralateral eye and movement corresponding to the movement of the ocular bed.⁹

Fig. 5 – Rehabilitation with ocular prosthesis.

In conventional technique gypsum molds are used for the fabrication of the wax pattern and for acrylization. This is more time consuming, molds are prone for fracture and cannot be reused. In our technique silicone molds were used instead of conventional gypsum molds. This technique was simple, easy, less time consuming, no fear of fracture of the molds and molds could be reused. Use of silicone molds instead of conventional gypsum molds can be undertaken at simple clinical and laboratory setup.

Conflicts of interest

All authors have none to declare.

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