

# Prosthetic rehabilitation on patient with orbital defect: A customised approach

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## Abstract

Loss of eye leads to significant psychological trauma which necessitate rehabilitation. Restoring eye defects with prostheses will uplift psychological status of such patients by re-establishing the facial structures and appearance, eventually returning them to their normal life. Even though prefabricated orbital prostheses are available, the lack of proper fitting indirectly affect comfort and aesthetics. Custom-made orbital prosthesis is still preferred due to its conformity which correspond to individual defect and the ability for shade personalization. This article elaborates the technique of fabrication of a custom-made orbital prosthesis in giving a life-like appearance to the patient.

**Keywords:** customized orbital prosthesis, eye prosthesis, maxillofacial rehabilitation

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## Introduction

Eyes are most prominent features of the face to be noticed when people communicate. The unfortunate loss or absence of the eyes may be caused by congenital defect, irreparable trauma or tumors (Perman & Baylis, 1988). According to the severity, there are various surgical modalities of management for example; exenteration, evisceration or enucleation. By definition, evisceration is surgical removal of some portion of intraocular contents of globe, and leaving some portion of sclera conjunctiva, extraocular muscles and optical nerve tissue. While enucleation is surgical removal of globe and a portion of optical nerve tissue of globe. Exenteration is defined by an en bloc

removal of entire orbit which involving partial or total removal of eyelids and most of the case is due to tumour (Croce *et al.*, 2008).

The facial disfigurement can cause significant physical and emotional problems. Some patient uses several accessories in order to hide the defect prior to rehabilitation; for example, usage of sunglasses, hat and facial mask in order to socialize with public and improve their self-confidence. Therefore, providing an artificial substitute to restore its form and functions is the mandatory reason for such disability. Prosthodontic rehabilitation has therefore become an option to restore aesthetics, comfort and also elevate psychological

status of such patients (Taylor, 2000). Orbital prosthesis can be custom made or prefabricated. Custom-made orbital prosthesis demonstrates close contact with surrounding tissue, hence has capability of distributing pressure equally subsequently reducing the incidence ulceration as compared to prefabricated form. Customized prosthesis also possesses several advantages including improved fit, comfort, adaptation to facial contours, and enhanced aesthetics gained from the control over the size of the iris, pupil and colour of the iris, sclera and tissue to be replaced (Beumer & Zlotolow, 1996; Artopoulou, 2006; Ow & Amrith, 1997).

The procedure of prosthetic eye replacement presented with many challenges in determining the precise alignment of the pupil, balancing the interpupillary distance and positioning the prosthesis in regard to the contralateral eye (Doshi & Aruna, 2005). Many methods for locating the iris have been described; for example, using ocular locator, fixed calipers, grids, dividers, inverted anatomic tracings, and visual assessment (Babu *et al.*, 2016). Other than that, the remaining anatomical structures may affect the outcome of the treatment especially in improving prosthesis retention. Before embarking to planning and prosthesis designing, it is essential to assess

the psychological element in order to gain the patients' confidence, in addition to a detailed medical history that includes the condition that led to the excision and enucleation in order to alert the possibility of recurrence (Cain, 1982). In this case report, a customised approach for fabrication of orbital prosthesis of an exenterated right orbital closed defect is presented. The objective of the proposed technique is to achieve predictable positioning of the iris to enhance the aesthetic effect.

### Case Report

A 65-year-old female reported to the Prosthodontics postgraduate clinic requesting rehabilitation for her right orbital defect. She had undergone surgical exenteration due to malignant melanoma in August 2017. Two months later, she was then cleared from malignancy. The patient presented with a favourable right eye defect sizing 7cm x 5cm (Figure 1). On examination, a well-healed orbital defect lined with split-skin graft was observed. The patient did not complain of pain or discomfort. An adhesive-retained orbital prosthesis was planned for complete prosthetic rehabilitation utilizing soft tissue undercuts.



Figure 1. Frontal view of the patient with a favourable right eye defect.

