Prosthetic challenges in a patient with ocular evisceration and global preservation: a case report

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INTRODUCTION

The eye is a vital organ from a functional perspective, but loss of an eye also often leads to altered emotional, psychological, behavioural and social responses. This may adversely affect the quality of life of a patient and many experience a feeling of societal discrimination, especially if there has been no provision of an acceptable prosthesis.[1] Unilateral enucleation has a major impact, as it results in complete deprivation of visual input to a section of the brain. Restriction to monocular vision affects spatial perception, motion systems and visual direction and may result in diminished performance.[2]

LITERATURE REVIEW

Many different conditions may lead to loss of vision or possibly to the need for removal of an eye.[3] If the latter becomes necessary, the options include three different types of surgical procedures:

Evisceration – involves removal of the inner eye contents, the iris and cornea, leaving the extra-ocular muscles attached to the remaining sclera. In this instance, the ideal restoration consists of an orbital implant placed inside the sclera to replace the lost volume. Thereafter, a scleral shell may be fitted.[3]

Enucleation – refers to removal of the eyeball, but with the remaining orbital contents left intact. If possible, the four extra-ocular muscles are preserved and attached to an orbital implant, which helps provide co-ordinated movement for the implant and prosthesis. These may be made of silicone, polymethyl-methacrylate (PMMA), porous polyethylene, hydroxyapatite or fat.[3] Enucleation is usually carried out in cases of intraocular tumours, infections (endopthalmitis), blind painful eye, or severe trauma.[4] A conformer should be fitted as soon after surgery as possible and replaced with a prosthesis once healing and settling of the socket has occurred.[3,5]

Exenteration – is the complete removal of the contents of the orbit including the eyeball, fat, muscles and other adjacent structures. In severe cases, the eyelids may also be removed. A maxilla-facial prosthesis is usually needed following this surgery.[3]

Artificial eyes are not functioning neural / bionic eyes and cannot restore lost vision, but do have high cosmetic value. They are usually made from cryolite glass or medical grade acrylic resin, are convex in shape and fabricated to replace missing ocular tissue.[1] There are two main designs:

1. Scleral shells fit over the scleral surface of the eye providing excellent motility, depending on the underlying socket and globe shape. They are indicated for cases of evisceration, phthsis, phthsis bulbi, phthsical eye (conditions where severe injury results in loss of eye function and shrinkage in size), accidents and injury leading to shrunken or disfigured globes, retinal detachment, glaucoma, or corneal dystrophy.
2. Custom ocular prostheses fit over an orbital implant or fill the entire socket, are close fitting and their fabrication demands accurate impressions. They may move with the remaining tissues in the socket bed, depending on the motility of the underlying muscles as well as the shape and edges of the prosthesis.[3] These restorations are indicated in cases of enucleation, blind painful eyes, diabetic retinopathy, tumours, severe trauma, ruptured globes, penetrating eye injuries, cataracts, infection, vitreous haemorrhage and endophthalmitis (a serious bacterial infection).[3]

Either scleral shells or ocular prostheses may be needed for children born with congenital eye defects.[3] In these cases, blank or clear ocular conformers are placed initially and then progressively modified and enlarged during the first two years of life as the child grows. The socket should be filled as much as possible to maintain the size of the bed, to prevent shrinkage and collapse of the surrounding tissues, and to try stimulate growth of the orbital muscles and bones.[3] Thereafter, a definitive ocular prosthesis may be fabricated, but this will need periodic replacement to ensure symmetry and equality in size with the remaining eye – up until about 10 years of age, when growth of this area slows down.

