ISSN 0975-3303
Mapana J Sci, **11**, 1(2012), 65-75
https://doi.org/10.12725/mjs.20.5

Custom Made Movable Ocular Prosthesis: Esthetics for Social Acceptance

Ravindra C Savadi,[*] Anupama Savadi,[†] Satheesh Kumar[‡] and Preeti Satheesh[§]

Abstract

An artificial eye is a prosthetic unit that serves to replace the lost orbital volume when the living eye is either shrunken or surgically removed. The custom prostheses are made to adapt to the contour of the orbital tissues and eyelids, and colored to match the companion eye. Although implant eye prosthesis has a superior outcome, due to economic factors it may not be advisable in all patients. Therefore, a custom-made ocular prosthesis is an excellent alternative. But the common failing of such custom made ocular prosthesis has been that there is no or very limited mobility of the eye prosthesis, which marks it as what it is, an artificial prosthesis. In the following clinical report it will be demonstrated with the help of a patient the use of a movable custom made ocular prosthesis, which shows marked mobility.

Keywords: eye-making, prosthesis, ocular, prosthodontics

[*] Maxillofacial Prosthodontist, Department of Prosthodontics, The Oxford Dental College, Hospital & Research Centre, Bangalore; rcsavadi@gmail.com

[†] Department of Orthodontics, The Oxford Dental College, Hospital & Research Centre, Bangalore; anusavadi@gmail.com

[‡] Maxillofacial Prosthodontist, Department of Prosthodontics, The Oxford Dental College, Hospital & Research Centre, Bangalore.

[§] Maxillofacial Prosthodontist, Department of Prosthodontics, The Oxford Dental College, Hospital & Research Centre, Bangalore; to_preeti@yahoo.co.uk

Received: Aug. 2011

1. Introduction

It can be expected that a facial deformity may have a significant impact on a patient's self image and ability to function and interact socially. The rehabilitation of these patients with a prosthesis that replaces the missing tissue functionally and esthetically can bring back not just their appearance but also the confidence which is needed to live in a civilized society. Reconstructive methods follow the principle of what should be either replaced or repaired. Sometimes it is difficult to repair. In such cases, replacement is an attractive option the disfigurement resulting from loss of eye can cause significant psychological, as well as social consequences. However with the advancement in ophthalmic surgery and ocular prosthesis, patient can be rehabilitated very effectively. Although implant eye prosthesis has a superior outcome, due to economic factors it may not be advisable in all patients. Therefore, a custom-made ocular prosthesis is an excellent alternative. But the common failing of such custom made ocular prosthesis has been that there is no or very limited mobility of the eye prosthesis, which marks it as what it is, an artificial prosthesis. In the following clinical report it will be demonstrated with the help of a patient the use of a movable custom made ocular prosthesis, which shows marked mobility.

2. History

Artificial eye-making has been practiced since ancient times. The first ocular prostheses were made by Roman and Egyptian priests as early as the fifth century BC. In those days artificial eyes were made of painted clay attached to cloth and worn outside the socket. In 1752 Laurent Hiester, a German surgeon suggested that the glass eyes are better tolerated by orbital tissues than the metal eyes. These early glass eyes were crude, uncomfortable to wear, very fragile. Thus the glass became the material of choice for ocular prosthesis for the next two hundred years. In mid 19th century, German glass blowers developed the superior technique of making hollow Kryolite glass prosthesis. In the United States, eyes continued to be made of glass until the onset of World War II, when German goods were limited and German glass blowers no

longer toured the United States. The United States military, along with a few private practitioners, developed a technique of fabricating prostheses using oil pigments and plastics. The transition from glass to plastic ocular prosthesis occurred during the World War II. The department of Navy set up the crash course in applying plastics to the field of ocularists, this lead to the development of acrylic ocular prosthesis. In 1950 the Dental Corps, Army of united states first reported & published a bulletin on the fabrication of the impression molded plastic eye.[1],[2]

Ocular prostheses can be given to patients who have lost ocular structures through orbital evisceration or orbital enucleation.[3] Ocular prostheses can be either readymade (stock) or custom-made. Stock eyes have some advantages including better mobility, even distribution of pressure due to equal movement thereby reducing incidence of ulceration, improved fit, comfort and adaptation, improved facial contours and esthetics. Stock eyes enhance tissue health by reducing potential stagnation spaces at the prosthesis-tissue interface.[4]

3. Case Report

A 27 year male patient reported to the Department of Maxillofacial Prosthetics with the complaint of missing left eye and gave a history of trauma, resulting in the loss of the eye, twenty years back. (Fig 1) The surrounding bone provided a protective case for the globe contents and allowed the surgeon to preserve the most of the muscle attachments and fatty tissue that cushions the eye. The eye socket was checked for any pathology, an ophthalmologist was consulted and treatment plan was outlined. The consent of the patient was obtained after the treatment plan was discussed with him.

