Prosthetic Eye Rehabilitation and Management of Completely Blind Patients

Muhanad M. Hatamleh, BSc, MPhil, MSc, Dip (MaxFac), PhD[a]/
Colin Haylock, MBE, FIMPT[b]/Philip Hollows, MBChB, BDS, FDSRCS, FRCS, MSc[c]/
Andrew Richmond, MIMPT[d]/Jason Watson, BMed Sc, MIMPT[e]

Facial prostheses aim to restore the appearance, contours, and esthetics of the face while consequently enhancing patients' self-esteem and reintegration into social life. Restoring unilateral missing ocular and orbital tissues is a challenging task that requires great skill from the clinician (anaplastologist) to accurately mimic the opposing natural tissues. Bilateral defects present additional technical and clinical challenges for clinicians and patients alike. This article presents two cases involving restoration of the ocular and orbital components of bilaterally blind patients. The first case comprised the construction of indwelling scleral eye shells for both eyes, while the second comprised left orbital (implant-retained) and right indwelling eye shell prostheses. Custom-made bilaterally indwelling eyes are more esthetically pleasing than stock options and show better fit and comfort following conventional impression techniques. Clinical challenges include impression taking, prosthesis fabrication, identification of the correct orientation into the socket, communication with the patient, and satisfaction of patient expectations. Since both patients were blind, their families played a vital role in describing their prostheses and thus in improving the patients' self-esteem and satisfaction with treatment. *Int J Prosthodont 2012;25:631–635.*

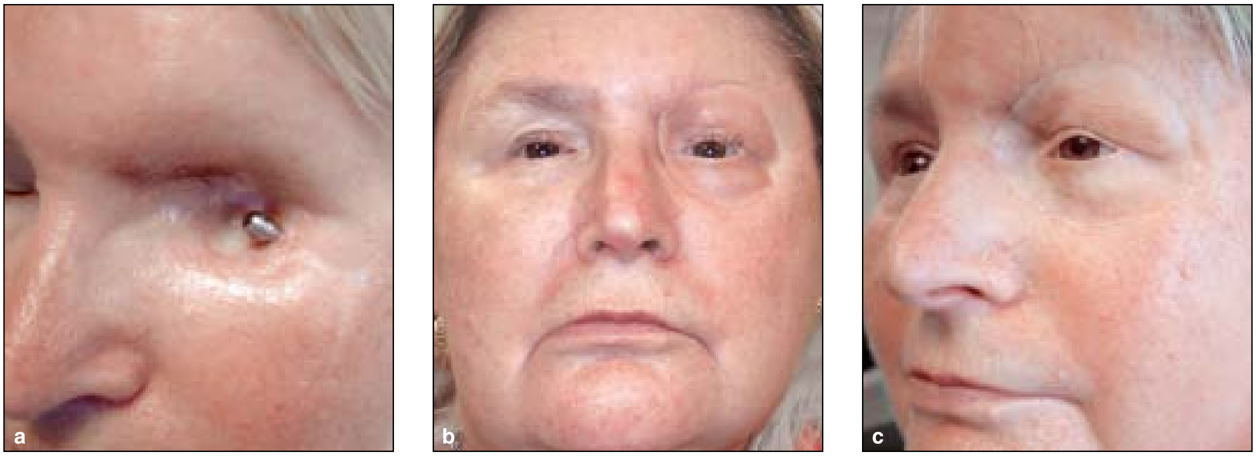
Maxillofacial defects are defined as facial disfigurements resulting from congenital abnormalities, surgical resection of tumors, and/or trauma.[1,2] A facial prosthesis is the most practical alternative when surgical methods cannot fulfill the patient's esthetic and functional demands.[3] In 2007, 1,193 facial and body prostheses were constructed in the United Kingdom, with ocular and orbital prostheses forming the first and third most common types of prostheses, respectively (501 ocular and 155 orbital).[4]

[a]*Researcher, Faculty of Applied Sciences, Jordan University of Science and Technology, Irbid, Jordan; Maxillofacial Prosthetist, Maxillofacial Department, Queens Medical Centre Campus, Nottingham University Hospitals Trust, Nottingham, United Kingdom.*
[b]*Consultant, International Ocular and Facial Prosthetic Services, NGO Charitable Services, London, United Kingdom.*
[c]*Consultant and Maxillofacial Surgeon, Maxillofacial Department, Queens Medical Centre Campus, Nottingham University Hospitals Trust, Nottingham, United Kingdom.*
[d]*Principle Maxillofacial Prosthetist, Maxillofacial Department, Queens Medical Centre Campus, Nottingham University Hospitals Trust, Nottingham, United Kingdom.*
[e]*Consultant and Maxilofacial Prosthetist Healthcare Scientist, Maxillofacial Department, Queens Medical Centre Campus, Nottingham University Hospitals Trust, Nottingham, United Kingdom.*

