CASE SERIES

CUSTOMIZED OCULAR PROSTHESIS TO REHABILITATE PATIENTS WITH OCULAR DEFECTS: SOLVING TWO DIFFERENT SITUATIONS

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ABSTRACT

An ocular defect not only affects a person's vision, but also causes severe psychological trauma. An ocular prosthesis improves appearance, increases confidence and enhances social acceptance. But stock eyes are not satisfactory in most situations. A custom made ocular prosthesis provides better adaptation, aesthetics and comfort than a stock one. Polymethyl methacrylate (PMMA) is most commonly used material for ocular prosthesis. Two patients with different ocular defects were treated with acrylic customized ocular prosthesis to provide better quality of life.

KEY WORDS

Evisceration, Enucleation, Ocular Prosthesis, Hollow Prosthesis

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INTRODUCTION

"The face is the mirror of the mind, and eyes without speaking confess the secrets of the heart." - St. Jerome

Even with the latest advancements in the medical science, it is still not possible to provide vision to a patient with a history of evisceration or enucleation of an eye. But a patient gets much more confidence and social acceptance after being rehabilitated with an ocular prosthesis. It enhances appearance and quality of life for that person.

An ocular prosthesis is an artificial replacement for the bulb of the eye (bulbus oculi, eyeball). The eyeball, or the organ of sight, is contained in this cavity of the orbit, where it is protected from injury and moves with the aid of the ocular muscles. When the entire content of the orbit (including muscles, fascia, eyelids, conjunctiva and the lacrimalapparatus) is removed, the artificial replacement is referred to as an orbital prosthesis.[19]

This article focuses on the rehabilitation by ocular prosthesis. It is always a challenge for the operator to fabricate an accurately fitting and aesthetically acceptable ocular prosthesis to satisfy a patient.

Ocular Defects:

Ocular defects may be congenital or acquired. Congenital defects include congenital anophthalmia and micropthalmia. Acquired defects may be due to trauma or due to surgical removal of a tumour like retinoblastoma, or due to glaucoma etc.[4]

Evisceration surgery refers to the removal of the inside contents of the eye (cornea, iris, lens, vitreous, and retina). The white shell of the eye (sclera) is left in place. The extraocular muscles are left attached to the eye surface and the optic nerve is not cut.[11]

Enucleation is the removal of the globe from the orbit, involving the separation of all the connections between the globe and the patient. Trauma is the principal reason of enucleation (41% cases), followed by neoplastic diseases (24% cases). Other precipitating factors include glaucoma, a blind and painful eye, infection, uveitis etc. Primary enucleation eliminates the risk of sympathetic ophthalmia (incidence rate upto 2%). Ocular

prosthesis with or without ocular implant is used to rehabilitate these cases.[6]

Exenteration means removal of the globe along with all the soft tissues of the orbit including extra-ocular muscles and eyelids. Here an orbital prosthesis is required to replace associated soft tissue structures along with the eye to obtain favourable aesthetic outcome.[6]

Introduction of PMMAin fabrication of Ocular Prosthesis:

Before the introduction of polymethylmethacrylate (PMMA) in 1930s, glass eyes were used throughout the world for rehabilitation of ocular defects. Germany was the centre for glass eye manufacturing since the mid-nineteenth century. In 1832, Ludwig Müller-Uri, a glassblower who used to make doll's eyes at the famous Lauscha Glass factory in Sonneberg (Germany), developed the cryolite glass eye which was more durable than previous glass eyes.[20,26]

In 1885, an English doctor, Phillip Henry Mules implanted a glass sphere into the scleral cavity of an eye following evisceration. Prior to this, the prosthetic eye was the only component involved in the restoration of the eye. The implant restored lost orbital volume and gave more movement to the overlying prosthetic eye.[20]