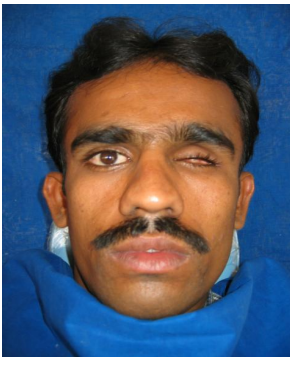

Fig1: Pre-Prosthetic

4. Examination of Eye Socket

Knowledge of the anatomic features of the eye socket is essential before proceeding with the replacement. In as much as eye sockets present varying structural and functional requirements, the existing muscle movements should be studied. Also to be taken into account is the type of operation by the ophthalmic surgeon, enucleation or evisceration. The amount of orbital adipose tissue present and the extent of atrophy of muscle and other tissue incident to the removal of the eye, as well as the contour and tonus of the eyelids, should be particularly evaluated at the time of examination. The condition of the conjunctiva should be observed as well as the depth of the fornices and presence of cul de sacs, which can be improve motion of the artificial eye. The presence of any abnormalities in the tissue, adhesions, or muscle attachments was noted. (Fig 2)

Fig 2: Socket Examination

5. Impression Technique

One of the most important steps in making accurate impressions is the close adaptation of the mucosal surface of the ocular prosthesis to the posterior wall of the eye socket. An impression is made of the ocular defect using vinyl polysiloxane impression material Putty consistency (Express, 3M ESPE; St. Paul, MN). The eyelids are drawn gently apart and the impression material is introduced at the inner side of the palpebral opening. Excess material is to be ejected over and around the lids to form a handle. During this procedure, the patient is asked to gaze at a fixed point so that the pupil is well-centered. With this impression a diagnostic cast is obtained. After blocking the undercuts custom made ocular tray is made with self cure resin material.[3] (Fig 3,4,5) During the procedure, the patient should be seated in an upright position with the head supported by the headrest. This position allows the natural positioning of the palpebrae and surrounding tissue


Fig 3: Diagnostic Impression


Fig 4: Block out


Fig 5: Ocular Tray

relative to the force of gravity. The tray should be placed into the defect to determine the proper orientation and fit without overextension. The tray is then removed and the impression material, light body is loaded in the syringe and sufficient material is ejected to fill the concavity of the tray. This allows the impression material to flow over the underlying muscle bed and the anatomic details to be recorded accurately to permit movement of the prosthetic eye. (Fig 6) The tray is reinserted and sufficient material is injected to elevate the lid contours similar to the normal side. Once filled the patient is directed to move their eyes both up and done.[5],[6] After the impression sets the assembly is removed and examined for defects and voids. A two-piece dental stone was poured to immerse the lower part of impression. (Fig 7) Then a hole is made on the centre of the handle. After the stone had set, separating media was applied on the surface. Then a second layer was poured. Markings were made on all four sides of the cast for proper reorientation of the cast.[2]

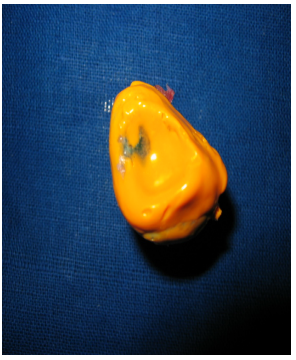
Fig 6: Final Impression

6. Wax Pattern

A stone mold(Prima-Rock; Whip Mix Corp) is made from the impression. The melted wax is then poured through the funnel shaped hole on the tray handle and into the assembled mold. Soaking the mold in water for a few minutes prior to filling it with molten wax will prevent the wax from adhering to the stone. After

