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RESEARCH ARTICLE

A SIMPLIFIED APPROACH FOR PROSTHETIC REHABILITATION OF AN OCULAR DEFECT

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ABSTRACT

Eyes are important part of the facial expression to be noticed. Loss or absence of a part of the eye can cause severe psychological and emotional problems to the patient. To prevent this, prosthetic rehabilitation should be done as soon as possible. Ready-made (stock) or custom made ocular prosthesis can be given to the patient. When time limitation exists, a stock ocular prosthesis can be given. Custom made ocular prosthesis is preferred over stock ocular prosthesis as it helps to improve aesthetics and gives comfort to the patient. So a less complex technique for the fabrication of custom-made ocular prosthesis is described in this case series.

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INTRODUCTION

The pair of eyes perform major role in the human life. It acts as a sense organ of sight, involved in nonverbal communication and gives beauty to the face. Malignancies, severe trauma, congenital defects can necessitate surgical intervention for the removal of an eye (John, 2016). There are different surgical procedures involved in removal of an eye: Evisceration (part of the globe of eye is removed), Enucleation (entire globe is removed along with portion of the optic nerve), Exenteration (entire orbital contents along with surrounding tissues and eyelids are removed) (Kaur, 2010). Loss of the eye can drastically affect the patient's psychological status and also lowers the quality of life (Lubkin, 1967). To improve the psychological wellbeing and appearance of the patient, prosthetic rehabilitation should be done as soon as possible. The historical reports of ocular rehabilitation have been found from the Roman and Egyptian civilization. Noble metals and precious stones were being used to fabricate the ocular prosthesis (John, 2016; Gray, 1967; Gordon, 1940). Germany and European countries started using stock glass eyes which was replaced by dental acrylic resin during second world war by United States Naval Schools (McArthur, 1977). Ocular prosthesis can be used as an artificial substitute in an enucleated eye. Ocular prosthesis are available as stock ocular prosthesis or custom-made ocular prosthesis. Stock ocular prosthesis is relatively inexpensive and can be delivered quickly but there are many disadvantages such as poor aesthetics, ill-fitting and so on (Gunaseelaraj, 2012). So custom-made ocular prosthesis is preferred due to its proper shade matching, improved aesthetics, movement of the eyeball. So this case series describes prosthetic rehabilitation of the eye having ocular defect. Here, custom made ocular prosthesis was fabricated by much simpler technique using heat polymerizing polymethyl methacrylate.

Case Report

Case 1: A male patient aged 40 years came to the department of prosthodontics with the chief complaint of ill-fitting right stock ocular prosthesis. He had history of trauma at the age of 10 and surgical enucleation of the eye was done and a stock ocular prosthesis was given (Figure-1). Due to ill-fitting of the stock ocular prosthesis, patient was seeking a new artificial prosthesis. Patient was observed for internal anatomy of the socket, tissue irregularities, any scar tissues, muscle control of the palpebrae, relationship of palpebral fissure in an open and closed position. On examination, the defect with intact tissue bed and adequate depth between fornices were observed. So fabrication of custom made ocular prosthesis was decided in this patient.

Procedure

- Clinical procedure was explained to the patient/guardian and consent was taken for recording of the clinical steps.