Rohm and Hass in 1936 introduced PMMA in the form of a transparent sheet and in 1937 Du Dout De Nemours introduced it in powder form. In 1937 methyl methacrylate was clinically evaluated by Wright and found to fulfil virtually all the requirements of an ideal denture base material. The acrylic resin represented such significant improvement in its application as denture base material that by 1946, it was estimated that 95% of all dentures were fabricated using methylmethacrylate polymers.[18,20,26]

German glass eyes became unavailable elsewhere due to the beginning of the Second World War. Following this, Fritz W. Jardon, a German dental technician who immigrated to the United States in 1932 and the dental technicians of the British Royal Navy developed PMMA prosthetic eyes at about the same time. Acrylic eyes were proved to be less brittle and more durable than the glass eyes. Its working properties also enabled prosthetic eyes to be custom made for the first time from an impression of the patient's socket. In the latter half of the 20th century, PMMA eyes supplanted the 350-year-old glass eye industry although a small number of glass eye manufacturers still exist in Europe. Custom made PMMA prostheses created opportunity for further development of orbital implants as well. Medical grade silicone is also used to fabricate ocular prosthesis.[18,20]

PMMA is now the most widely used material for fabrication of ocular prosthesis as it requires relatively less technical skills and having properties like good colour stability, light weight, dimensional stability, bio-compatibility etc.

CASE 1:

A 48 year old male patient reported to the Department of Prosthodontics and Crown & Bridge of Guru Nanak Institute of Dental Sciences and Research, Kolkata. His right eye was severely injured in an accident and evisceration surgery was performed on that eye around 20 years back (Fig 1). At that time, he was given a stock ocular prosthesis. But he never used that one as because that was not aesthetic and ill-fitting. On examination, it was found that the upper and lower fornices had sufficient depth to provide retention for the ocular prosthesis. The tissue bed was initially sensitive to touch. It was decided to fabricate a custom PMMA ocular prosthesis though the available space was not ample (approximately 5 mm). An informed consent of the patient was taken before the fabrication procedure. For sensitivity he was prescribed an eye drop containing Atropine (anticholinergic), Chloramphenicol (antibiotic) and Dexamethasone (steroid).

PROCEDURE:

Prior to making impression, the patient was draped and petroleum jelly was applied to his right eyebrow and eyelids. An ocular conformer, made in clear acrylic resin, was used to make the impression. Multiple holes were made in the conformer to provide mechanical retention to the impression material. At the centre of the conformer a 5ml injection syringe was attached(Fig 2). After proper disinfection, the conformer along with a syringe was checked in patient's eye. Adhesive was applied over the conformer. Polyvinyl siloxane (light body consistency) impression material was usedfor impression. The patient was instructed to move his eyes in all directions to facilitate flow of impression material into the socket and was later adviced to look straight. The impression was checked for voids and defects (Fig 3). The impression was then poured in stone and a cast was obtained. A thin scleral shell was made with inlay wax on that cast. The shell was then placed inside the patient's eye, contoured properly, and position of pupil was marked with a black marker (fig 4).The diameter of pupil of the other eye (left eye) was measured and a small and thin disc of clear acrylic resin with same diameter was fabricated. The disc was painted with acrylic colour to replicate the colour and contour of the other pupil (Fig 5). The disc was positioned properly on the scleral shell. A small wire was fixed on the pupil as position indicator and the wax pattern was invested. Following dewaxing, packing was done with tooth-coloured heat cure acrylic resin. A thin layer of monopoly was applied after final characterization of that cured prosthesis.

Figure1 : Patient with ocular defect

Figure2: Ocular conformer

Figure 3: Ocular impression

Figure 4: Wax pattern with marking

Figure 5: Customized iris

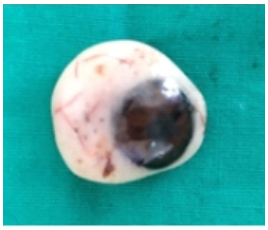

Figure 6: Final prosthesis

Figure 7: Patient with ocular prosthesis

Later finishing and polishing were done (Fig 6).The prosthesis was disinfected with 2% glutaraldehyde solution. Final prosthesis was compared with the other side normal eye (Fig 7). Post-insertion instructions were given.Post-operative check-up done after 24 hours and some necessary corrections were made. Further check-up was done after 1 week and after 1 month. Patient was satisfied with his appearance and fitting of the prosthesis.