## Phases of fabrication of orbital prosthesis

### a) Orbital impression making

During the first visit, facial and orbital impressions were made. Facial impression was taken for facial planning of prosthesis construction in the laboratory while orbital impression was used as working model. The patient was seated on the dental chair at an upright, relaxed position. Petroleum jelly was applied at the patient's eyebrows and eyelashes. Gauze piece coated with petroleum jelly and ligated with floss was inserted into the nasal orifices to prevent the flow of impression material into nasal cavity. For the facial impression, two breathing tubes were inserted into the patient's mouth to allow breathing. The facial tray was checked on the patient face; a hole made on the nasal area to minimize pressure and reduce tissue deformation while making the impression. The facial impression was made using irreversible hydrocolloid impression material (Kromopan, Lascod, USA). The material was spread on the patient's face; the facial tray was loaded with impression material and positioned on the face. The

impression was detached from the face after complete set and was checked for any deformities or defect. For primary orbital impression, the impression was made using light-body and heavy-body vinyl polysiloxane impression material (VPS, Chemi-Sil, B&E, Korea) to capture texture and details of the defect for proper adaptation of the prosthesis. Light-body VPS was first injected into the defect followed by the heavy-body VPS into the rest of the right orbital region (Figure 2). After complete polymerization, impression was removed and inspected for any deformity or defect. Then, the patient was advised to sit in a relax position and to look straight ahead. The ocular and eye brow orientation points were defined and recorded.

### b) Ocular component fabrication

Left iris shade was recorded. The iris for ocular component was fabricated utilising iris button painting technique (Fernandes *et. al*, 2009) (Figure 3). The contralateral iris diameter was measured. The size and shape of the ocular wax pattern was adjusted accordingly and processed to be inserted into the orbital prosthesis.



Figure 2. Orbital impression using light-body and heavy-body polyvinyl siloxane impression material.



Figure 3. Iris button was produced using acrylic paint technique.



Figure 4. After completion of ocular prosthesis processing.

### **c) Orbital wax pattern fabrication and try-in stage**

Both impressions were casted using Type 3 dental stone (Model Stone, Zhermack, Italy) (Figure 5), for orbital and facial cast. A framework was fabricated using light cured clear acrylic resin (Vertex™ Rapid Simplified, Vertex Dental) and customised with a mix of soft yellow intrinsic colour (P115 Intrinsic Staining, Technovent, UK). The framework was incorporated with perforations to reduce the weight of the prosthesis and to enhance silicone retention (Figure 6). The perforated framework was evaluated for fitting and retention while performing facial movements including opening and closing of

mouth and raising the left eyebrow. A wax pattern of the orbital prosthesis was sculptured initially using modelling wax (Collegewax, Metrodent, UK) on the facial cast, to ensure the parallelism in relation to other facial landmarks (Figure 7). Then, soft wax was inserted into desirable undercuts of the orbital cast. The orbital wax pattern was attached to the soft wax on the orbital cast to ensure proper extension and fit of the prosthesis. Later, the ocular component was incorporated and evaluated chairside. The symmetry, contouring, and shape of the wax pattern were compared to the contralateral eye and its relation to other facial structures. The adaptation of the wax pattern was also assessed, especially on the borders. Texture and creases were created to match with



patient's skin. It was examined from frontal, lateral, and 12 o'clock views. To evaluate prosthesis retention, the patient was asked to make several facial expressions. The skin

base shade matching was determined by selecting the facial region that has a slightly lighter skin tone.