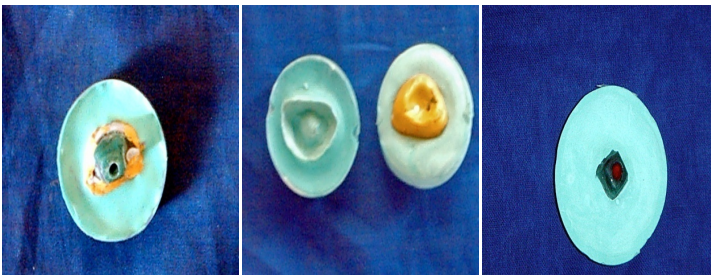

Fig 7: A two-piece dental stone was poured

the wax has cooled, the wax pattern is recovered. Once the wax pattern has been smoothed and polished, it is ready to be tried in the eye socket. The wax form or scleral bank acts as a try in ocular prosthesis and it should be tried in the patient and adjusted to achieve proper tissue contours and fit before acrylisation. The pupil of the prosthetic eye is related to the existing natural pupil by facial measurements.[7] Vertical marks are placed on the forehead and chin in midsagittal plane. At least one horizontal mark is made to intersect the vertical mark. A locator is placed on the face so that the scribed midline of locator is superimposed over the vertical marks. The intersection of the horizontal and vertical lines is traced onto the surface of locator.The eye anatomy is traced onto surface of locator. The locator is turned 180º on midsagittal plane and placed on the stone moulage to aid in correct placement of the artificial eye.

The natural eye is observed closely and the diameter of the iris is estimated using a millimeter measurement gauge or optical scale. A prefabricated iris button, whose shape matched with the contralateral eye, was selected. A single droplet of the monomer-polymer syrup is then placed in the center of the iris disk and the lens button is gently placed and centered. The positioning of the iris-lens assembly on the wax scleral pattern is the most important phase in fabrication of the prosthesis. The lens button is fixed to the wax pattern in a manner such that the apparent gaze of both

Fig 8: Wax Pattern

natural and artificial eyes is on the same object, or parallel to one another and in the same plane.

To insert the wax pattern, the upper lid is lifted, and the superior edge of the pattern is placed behind the lid and gently pushed upward. While drawing the lower lid down, the inferior border of the pattern is seated in the inferior fornix, and then the lower lid is released. The eye contours are checked. (Fig 8, 9)

Fig 9: Try In

7. Packing & Finishing

The finished pattern is then invested in a small two-piece brass flask.(Fig 10) Dewaxing is done .Next Red Rayon-thread fibrils are placed onto the surface of the sclera to mimic the blood vessels of the patient's natural eye. The entire scleral portion is then coated with monomer polymer syrup to keep the blood-vessel fibers in place and allowed to set. The pattern and type of vessels (tortuous, straight, branched) of the opposite eye are reproduced.(Fig 11) Finally, any characteristic details present in the natural eye are added. After the proper scleral shade has been selected,(DPI-Heat Cure Tooth Moulding Powder; Dental Product of India, Mumbai, India) the monomer is mixed with the selected scleral shade in the ratio of 1 to 3. When of proper consistency, the mix is packed in the the flask. After curing, the prosthesis is removed from the flask. With mounted arbor bands, the excess is removed and the entire

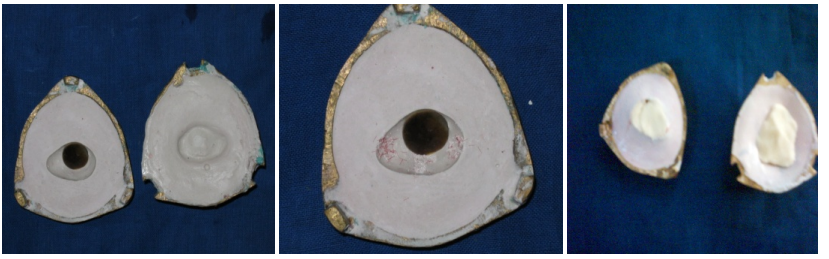

Fig 10: De Waxing Fig 11: Simulate Blood Vessels Fig 12:Packing

prosthesis is carefully smoothened. (Fig 12)

8. Polishing and Fitting

All rough areas are removed and polished. It is most important to remove all scratches, as they would be a source of irritation to the delicate mucous membranes of the socket. (Fig 13)

Fig 13: Finished Prosthesis

9. Insertion

A high luster is advisable for comfort. A drop of mineral oil is placed on the forefinger and distributed over both sides of the acrylic eye. The patient is then shown how to insert and remove the eye. Instructions are given on the care of the socket and the eye. Usually the prosthesis should be worn for 24 hours before any alterations are made so that the orbital tissues can adjust themselves. (Fig 14, 15, 16, 17)

Fig 14: Post Prosthesis

10. Post Insertion Instructions

After inserting the ocular prosthesis there are a few things about caring for and handling the prosthesis properly:

i. Remove the ocular prosthesis only as necessary. Too much handling can cause socket irritation and result in excessive secretions.

ii. If the ocular prosthesis is removed, be sure to store it in water or soft contact lens saline solution. This will keep deposits from drying on the surface.

iii. To clean the prosthesis, use an antibacterial soap. Wash the eye between your fingertips.

iv. To rinse out the socket, use sterile saline with bulb syringe.

v. Visit **at least once a year** or more often to have your ocular prosthesis checked, cleaned and polished.