CASE 2:

A 27 years old male patient reported to the Department of Prosthodontics and Crown & Bridge of Guru Nanak Institute of Dental Sciences and Research, Kolkata, with a history of enucleation following trauma to the left eye nearly 3 years back He was using a stock eye since then, which was aesthetically not satisfactory (Fig.08). There was no intra-orbitalimplant placed previously. The patient

Figure 8: Patient with stock ocular prosthesis

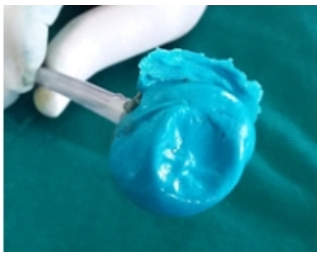

Figure 9: Impression with polyvinyl siloxane material

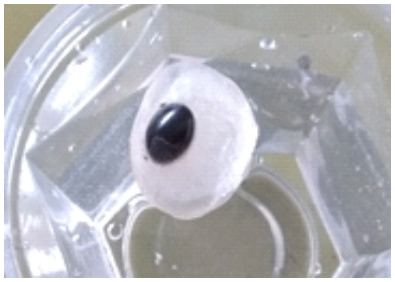

Figure 10: Hollow prosthesis floating on water

Figure 11: Finished prosthesis

Figure 12: Patient with custom made ocular prosthesis

was not interested to go through another surgery to place an intra-orbital implant. After taking his consent, impression was made with polyvinylsiloxane impression material (Fig. 09). As the available space was large, it was decided to make a hollow PMMA ocular prosthesis to reduce weight. All the steps were same as the previous case, except that during processing of acrylic resin, lost salt technique was used to make the prosthesis hollow (Fig.10). After external characterization, layers of monopoly were added. After finishing and polishing, proper disinfection of the prosthesis was done before delivering the prosthesis to the patient. (Fig. 11, 12)

DISCUSSION

An ocular prosthesis can be stock or custom-made. Retention of the ocular prostheses is mechanical where the sulcular fornix usually retains the prosthesis. The adaptation of an adjusted stock eye with the tissue surface can never be as precise as a customized ocular prosthesis. As a result, a dead space always exists in between the stock eye and tissue bed, leading to debris accumulation and subsequent inflammation. Sometimes the fitting surface of an acrylic stock eye is also modified with acrylic to improve adaptation. A properly fabricated customised ocular prosthesis not only provides better adaptation, but is also more aesthetic. Custom-made prosthetic eye fabrication involves complex painting procedures in various stages that are quite difficult and are based purely on painting skills of the operator.[3]

Dimensions of the defect determine the quality of an ocular prosthesis. Ideally 10 mm space (in between the tissue bed and external prosthesis surface) is required for fabrication of a customised prosthesis with 3-dimensional depth perception. If the space is less than 5 mm, then ocular shell prosthesis is fabricated with paint-on technique. It is more common in case of evisceration surgeries. However, ocular shell prosthesis is usually not as aesthetic as a normal ocular prosthesis.[25]

In the first case, the patient had long-standing ocular defect with sensitive tissue bed. The space was sufficient for ocular shell prosthesis, but not for ocular prosthesis. Fortunately sensitivity reduced after 1 month of medication. Understanding his aesthetic demand, we decided to fabricate an ocular prosthesis with 3-dimentional effect. The resultant prosthesis was sufficient to please the patient. Eye movement was good. In the second situation, the space was excessive. Patient was already using prosthesis. However the hollow prosthesis solved the aesthetic problem. Still movement of the prosthesis was not satisfactory. There is no doubt that in both the cases, ocular prosthesis drastically changed the appearance and social acceptance of the patients with ocular defect.

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