- For the primary impression, stock tray, disposable syringe and irreversible hydrocolloid were used. Initially stock tray (prefabricated), which would fit the socket passively and without any discomfort was selected. Petroleum jelly was applied to the eyelids and eyebrows for easy retrieval of the primary impression. Patient was asked to stare at distant spot and hold his gaze in forward direction.
- Irreversible hydrocolloid (dentsply vignette chromatic alginate) of smooth and runny mix was loaded in the syringe. Tray was attached to the syringe and then placedinto the socket. Alginate was injected slowly into the socket. Patient was asked to rotate his eyeball in upward and downward direction so that alginate would flow into all the areas of the enucleated socket. After setting of alginate, impression was removed from the socket and was examined for porosities, border extensions and any irregularities (Figure-2a).
- Cast was poured in two parts. Lower by plaster of paris and second part by dental stone (Ultrarock; Kalabhai, India)
- For final impression, Custom tray using clear acrylic was fabricated on this cast. This tray was perforated to avoid compression of the tissues in the socket. Tray was evaluated in eye socket for its border extensions, sharp margins.
- Final impression was made using light body addition silicone (Figure-2b). Impression procedure was followed as described for the primary impression. Cast was poured in two parts along with the tip of dispensing gun of addition silicone after making orientation grooves on the first part and application of separating medium. Impression along with the tip was removed from first part and molten modelling wax (Hindustan Modelling Wax; The Hindustan Dental Products, Hyderabad, India) was poured through the hole into the hollow cavity between two parts.
- This wax pattern was retrieved and its front surface was modified to form hemisphere. It was then tried in patient's eye. Modifications were done according to contralateral natural eye. With the help of measuring scale (segal optics), position of pupil was marked while patient was staring at distant spot and held his gaze in forward direction.

Figure 1.

Figure 2a.

Figure 2a

Figure 2a.

Figure 2b.

Figure 3.

Figure 3.

Figure 4.

- Iris was selected from stock ocular prosthesis by comparing its shade and size with natural eye. Here, iris of size <1mm than the measured size was selected because corneal prominence will cause slight magnification of iris disk. This iris was placed in wax pattern and checked for its centralization, corneal prominence, gaze and level of palpebral fissure by comparing with the natural eye (Figure-3). For scleral shade selection, different shades and proportions of tooth coloured acrylic were mixed to prepare shade tabsand areas to be characterized were marked.
- Then this modified wax pattern was invested, flasked and dewaxing was done. Determined shade of heat polymerizing tooth-coloured acrylic (DPI tooth moulding powder), was packed and routine curing, finishing and polishing was done (Figure-4).

Figure-5a

Figure-5b.

- A thin layer of sclera was removed and characterization was done using acrylic paints (Fevicryl acrylic colours; Pedilite Industries Ltd, Mumbai, India). It was tried in patient's eye for colour matching, fitting and comfort of the patient (Figure-5a). Finally, a thin film of clear acrylic (Acrylan-H; Asian acrylates, Mumbai, India) was applied over the prosthesis to protect the under surface over which characterization was done and to give better finishing to the prosthesis. After proper finishing and polishing of the prosthesis, it was delivered to the patient (Figure-5b).Ophthalmic

lubricant (Flogel Eye Drops; Cipla Ltd, India) was given which would help for the easy movement of prosthesis in eye socket. Instructions regarding insertion, removal, cleaning and maintenance were given to the patient and regular recall appointments were undertaken.

Case 2

A 74 year old male patient reported to the department with missing left eye due to retinoblastoma which was treated by enucleation without any graft placement. The surgery led to shrinkage of socket space due to scar formation (Figure-6). So, fabrication of ocular prosthesis was decided in this patient.

Figure 6.

Figure 7a.

Figure 7b.

Figure 7b.

Figure 7b.

Figure 8a.

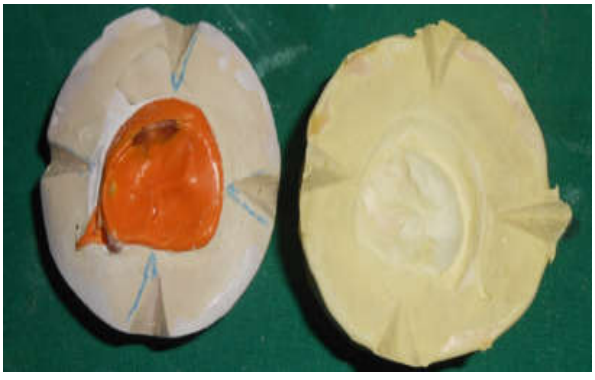

Figure 8a.

Figure 8b.

Figure 9.

Figure 9.