11. Discussion

The prosthesis is not intended to restore vision but research has showed that patients can see better when the prosthesis is in the cavity. The only explanation for this phenomenon is that once you have relieved any undue tension on both upper lids then they are symmetrically aligned and hence the better vision.

Fig 15: Movements with the eye prosthesis

Meibomian and Lacrimal glands and the mucus membrane release fluid. This combination of liquid causes a protein deposit to gradually accumulate on the prosthetic surface. This build up can irritate the underlying tissue. A daily hygiene routine of cleansing the lids, lashes and surface of the prosthesis (without removal) will forestall the time when it becomes necessary to remove it. On very cold or windy days the patient may experience dryness on the surface of the prosthesis. This dryness causes the upper eyelid to stick to the prosthesis, especially, if when he tries to blink. This may be remedied with a lubricating solution. The tear duct in the inner canthus of the lids is not able to act as the drainage for all of the tears. The anatomy has changed when there is loss of an eye. Several things are of importance with regard to patient education. First of all, since the artificial eye does not track with the natural

eye of the opposite side, the patient should learn to turn his head when changing his line of vision. By looking at all objects from a "head-on" view, the most natural appearance can be maintained at all times. The wearing of eye glasses also enhances the natural appearance of such prosthesis by covering the margins of the prosthesis and rendering the discrepancy in the two eyes (natural and artificial) less noticeable.

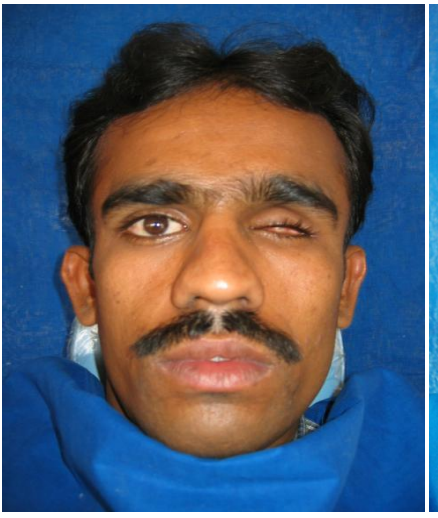

Fig 16: Pre-Prosthetic

Fig 17: Post -Prosthetic

The patient should be taught how to clean the prosthesis in warm water with a mild soap. The prosthesis should not be worn while sleeping and thus 'bedtime is a convenient period for cleaning the prosthesis. On arising the next morning it can then be replaced promptly by the patient.

12. Advantages of eye prosthesis

1) Comfort
2) Cosmetics- Restore facial contour.
3) Bony Orbital Wall and Eyelid development.
4) To maintain the volume of the eye socket
5) Protects delicate tissues and maintains proper humidity for Mucosa or orbital structures.

6) Provides a great psychological benefit in the rehabilitation of the patient.
7) Quick and early adjustment to monocular vision.

13. Conclusion

The use of custom-made ocular prosthesis has been a boon to the average patient who cannot afford the expensive treatment options available. The esthetic and functional outcome of the prosthesis is superior to the stock ocular prosthesis.

This prosthesis can be a critical requirement to improve the quality of life of an individual where rehabilitation is a lifelong proposition. A proper evaluation of the defect and a proper treatment plan can bring back the smile on the patients face.

References

[1] M. E. Ring, "The History of Maxillofacial Prosthetics," *Plast. Reconstr. Surg.*, vol. 87, no. 1, pp. 174-184, Jan. 1991
[2] J. Beumer *et al*., *Maxillofacial Rehabilitation: Prosthodontic and Surgical Considerations*. Michigan: Ishiyaku EuroAmerica, 1996, pp. 431-449.
[3] T. D. Taylor, *Clinical Maxillofacial Prosthetics*. Chicago: Quintessence, 2000, pp. 265-276.
[4] J. R. Cain, "Custom Ocular Prosthesis," *J. Prosthet. Dent.*, vol. 48, no. 6, pp. 690-694, Dec. 1982.
[5] M. F. Mathews *et al*., "The ocular impression: A review of the literature and presentation of an alternate technique," *Journal of Prosthodontics,* vol. 9 no. 4, pp. 210-216, Dec. 2000.
[6] L. M. Sykes, "Custom made ocular prostheses: A clinical report," *J. Prosthet. Dent.*, vol. 75, no. 1, pp. 1-3, Jan. 1996.
[7] D. R. McArthur, "Aids for positioning prosthetic eyes in orbital prosthesis," *J. Prosthet. Dent.*, vol. 37, no. 3, pp. 320-326, Mar. 1977.