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MODIFIED HOLLOW OCULAR PROSTHESIS TO REHABILITATE VOLUMINOUS OCULAR DEFECT

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Abstract

Background: *Ocular defects post-enucleation can be rehabilitated using stock or custom ocular prostheses. The stock ocular prosthesis was premade, thus limited in color, shape, size, and iris orientation. Whereas custom ocular prosthesis provides a better aesthetic and fit with good motility, if it is large and heavy, it can burden the lower eyelids and cause lid laxity. In the following case, the ocular prosthesis volume was 4.5mL, which exceeded the ideal volume of 2.2mL.* ***Objectivess:*** *Fabricating hollow using chocolate to reduce weight without affecting the shape and aesthetics of the custom ocular prosthesis.* ***Case Report:*** *A 30-yearold man presented to the Dental Hospital of Sumatera Utara with a chief complaint of unmatching colour, iris disorientation, and minimal motility with the present stock ocular prosthesis post-enucleation. The initial impression was carried out and the scleral wax volume was 4.5mL. The custom occular prosthesis fabrication was done by utilizing chocolate as a hollow matrix. The chocolate matrix was made by placing wax relief on both parts of the mold, then filled with melted chocolate, and after setting, the wax was replaced with scleral acrylic. The chocolate matrix was moldable, had a high density, so it was stable under pressure during acrylic packing, evacuated easily and resulted in an even thickness of acrylic.* ***Conclusion:*** *Fabrication of custom hollow prosthesis eyes with a chocolate matrix obtains a comfortable, aesthetic, lightweight ocular prosthesis and optimum motility.*

Keywords*: Enucleation, Hollow Ocular Prosthesis, Ocular Defect*

INTRODUCTION

When one of the body's parts, like the eye, is lost, it can have a significant emotional influence on how the patient perceives both his or her own appearance and that of others.[1] The patient would face functional and cosmetic issues following eye removal via enucleation, eviceration, or exentration. The most common loss of confidence is one of the extremely devastating psychological impacts of sight loss. Thus, the major goal of maxillofacial prosthodontics is to restore the patient's appearance and ability to lead a stress-free life. [2–4] when an eye is lost, the patient's main concern is that the new ocular prosthesis remains in the socket and has acceptable iris orientation, in addition to being comfortable and having good motility.[1]

Stock ocular prosthetics or custom ocular prostheses can be used to treat ocular defects. The stock ocular prosthesis is usually a deep concave shape on the posterior part of the eye prosthesis with a

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limited color, size and orientation of the iris, but the custom-fit is obtained by choosing a larger size. The main advantages of stock ocular prostheses are that they are manufacture at low cost and are large enough that the ocular prosthetist does not need to make any additional adjustment.[1,5] The disadvantage of stock ocular prosthesis is poor fit, which is that it cannot adapt perfectly to the tissue bed of the eye, causing discomfort to the patient; and it does not have aesthetics in terms of color and inappropriate iris orientation.[6] As for the custom ocular prosthesis, it can be made according to the condition of the eye socket and the patient's collateral eye color, which will increase the comfort and aesthetics of the prosthesis so as to achieve optimal motility.[1, 5] Custom ocular prosthesis can create the exact volume and weight as the eye socket, good contours, excellent aesthetics, and good patient adaptation.[5, 6]

The volume of the eye removed post-enucleation should be replaced by an intraconal implant placed at the time of enucleation and a custom ocular prosthesis created after the socket is recovered. The total volume to be replaced must be highly considered because the maximum prosthesis volume is 4.2ml, so it does not produce bulky prostheses (3-4ml).[7, 8] A conventional solid ocular prosthesis will sit on the lower lid and, due to the weight, will cause lower fornix dehiscence and/or asymmetrical alignment of the entire palpebra fissure, patient discomfort, irritation, discharge, and redness.[9, 10] To overcome the problem of voluminous ocular prostheses, there are various techniques for reducing the weight of ocular prostheses. The innovation in the manufacture of hollow ocular prostheses is to obtain lighter ocular prostheses with the exact size, shape, and volume of existing solid prostheses with techniques in the manufacture of hollows with modified matrix material, which can improve comfort and functional while utilizing revolutionary conventional manufacturing techniques and low cost as one of the treatment options. [9]