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Many procedures for fabricating ocular prostheses have been documented.[1-5] These range from selecting and fitting a stock eye, modification of a stock eye using an impression of the socket and the custom eye technique.[6-8] The latter provides the most aesthetic results, as it is based on an impression which captures the contours of the defect precisely. The iris and sclera are custom fabricated and painted for each patient.[9] Acrylic resin is the material of choice as it is lightweight, easy to fit and adjust, unbreakable, translucent, easily fabricated, can be coloured intrinsically and extrinsically, is inert to socket secretions and is biologically well tolerated.[10]

Common prosthetic problems experienced when fabricating an ocular prosthesis include size imbalances between the prosthesis and the socket, size and colour discrepancies in comparison with the remaining eye, eyelid defects, immobility and lack of retention.[1] There have been numerous articles written on the basic techniques for ocular fabrication.[1-5] However, it is often necessary to make adaptations to suit individual requirements. This paper reports on a case presenting the specific challenge of fabricating an aesthetic ocular prosthesis, in a patient with an incompetent lower eyelid and limited prosthetic space due to the underlying globe.

CASE REPORT

A 32-year-old male patient suffered trauma to his left eye, following an assault in which the assailant struck him with a glass bottle. He lost vision in the eye, but surgeons were able to preserve the globe. Whilst the eye was not painful, it was un-aesthetic and lacked eyelid support (Figure 1 & 2). At the time, he did not have a prosthesis made due to financial reasons. Two years later, he presented at the Oral and Dental Hospital for a tooth-related problem. It was then that he was referred to the Maxillo-facial Prosthodontics Department for a consultation. After an initial examination and a discussion of treatment options, a decision was taken to fabricate a haptic-shell type ocular prosthesis.

Figure 1: Frontal view of patient without prosthesis (the patient granted permission for the publication of these photographs).

Figure 2: Globe still present

A special tray was custom-made due to limited space available in the socket. It was perforated, had a hollow handle and was reduced in size to avoid encroaching on and distorting the delicate musculature in the eye socket.[11] The tray was inserted into the eye bed, and the impression material then injected through the hollow handle into the socket. An unflavoured dust-free irreversible hydrocolloid impression material was used (Blueprint 20+, Dentsply De Trey GmbH). An extra half-measure of lukewarm water was added to produce a runny mix, that was easy to squeeze through the tip of a 10cc plastic disposable syringe, but which would still set quickly. A functional impression was taken by making the patient look in all directions, blink and close his eyelids tightly. The impression tray was supported by the handle during setting while at the same time, a gentle inwards pressure was exerted to prevent the tray from being extruded / dislodged by the movements. During the final setting, the patient was instructed to gaze directly forward to ensure the posterior aspect of the socket bed was in the correct position.[12] The superior aspect of the impression was marked with an indelible pencil. A two-piece split cast mould was poured and used to make the initial wax conformer. At the same visit, a clear acrylic iris button with a flat posterior surface was painted to match the patient's remaining eye. Whilst not required in this case, it is worth noting that in cases where there is limited prosthetic space, a button with a concave posterior surface may be used.

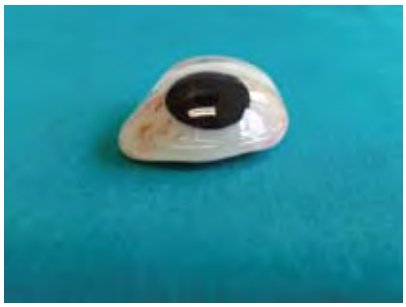

Figure 3: Extended inferior border

Figure 4: "Lip" of resin added to anterior inferior surface

At the second visit, the wax conformer was fitted and adjusted until its size, dimensions and the lid support it provided, matched that of the remaining eye. The iris position was then marked with an indelible pencil using the remaining eye as a guide and with the patient sitting upright and looking forward. The conformer was removed and the iris button embedded into the warmed wax. It was then re-inserted to verify that its position matched that of the remaining eye. The patient was instructed to open and close his eyes and perform various eye movements so that retention could be assessed. There was a problem when he looked upwards, as the inferior border of the prosthesis pushed the lower lid outwards, resulting in poor retention. The thickness of the inferior portion was reduced in the attempt to resolve this problem, but the reduction resulted in an inferior border which was too thin. The length was then reduced, which resolved the instability, but resulted in parts of the border becoming visible and un-aesthetic. After an extensive trial-and- error process of adjustments, it was decided to try adding a wax "lip" to the inferior facial aspect (Figures 3 & 4). This supported the lower lid, stopped it from slipping down and under the prosthesis and thus prevented the inferior margin from being exposed with possible dislodgement of the prosthesis. The scleral shade of the natural eye was taken and a diagram indicating other characterisations such as staining and veining was drawn. These features were incorporated into the final acrylic resin scleral shell.