Correspondence to: *Dr Muhanad M. Hatamleh, Faculty of Applied Medical Sciences, Jordan University of Science and Technology, PO Box 3030, Irbid, Jordan 22110. Email: muhanad.hatamleh@gmail.com*

Causes of blindness vary among different regions of the world, based largely on climate, economic, and environmental factors as well as access to care.[5] Focal diseases that affect the poorest populations include vitamin A deficiency, trachoma, onchocerciasis, and leprosy. Other focal diseases include glaucoma, diabetic retinopathy, and age-related macular degeneration.[5,6]

The loss or absence of an eye can be managed by evisceration (removal of intraocular contents of the globe), enucleation (removal of the globe and parts of the optic nerve), or exenteration (removal of the entire orbital contents, primarily for eradication of malignant orbital tumors).[7] Subsequent prostheses can be retained by the natural undercut of the lids (evisceration and enucleation) and are described as indwelling eyes or ocular prostheses. Otherwise, the prostheses can be retained by either adhesive methods or implants (exenteration). Osseointegrated craniofacial implants have been proven to enhance prosthesis retention and patients' self-esteem.[8] In the majority of patients, satisfaction depends on how well the prosthetic eye (and its components) resembles the opposing natural site. However, when a patient is missing both eyes, there is no point of reference for the clinician and patient to determine and assess the prosthesis color. This article presents two cases of prosthetic management of completely blind



Figs 1a to 1c **(a)** Implant and prosthesis magnet in place. **(b and c)** Prostheses (right ocular and left orbital) in situ.

patients. The first case involved a patient who had suffered multiple retinoblastomas in both eyes and was rehabilitated with right ocular and left implant-retained orbital prostheses. The second patient presented with evisceration in both eyes due to trauma.

Case Reports

Patient 1

A 58-year-old female patient was referred to the Maxillofacial Unit, Queens Medical Centre, Nottingham University Hospitals Trust, Nottingham, United Kingdom, for construction of an implant-retained left orbital prosthesis. The patient was completely blind secondary to retinoblastomas that had occurred in both eyes at different time intervals since 1953. Initially, she was treated with an adhesive-retained orbital prosthesis; however, she developed skin inflammation due to poor hygiene. She reported that it was very difficult to maintain proper hygiene on the fitting surface of the prosthesis, leading to adhesive buildup. Creams were applied but did not improve the situation. After a surgical opinion was sought, it was decided to place a single osseointegrated 7-mm dental implant (Nobel Biocare) in the lateral orbital floor (year of placement: 2010), and an implant-retained orbital prosthesis was fabricated. On examination, the implant adequately retained the prosthesis and resolved the irritation of the surrounding tissues (Fig 1a).

The right ocular prosthesis had been replaced 5 years previously and was ill-fitting, causing irritation of the conjunctiva. The patient was advised to have it replaced. The ocular and orbital prostheses were constructed conventionally.[9] A conventional alginate impression (Hydrogum, Zhermack) was taken of the right side of the face for the construction of an ocular prosthesis. Simultaneously, an alginate impression was taken of the left side using the closed impression technique to construct the orbital prosthesis. A 3-mm magnetic abutment (MAXI Magnet, Technovent) was placed on the implant, and a magnet (MAXI Magnet) was attached to the abutment. The skin shade was recorded using SpectroMatch (SpectroMatch), and the orbital prosthesis was constructed following the conventional technique of packing maxillofacial silicone elastomer (M511 Cosmesil, Principality Medical) and curing at 100°C for 1 hour. After bench cooling, the flask was opened and the prosthesis was finished and tried-in prior to final external colorization (Figs 1b and 1c).

Patient 2

A male patient who was completely blind secondary to evisceration presented to the clinic for prosthetic rehabilitation. The patient had sustained trauma to the midfacial region and bony orbits in a road traffic accident, resulting in extensive damage to the orbital globes. The patient's prosthetic rehabilitation was completed by fabricating conventional sclera eye shells over the phthisis eyes. Similar clinical steps as those described for the first patient were followed. The patient and his relatives were very happy with the final prostheses (Figs 2a to 2c).

Figs 2a to 2c **(a)** Pretreatment view. **(b and c)** Posttreatment view with the sclera eye shell prostheses in place.

Discussion

The disfigurement associated with the loss of an eye can cause both physical and emotional problems. Most patients experience significant stress following the loss of an eye, primarily due to the functional disability as well as to societal reactions to the facial impairment.[10] Multidisciplinary management and a team approach are essential to provide proper rehabilitation and follow-up care for the patient. While replacing the lost eye as soon as possible is often necessary to promote physical and psychologic healing for the patient, bilaterally blind patients may require more complex and time-consuming treatment to achieve the best results.