CASE REPORT

A thirty-two-years-old male patient reported to Rumah Sakit Gigi dan Mulut Universitas Sumatera Utara with a chief complaint of distinction in colour. The patient had a history of trauma to the right eye five years back due to a work accident, leading to surgical enucleation over the two months and utilization of a stock eye prothesis immediately. On examination, the mucosa of the eye socket is healthy with no sign of infection or inflammation covering the posterior wall of the anopthalmic socket. It was thus decided to fabricate a customized ocular prosthesis. An intraocular tray for primary impression was fabricated with auto polymerizing acrylic resin (Self-Curing Vertex®, Vertex-Dental B.V., and Netherland). (Figure 1a) The convex surface was utilized with the patient's previous eye prosthesis to stimulate the convexity, size, and shape of the eye socket. The tray was adjusted for a passive fit in the patient's eye socket. Prior to making an impression, a thin layer of petroleum jelly (Vaseline®, Unilever, India) was applied on the eyelashes and around the eye socket to prevent the impression material from sticking to the eyelashes. Polyvinylsiloxane light body impression material (Light Body Nobilium®, CMP Industries LLC, and New York) was stacked in the syringe and injected into the socket and onto the tray. The patient was situated with their head tilted at a 45° angle, then the impression material was first placed superiorly and allowed to flow into the socket using a disposable syringe. The patient is then asked to look down, and when the intraocular tray is filled with impression material, the patient is then asked to gently close their eyes and next open their eyes and move their eyes both up and down, to the right and to the left to facilitate the flow of impression material into all aspects of the sockets. Later, the patient was approached to look straight ahead at a fixed point. Therefore, the impression created is used to produce an accurate reproduction of the socket anatomy. (Figure 1b)

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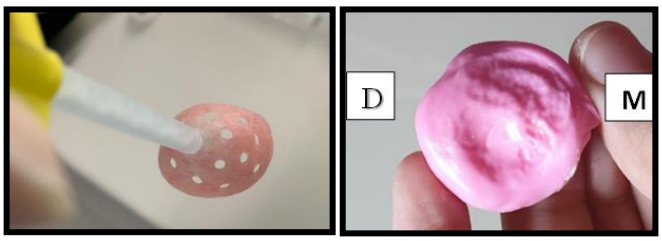


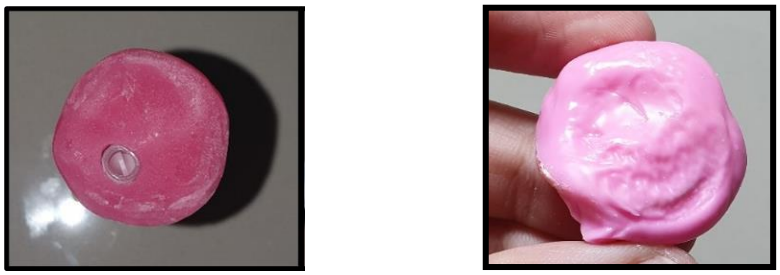
(a) (b)

Figure 1: (a) Intraocular tray, (b) Primary Impression

After an acceptable impression of the eye socket had been obtained, a two-piece type IV dental stone (Hard Stone THS-S Type 4, TST Taiwan) cast was poured to immerse the lower part of the impression and, before the stone was completely set, to make three keynote on the surface. After the stone had set, separating media was applied to the surface. Then a second layer was poured. Marking was made on all four sides of the cast for proper reorientation of the cast. A layer of cold mould seal was applied over the impression surface of the cast. Molten wax (Shangchi®, Shanghai Medical Instruments Co., LTD, and China) was poured on the cast. Once the wax was solidified, the wax pattern was removed. The wax was properly contoured and craved, then tried in the patient's socket to check for size, comfort, support, fullness, and retention by performing the functional movement. Necessary modifications were made, re-polished, and again inserted into the patient's eye socket. This was done until the soft tissue contour and the palpebral tissue resembled the patient's natural eye. (Figure 2)

Figure 2: Sklera wax pattern try in

The palpebra part of the wax was duplicated using putty (I-Sil™, Spident Co., LTD, Korea) to act as a putty index for fabricating the special tray. Before the putty was set, two keyholes of different sizes were made on the putty surface, and after the putty had set, separating media was applied on the surface. Then a second layer of putty was made. An individual impression tray was prepared using light-cured acrylic (Cavex LD Dental Tray, Cavex, Germany) and the putty index. (Figure 3a) The final impression of the socket was made with a polyvinylsiloxane light viscosity impression material (Light Body Nobilium®, CMP Industries LLC, and New York). (Figure 3b) Then two pieces of the physiologic model and a scleral wax pattern were made.