Procedure

1. Primary impression of right eye was taken using putty consistency of condensation silicone (Zetalpus, Zermack clinical, Italy) to get the bulge of the eye (Figure-7a). It was then poured in two parts same as described in above procedure (Figure-7b). Approximately 2mm of cast was trimmed to subtract the thickness of eye lid recorded in the impression.
2. A custom tray was fabricated on this modified cast with clear acrylic autopolymerising resin. Tip of addition-silicone light body was attached to the tray. Fitting of tray was checked inside the left eye socket and light body impression of left socket was taken. Tip was cut from the shaft and impression was rechecked in patient's left eye.
3. Master cast was poured again in two parts as described in above procedure. Indexing was done which helped in reorienting the two parts together. Casts were retrieved (Figure-8a). Wax pattern was fabricated by pouring molten wax into the assembled base and counter cast. Wax pattern was tried in patient's eye to check it's fit and bulge.
4. Wax pattern was reoriented into the master cast and flasking and counter flasking was done. It was acrylized usingheat polymerizing tooth coloured acrylic. 1mm of the bulge was reduced to make space for clear acrylic for later. Acrylic pattern was tried inside patient's eye. Marking for iris was done in front of patient and tried. Iris and capillaries were painted with acrylic paint and stabilized using fevi quick (cyanoacrylate). The painted prosthesis was tried in the patient's eye.
5. It was again flasked in same flask with layer of clear acrylic on the bulge area and curing was done. Final prosthesis was retrieved with same bulge as wax pattern and 1mm layer of clear acrylic on the bulge area to give it shiny and lifelike appearance.
6. The finished and polished prosthesis was delivered to the patient after disinfetion and ophthalmic lubricant was given (Figure-8b).

Case 3

A 56 year old femahe patient reported to the department of prosthodontics with the chief complaint of impinging right eyelid by stock ocular prosthesis. On examination, the prosthesis was overcontoured with overextended borders causing discomfort to the patient. So, fabrication of custom-made ocular prosthesis was decided in this patient.Procedure used for the fabrication of prosthesis was same as described in case 2.Preoperative and postoperative photographs are shown in Figure-9

DISCUSSION

Prefabricated (stock) ocular prosthesis do not fit the socket properly, they may be oversized or undersized. Overextended borders may cause irritation, lid incompetence. Custom-made ocular prostheses are more preferred as they fit the socket properly, more comfortable to the patient(Cain, 1982). Complex painting procedures for the characterization of ocular prosthesis are required which depend upon the skills of the operator (Allen, 1969). Here, in the first case iris was selected from the stock ocular prosthesis and characterization was done using acrylic paints. This helped to accurately match the prosthesis with the natural eye. According to Beumer *et al*. (1996) custom-made ocular prosthesis that closely adapts to the tissue bed of the eye socket thatis needed to distribute even pressure on the tissues. Mucus and debris gets collected in the voids of stock ocular prosthesis and cause irritation of the mucosa that may result into infection. This potential source of

infection can be minimized by custom-made ocular prosthesis (Cain, 1982; Grisius, 1993). Various methods for the customization of iris have been suggested till now. Such as conventional painting, reverse painting, digital and hard copy images of natural eye. Digital technique is much reliable technique but it requires patient's cooperation, complex photography equipment (John, 2016). Here, natural eye was observed in detail for iris size, shade andcustomiris was fabricated by using only acrylic paints and paintbrush. Three types of ocular prosthesis are used: custom-made ocular prosthesis, stock ocular prosthesis and modified stock ocular prosthesis. Various materials are used for the fabrication of prosthesis such as glass, silicone, polymethyl methacrylate (Devaraju, 2014). But among these materials, polymethyl methacrylate allows modifications in size and shape of the prosthesis and it also gives more strength to the prosthesis.

There may be some errors in centralization of the iris, characterization of the prosthesis and shade selection of the sclera, which are limitations of this technique. By comparing with other techniques, reliability of this technique can be verified.

Conclusion

This technique helps improve equal distribution of the pressure to the tissues. Custom-made ocular prosthesis provides more comfort to the patient as there is increased adaptiveness to the tissues. Although the patient cannot see with this prosthesis, it helps to improve self-confidence of the patient.

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