Minor adjustments were made on delivery; thereafter the eye was polished to a high shine and delivered to the patient along with after-care instructions (Figure 5 & 6). A recall visit was scheduled for two weeks later to assess the patient's tolerance and any settling which may have occurred. Minor modifications were carried out at that stage to improve the lid position.

DISCUSSION

Following enucleation or evisceration, the condition of the socket, fornices and eyelids, as well as the amount of movement of underlying muscles, together with the patient's psychological status, will all impact on the acceptability and success of an ocular prosthesis.[12] Most exchanges with other people are initiated by eye contact, thus discrepancies in eye colour, position, movement and lid support are immediately noticed. In some instances, an un-aesthetic ocular prosthesis may be psychologically worse for the patient than no prosthesis at all.[12] Ptosis of the upper eyelid and ectropion of the lower lid are commonly encountered problems. Ptosis can be corrected by extending the anterior surface of the prosthesis forwards, thus wedging the eyelid margins apart. Another method is to add an acrylic shelf across the front surface of the eye to hold the eyelid at the desired open position, however this often prevents the eyelid from blinking or closing fully.[12] Patients with ectropion of the lower lid have difficulty with retention of the prosthesis, as it tends to slip down and out over the everted eyelid.[12] In this patient, whilst the eyelids were competent, there was a lack of retention, due to dislodgement of the prosthesis by the inferior orbital muscles during function. Reduction of the lower border of the prosthesis led to an improvement in retention, but posed an aesthetic problem as the margin then became visible. In most cases of lower lid ectropion, the problem can be addressed by extending the prosthesis deeper into the socket in an attempt to deepen the fornix.[12] However, in this situation, such an extension of the prosthesis would have exacerbated the problem. A narrow "lip" of wax was added to the anterior segment of the shortened prosthesis. This wedged the lower lid upwards preventing it from falling down to expose the margin of the prosthesis. On delivery, it was observed that the new "lip" created a slight bulge in the lower lid. This was therefore reduced in thickness to improve aesthetics but without compromising the support.

Figure 5: Frontal view of prosthesis supporting lower eyelid

Figure 6: Ocular prosthesis in place

After provision of an ocular prosthesis, regular follow-up is needed, as early settling and sinking often occurs.[6] This is due to tissues in the socket undergoing healing with atrophy and shrinkage, resulting in a smaller-looking prosthesis. For this reason, it is best to provide the patient with a custom-made clear / blank acrylic resin conformer which can be modified during the first few weeks of healing to accommodate changes in the socket and surrounding soft tissues.[6] Definitive ocular prostheses are not made initially, as adjustments to these usually alter the position of the iris.[6] In patients such as is reported in this case, where the globe was still present, the post-insertion settling requirements are not as demanding. However, the eyelid support may pose a greater challenge, as laxity and immobility of the eyelids can lead to both retentive and aesthetic problems. In these situations, it may be possible to alter the facial surface of the prosthesis to provide additional support, without compromising the iris position.[5] Regular recall visits are recommended as all ocular prostheses become scratched or pitted over time, resulting in patients complaining of increased 'tearing" or a scratchy sensation. The replacement eye can then of course be re-polished.[13]

CONCLUSION

Prosthodontic rehabilitation of a patient who has suffered the physical and psychological trauma of an ocular loss is challenging. The prosthodontist should strive to manufacture a functionally and aesthetically pleasing prosthesis that matches the remaining eye closely in terms of colour, size, lid support and movement. This often requires modifications of the basic technique to address each individual situation.

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