(a) (b)

Figure 3 (a) Individual impression tray (b) Final impression

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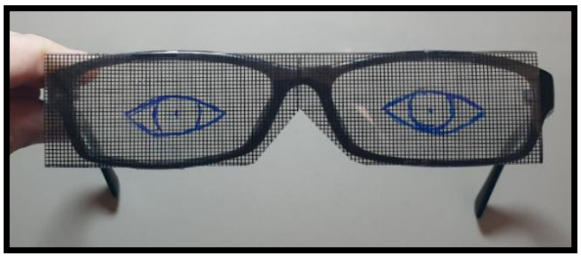
At the time of trying in scleral wax, it is checked and relieved for any areas of discomfort or pressure points; the eye contour and lid configuration are checked from different angles, with the patient's eyes open and by manual palpation with the eyes closed; the centre the height of convexity over the pupil, which is usually slightly medial to the midline between the inner and outer canthi; the eyelids should close completely over the wax pattern; and the contours and palpebral fissure should resemble the adjacent normal eye. [11] The shade and size of the iris were determined and marked on the wax pattern using the normal eye as the guide. To achieve this exact location, a spectacles frame was customized using a transparent grid in which the distance between each line was 1mm. The patient's both eyes' outline and the iris of the normal eye outline were transferred to the transparent grid that was attached to the spectacles. (Figure 4a) Mark the patient's midline, then the distance between the medial and lateral ends of the iris was measured, then the marking of the left iris outline was mirrored to the right side. (Figure 4b)

(a)



(b)

Figure 4: (a) Outline on a transparent grid, (b). Iris positioning at eyeglasses transparant grid

The custom-made iris was evaluated with the graph template. The iris was manually painted using acrylic paint colors (Faber-Castell Acrylic Colours, Faber-Castell International, and Indonesia) to customize it. (Figure 5) A custom-made clear acrylic corneal button, similar to the size of the painted iris disc (Figure 5b), the iris button was then positioned accurately onto the sklera wax pattern, ensuring the correct gaze position both during movement and the rest. (Figure 5c). The wax pattern was sterilized, and a split model was made.

To fabricate the void, the wax was removed and a 2 mm sheet of wax relief was placed on both sides of the flask (Figure 6). The matrix used to create the hollow must have the requisite properties for the matrix to be moldable, yet hard when set, stable under the bench press during acrylic packing, and simple to remove once cured. (9) Full evacuation of the matrix through a pin hole was required to leave a clean void within the eye. After experimentation by the author, dark chocolate exhibited all the matrix properties.

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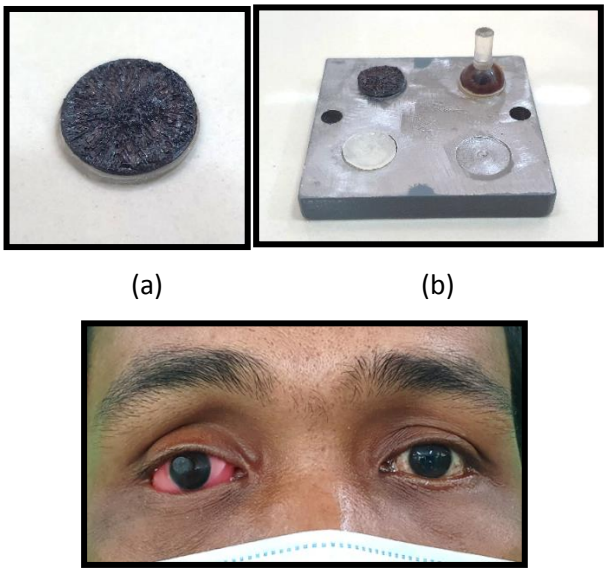

(a) (b)

(c)

Figure 5: (a) Custom made iris, (b) Iris mold, (c) Determination of irises on scleral wax pattern

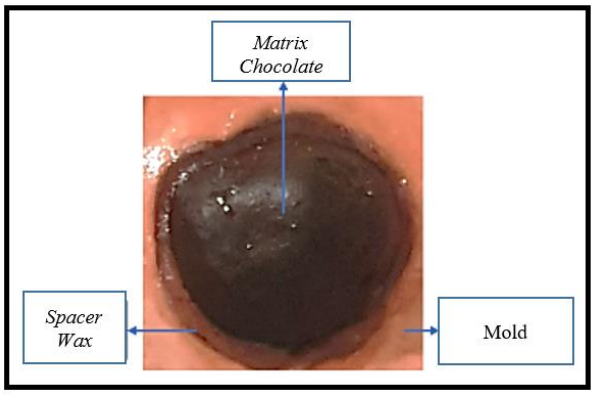

Figure 6: Chocolate matrix with 2mm wax spacer on the flask

The chocolate matrix (Colatta, PT Mas Gandum Kencana, and Indonesia) was formed under bench pressing and allowed to set overnight. The wax was removed from the superior mold, the scleral acrylic, which was made from clear heat-cured acrylic (Regular Vertex® #4, Vertex-Dental B.V., Netherland) mixed with acrylic color (Faber-Castell Acrylic Colours, Faber-Castell International, Indonesia), was packed under the bench press and we continued with the inferior mold. After packing and heat-curing the sclera acrylic, the ocular prostheses were carefully removed to maintain the mould. The sclera acrylic was trimmed to about 1mm to allow for sclera characterization and a clear lens covering the ocular prothesis with putty index as guidance. A pinhole was drilled in the eye and immersed in hot water, revealing the fully evacuated void (Figure 7). A small addition of sclera self-cure acrylic (Snap, Parkell, USA) sealed the pinhole. Characterization was finished by the application of stains and veining. The super clear heat-cured acrylic (Regular Vertex® #4, Vertex-Dental B.V., and Netherland) sealed the detailing and the eye was cured again. The rough edges of the prosthesis were trimmed off. It was polished with the help of polishing burs, pumice, and a buff to give the prosthesis a natural glossy finish. (Figure 8)