Bilaterally blind patients are rarely treated by clinicians since the majority of cases treated worldwide involve unilateral defects; therefore, this article provides an original approach to treating bilateral defects. Achieving harmony between the prostheses and surrounding soft tissues in these cases was challenging since the underlying damage had created two different treatment sites. It is important to take impressions of both sites and individually fabricate the prosthetic eyes. While stock eyes are cheap and readily available in completely identical sets, custom ocular prostheses based on two separate impressions offer improved adaptation to the underlying tissues, mobility, and facial contours. Additionally, these custom-made prostheses promote enhanced esthetics due to improved control over the size of the iris and pupil and color of the iris and sclera.[11] Nevertheless, increased fabrication time and costs represent the primary disadvantages of this technique.[12] Further, alignment of the iris units is difficult. In the first patient, where the left eyelid was still present, the left indwelling eye was fabricated first and then used to help determine the eyelid opening of the right orbital prosthesis. Each prosthesis should have symmetric lid contours, accurate globe placement, proper positioning of the prosthetic margins, and appropriate surface texture and color in relation to the contralateral eye.[13]

The choice of iris unit (diameter and painting) and sclera color depend on the patient's age and race. Additionally, the patient's relatives can be useful during this process. The first patient requested brown irises. It was challenging for the ocularist to precisely match the first iris painted since no digital recording is kept and no exact sequential steps of pigment concentrations can be maintained. The second patient's sister was present, which was of great assistance during the painting process since the patient's eyes were similar to his sister's. In both cases, it was important to meet the patients' expectations. Both families indicated that the prosthetic eyes accurately recreated the patients' appearance before loss. In both cases, an ocular tray was used when loading the impression material and recording the ocular space. The effectiveness of ocular impressions relies on operator experience and the materials and equipment used,[14] and different techniques are suggested depending on whether the patient has an existing prosthesis or conformer.[12]

The single 7-mm dental implant was placed in the lateral orbital floor to improve retention of the orbital prosthesis. It should be expected that radiation exposure may lead to orbital bone changes, thus affecting the integrity and vascularity of orbital bone and leading to higher failure rates.[6] The severity of such changes will depend on the radiation intensity and duration of exposure. In the first patient, dimensional changes on the implant side were not noted because the orbit was fully grown; however, radiotherapy did cause significant skin surface trauma that had to be resolved before impressions were taken. Prosthetic treatment with the implant-retained orbital prosthesis was carried out 8 weeks after surgery.

Implant-retained prostheses have been reported to remain in service for twice as long (19 to 24 months) as adhesive-retained prostheses (7 to 12 months).[4] Magnetic retention was chosen over bar-clip attachment because it requires minimal space (can be used in shallow areas), offers simpler hygiene maintenance, and is easy for blind patients to locate.[15,16] Further, magnetic retention systems create relatively low forces on the supporting abutment when the prosthesis is removed by a tilt-slide-release action.[16] Nonetheless, a careful approach to implant follow-up was needed since the patient was at high risk of failure due to diabetes and radiotherapy of the orbital bone. Additionally, it is generally advised to place more than one implant because of the high failure rate of craniofacial implants in the orbital region.[13] However, it is the authors' practice to place the minimum number of implants required, which in this case was one. This is a routine procedure for the authors, who have a 100% success rate in the orbital region. If an implant were to be lost, the patient would be offered a quick, single-stage turnaround.

Considering that patients with partial vision often have difficulties maintaining hygiene at the prosthetic site, patients who have lost both eyes are likely to need even greater support. With the first patient, however, hygiene at the implant has remained very good since 2010, despite the patient's partner also being blind. The patient has been very attentive to the hygiene instructions provided.

Collaboration with family members is crucial to success when treating bilaterally blind patients. The patient's relatives can help select the proper esthetic characteristics as well as describe the appearance of the prosthesis to the patient. Family members can also help the patient maintain good hygiene of the prosthesis and defect site. Therefore, it is recommended to educate the patient's family regarding hygiene procedures, including how to check for infection around the implant.

It is important to ensure that completely blind patients can differentiate between their left and right indwelling prostheses and find the superior aspect for insertion without assistance. Some sort of mechanical marking can be used to help blind patients locate their eye units properly, similar to how blind patients can read using the Braille system. However, one danger of creating such markings via roughening or notching is increased bacterial colonization and subsequent irritation to the underlying tissues. Thus, it is better to instruct the patient to read the contours of the prosthesis and differentiate between left and right. When the prostheses are not being worn, they can be stored in clearly indicated left/right containers. In the current cases, the patients were advised to pull the lower lid down, gazing overhead, and engage the lower margin of the prosthesis with one finger so that it is expelled downward into the hand. They were advised to wear the prostheses day and night, only removing them for cleaning with nonabrasive cleaners (eg, tepid water and soap) every so often or when mucus had accumulated.[17]

Both patients were pleased with their prostheses and expressed improved satisfaction and confidence regarding their appearance, which in turn will significantly improve their quality of life.[18]

Conclusions

Prosthetic rehabilitation of completely blind patients is a challenge that requires clinicians to establish close communication and rapport with their patients. Custom-made bilaterally indwelling eyes are more esthetically pleasing than stock options and show better fit and comfort following conventional impression techniques. In the cases presented here, both the patients and their families were very satisfied with the final results of treatment.

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