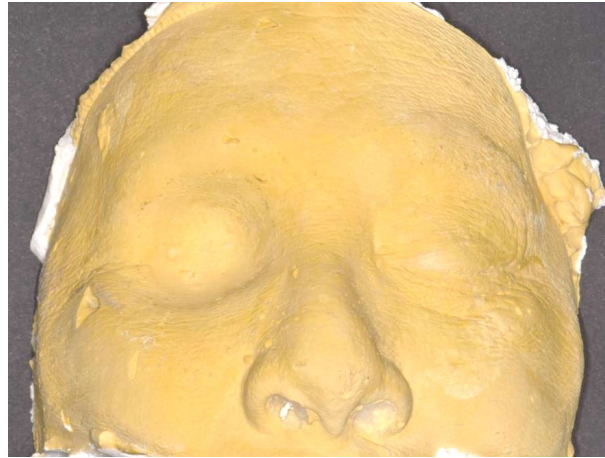


Figure 5. Facial model casted using Type 3 dental stone (Model Stone, Zhermack, Italy).



Figure 6. Positioning of ocular and acrylic framework on patient's face.



Figure 7. Wax pattern with ocular prosthesis on patient's face from frontal view.

#### d) Processing of orbital prosthesis

The wax pattern was sealed on the working cast to ensure good marginal adaptation. The sculpt was finally given a stippled surface using a bristle toothbrush. Ocular component was also indexed by attaching a plastic rod with cyanoacrylate resin to secure to the investment during dewaxing. The cast was invested in a two-piece dental flask (Figure 8). Dewaxing was performed and both flasks were left opened to dry. Separating medium was applied (Separating

Fluid, Ivoclar Vivadent, Germany). Maxillofacial silicone elastomer was mixed according to the manufacturer's instructions (Platinum Silicone, Medical grade Technovent Co, UK). Shades of cream, light brown, and grey intrinsic stains (P115 Intrinsic Staining, Technovent, UK) were added with in combination with red (to mimic blood vessels) and yellow flocking to the mixed silicone. Then, the silicone elastomer was packed into a two-piece dental flask and polymerized for 60 minutes at 100°C following manufacturer's instructions.



Figure 8. Investment of orbital prosthesis.

#### e) Delivery of orbital prosthesis

The prosthesis was first fitted to the orbital defect area. Its engagement to the available undercuts was assessed (Figure 9). The prosthesis was able to be inserted and removed easily without causing any pain or discomfort. Retention was evaluated by asking the patient to perform facial movement, including mouth opening, smiling, and whistling. She was also asked to move her head sideways and bending down. The retention was deemed acceptable. However, to improve her confidence, a water-based adhesive (G609 Probond Adhesive, Technovent, UK) was prescribed. The margins and extension of the prosthesis

were checked and adjusted. Silicone flash on the peripheries was left in-situ to ensure transitional blending to the skin. After chairside assessment, the external staining was painted using extrinsic stains (P702i extrinsic color, Technovent, UK) to complement patient's skin colour. Finally, extrinsic sealant (P799 extrinsic sealant, Technovent, UK) was applied and left for 60 minutes to set following manufacturer instructions. Artificial eyelashes were incorporated into the orbital prosthesis before delivery to the patient (Figure 10). The placement of the prosthesis was demonstrated to the patient. A non-prescription eyeglass was also prescribed to camouflage her prosthesis wearing. Maintenance care instructions regarding

were provided to the patient and her spouse. Patient was asked to wipe clean the prosthesis with water and a clean cloth, avoid using soap. The patient was also instructed to avoid direct exposure to

sunlight, and advocate the use sunglasses or umbrella as protection. She was aesthetically satisfied with the orbital prosthesis. She was also emphasized on the usage and of the prosthesis.



Figure 9: Processed silicone with ocular prosthesis without staining.



Figure 9. Extrinsic staining and Incorporation of artificial eyelashes prior to delivery.

#### **f) Review and follow up**

Patient was called for her first review after a week to check for patient satisfaction, retention of prosthesis, and adaptation of remaining soft tissue to the orbital prosthesis. Patient mentioned that the prosthesis is slightly loose and the chemical adhesive had helped a lot to retain the prosthesis. She was satisfied with her appearance wearing the prosthesis and to

improve the look, she used spectacles to camouflage the prosthesis (Figure 11). Following three months review, patient was happy with her prosthesis. She would like to continue the usage of adhesive which gave her more confidence in public. The shade and fit of the prosthesis were checked and deemed satisfactory.