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Figure 7: Trimmed sclera acrylic with putty index with pinhole to evacuated void

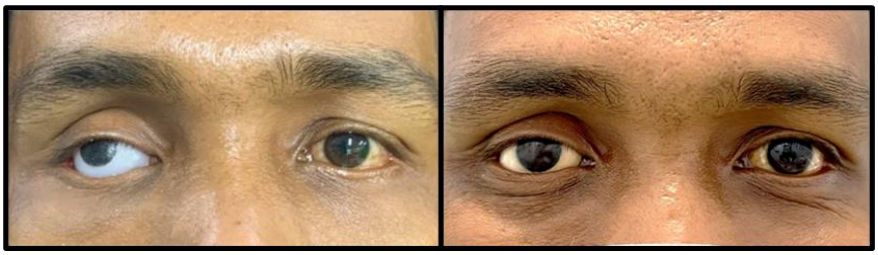

Figure 8: Before and after hollow custom ocular prosthesis insertion

DISCUSSION

Insertion of an ocular prosthesis shortly after surgical removal of the eyeball and followed by constant replacement of ocular prostheses at the time of growth will prevent orbital growth retardation. [8] The average volume of the enucleation eye is 7.9ml with an implant diameter ranging from 14–22 mm with an ocular prosthesis volume of 2.2–2.3 ml.[7] Hai Phan Hoang et al. concluded that the average dimensions of an ocular prosthesis are 23.82, 22.98, 8.82 in each horizontal width, vertical height, and thickness, so that the average volume of an ocular prosthesis is usually less than 3ml. [8] According to Sara, the smallest volume of ocular prostheses was 0.75ml in patients with severe socket contraction and 1.1 ml in patients with anterior implant and moderate socket contraction. The largest volume of an ocular prosthesis was 4.2 ml in patients with moderate socket contraction and the smallest was 13 mm of anteriorly migrated implants that had been used since childhood. So the ideal volume of an ocular prosthesis is 2.2ml and a large prosthesis (3-4ml) can cause ectropion (a decrease in the lower eyelid) or lid laxity (weakened eyelid), which may be a consequence of prosthetic augmentation for ptosis (dropping upper lid).[7] In this case, it was found that the patient's eye prosthesis volume of 4.5ml had exceeded the ideal volume so that a hollow ocular prosthesis was made where the shape and size remained the same as the anopthalmic socket but was light so as not to overload the lower eyelid.

Much of the literature explains various techniques in the manufacture of hollow ocular prostheses. Maskey, et al.[12] used putty spacers and matchsticks to obtain cavities in the eye prosthesis. Aggarwal et al.[10] use a two-step technique when packing acrylic with wax spacers, which will later be followed by a lost-wax technique. Udayshankar et al.[13] used silicon putty index to obtain the same acrylic scleral thickness and wax modeling in the manufacture of cavities in ocular prostheses. Worrell et al.[9] use a sugar matrix, which is a mixture of egg whites with sugar in a ratio of 1: 5 to fill the inside of the ocular prosthesis, which will later be cleaned by dissolving the sugar matrix in hot water. However, the materials needed in one mix are many and only used a little. It takes one day to harden the matrix, and the sugar matrix can change shape when under pressure when packing acrylic and produce an unequal thickness on the walls of the ocular prosthesis, which will affect the strength of the ocular prosthesis.[12] Khan et al.[14] use soap spacers, which is soap that is melted and poured and will later be

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cleaned with hot water. The use of a soap matrix is likely to have difficulty when cleaning soap on the inside of the ocular prosthesis with only two small escape holes due to the high melting point of soap, which is 60 °C, which is approximately the same as the melting point of wax.

CONCLUSION AND SUGGESTION

The manufacture of hollow ocular prostheses can reduce the weight of protheses with large orbital defects. A hollow ocular prosthesis has a cavity inside the prosthesis but is large enough to fill the socket and is unobtrusive, comfortable, and aesthetically pleasing. There are many techniques for making hollows in the eye prostheses by modifying the matrix used. The use of the chocolate matrix can be one of the alternatives in the manufacture of hollow ocular prosthesis because chocolate is easy to obtain; it is not expensive; it does not require special tools; it is easy to melt and harden quickly by soaking it in cold water, and it can be formed or carved after hard; and the color of the chocolate can be a marker of whether or not the cavity inside is completely clean.

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