Then, her recall appointment was scheduled annually. Her prosthesis was assessed for



the need of recolouring and the adhesive supply was replenished. Patient has been rehabilitated successfully for three years without any complications. At three years wearing, the margin of prosthesis was still

good with excellent hygiene. Its shade was a tone lighter and external recolouring was attempted after three years insertion. The artificial eyelashes were also replaced.



Figure 10. Orbital prosthesis with spectacles to camouflage the prosthesis.

## Discussion

Malignant melanoma of the eye is an uncommon disease but potentially life-threatening cancerous growth in the eye. It comprises about 2% of all eye tumors, about 5% of melanomas in the ocular region (Isager *et al.*, 2006) and 0.25% of all melanomas overall (Chang *et al.*, 1998). Enucleation and exenteration are radical treatments to eradicate the conjunctival melanoma especially in diffuse melanoma (Reese, 1966). However, such approaches have shown no improvement in survival and have the consequences of disfigurement and blindness (Paridaens *et al.*, 1994). These techniques are only performed as relief for tumors that invade the orbit or fully involve the entire conjunctiva (Shields *et al.*, 2011). The disfigurement associated with the loss of an eye can cause both emotional and physiological distress. Most patients

experience significant stress primarily due to the function disability and also societal reactions towards facial impairment (Lubkin & Sloan, 1990). To improve appearance of this patients, orbital prosthesis was recommended. The requirements for orbital prosthesis should be aesthetic, light weight, economical, and retentive. Silicone material is the preferred material for orbital prosthesis as they provide better marginal adaptation and good appearance than acrylic (Guttal *et al.*, 2008). Attention to detail is mandatory in each and every step to bring out a satisfactory end result. For this case, minimal retention is obtained at the superior border of the orbit. Orbital prosthesis could be retained by multiple methods such as undercuts, facial accessories (such as spectacles), medical grade adhesive, or osseointegrated implants (Beumer *et al.*, 2011). Difficulty faced in attempting to restore the symmetry and to hide the



margins of the prosthesis. For this case, implant was not an option due to patient's financial constraint and it will take longer treatment time. Retention using spectacles was also not considered due to difficulty of patient to adjust during insertion of prosthesis. The best treatment option would be retention of the prosthesis by means of utilizing available undercuts and skin creases, and usage of adhesive if needed. Prolonged usage of adhesive is not recommended due to the following reasons:

1. High level of dexterity to apply the adhesive,
2. More care for cleaning of the prosthesis and defect,
3. Possibility of tearing the borders while applying,
4. Financial burden to the patient.

During the fabrication of the prosthesis, perforated acrylic framework was incorporated to locate the prosthesis's position and also to reduce the weight of prosthesis. There were several limitations of constructing this prosthesis including difficulty in processing the silicone since the defect was quite large, incorporating and matching the ocular into orbital component, producing monotonous skin shade and hiding the margin of the prosthesis on the defect area. Regardless the difficulties, the advantages of this customize prosthesis were replicating individual and specific anatomical structure, skin and ocular shade were definite to the patient and last but not least were patient comfort and satisfaction. Special instructions were given to the patient to avoid washing the prosthesis with acidic or basic solutions that might cause fading to the extrinsic shades. There were several drawbacks with this such elastomeric prosthesis due to degradation of their colour and physical properties (Hatamleh & Watts, 2010; Kurunmaki *et al.*, 2008). Some article revealed this prosthesis needed to be replaced within 6-12 months and the main factors was colour changes due to exposure to ultraviolet radiation, humidity, cleansing agent and contact with body fluids (Andres *et al.*, 1992; Lemon *et al.*, 1995). However, for this patient, she was reviewed up to 3 years and the prosthesis

was still able to adapt to the defect area and minimal colour changes noted. Patient was comfort to the current prosthesis and the longevity of the prosthesis might be due to good hygiene and handling care by the patient.

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