

Analysis of 2 Years Experience of Acrylic Implants for Artificial Eyes

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Abstract: Purpose: To analyze the 2 years results of use of acrylic implants for artificial eyes. **Patients and Methods:** Twenty-three eyes were implanted with acrylic implant for cosmetic purposes. The preoperative and postoperative appearances were revised. And the main outcomes were the cosmetic appearance, and patient satisfaction. **Results:** All patients were undergone implantation of acrylic implants for artificial eyes in Sohag University Hospital. During the follow up period 2 artificial eyes were explanted. Five cases developed lid edema and ecchymosis. Three patients were missed during the follow up period. Fifteen patients of 20 (75%) patients had very good cosmetic appearance of the implanted eye and ocular motility present and the patients were completely satisfied. Three patients of 20 (15 %) patients were partially satisfied as the ocular motility was in complete. Two patients (10%) were not satisfied. **Conclusion:** The use of acrylic implants for artificial eye proved to be efficient and inexpensive with excellent cosmesis. The procedure is simple with easy learning curve to oculoplastic surgeons. Great patient satisfaction was noted regarding the eye movements and final new look.

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1. Introduction:

Since 1885 when Mules placed the first orbital implant consisting of a blown glass sphere, various types of materials have been placed in the orbit following removal of an eye.¹ Glass, rubber, steel, gold, silver, silicone, acrylic, titanium mesh, and polymethylmethacrylate (PMMA) spheres have been used. Many of these materials are well tolerated by the host and provide adequate orbital volume. However, direct extraocular muscle attachment is impossible and motility is limited. Further refinement occurred with the use of quasi-integrated implants such as the Allen, Iowa, and Universal models. In these implants, the extraocular muscles were attached to the implants directly and implant movement was transferred to the prosthesis via matching irregularly shaped surfaces on the implant and prosthesis. Quasi-integrated implants are now rarely used because of their difficulty of implantation and higher risk of migration and extrusion.²

The disfigurement associated with the loss of an eye can cause significant physical and emotional problems³. The rehabilitation of a patient who has suffered the psychological trauma of an ocular loss requires a prosthesis that will provide the optimum cosmetic and functional result. An ocular prosthetic does not provide vision; this would be a visual prosthetic. Someone with an ocular prosthesis is totally blind on the affected side and has monocular (one sided) vision which affects depth perception. Before starting the design of the prosthesis, it is essential to assess the psychological component in

order to gain the confidence of the patient, 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.⁴

The art of making artificial eyes has been practiced since ancient times. Egyptian priests made the first ocular prosthesis, called Ectblepharons, as early as the 5th century BC. In those days, artificial eyes were made of enameled metal or painted clay and attached to cloth and worn outside the socket.^{5,6}

Implant and prosthesis movement are important aspects of the overall cosmetic appearance after enucleation and are essential to the ideal objective of crafting a lifelike eye similar in all aspects to the normal fellow eye.^{7,8} There are several theories of improved eye movement, such as using integrating prosthetic material, pegging the implant, covering the implant (e.g. with scleral tissue), or suturing the eye muscles directly to the prosthetic implant. The efficiency of transmitting movement from the implant to the prosthesis determines the degree of prosthetic motility. Movement is transmitted from traditional nonporous spherical implants through the surface tension at the conjunctival-prosthetic interface and movement of the fornices. Quasi-integrated implants have irregularly shaped surfaces that create an indirect coupling mechanism between the implant and prosthesis that imparts greater movement to the prosthesis. Directly integrating the implant to the prosthesis through an externalized coupling

mechanism would be expected to improve motility further.⁹

Purpose

The objective of study was analyze the 2 years results of use of acrylic implant for artificial eyes. The main outcome measures were the cosmetic aspects in terms of volume replacement, cosmesis and complications in patients with lost eyes which undergo evisceration.

2. Patients and Methods

Twenty three patients (14 females and 9 males) with mean age of 24.2 ± 6.9 years (range 14-50 years) with disfiguring eyes with lost visual function underwent evisceration and acrylic artificial eyes implantation in Sohag University Hospital and followed up for at least 24 months. The cause of losing the eye was variable from patient to another. Common causes were ruptured anterior staphyloma and atrophic eye after trauma. The surgical procedure was done as follow:

- Evisceration was done by opening the conjunctiva, scleral wound through which the content was evacuated.
- The corneal epithelium was removed.
- The sizer (12, 14, 16, 18 and 20) was placed inside the globe to detect its size (Figure 1).

- Then, acrylic implant was inserted.
- Closure of the sclera, tenon's capsule and conjunctiva in layers.
- Then the conformer was placed to be removed 2 weeks later (Figure 2).
- Then the prosthesis was placed.

The postoperative treatment for all patients was systemic antibiotic and anti-inflammatory and followed up on 1st week and then monthly for 6 months then every 3 months for 24 months.

The main outcome measures were the cosmetic appearance of the implanted eye in comparison with the sound eye and its movements and the patient satisfaction about this cosmetic appearance.

The patients were given instruction for wearing the prosthesis and it's home care protocol which is given below:

- Prosthesis should be handled with care and with clean hands.
- Removal of Acrylic prosthesis during night is ideal. It should be soaked in an antibacterial solution to kill the surface bacteria.
- Routine polishing of prosthesis should be done every year to prevent deposition of protein and bacteria.



Figure 1: Sizers (20, 18, 16, 14 and 12 from right to left)



Figure 2: Acrylic implants of various sizes



Figure 3: Two shapes of conformers

3.Results

Total number of the patients was 23 (23 eyes). Nine patients (39.1%) were males and 14 (60.9%) were females. Three patients were excluded due to missing follow up. The age range was 12-50 years. Table 1 shows the age range of the patients. Post-operative results are shown in (Figures 4,5,6,7 and8). The good cosmetic results were noted in 15 cases (75%) with preserved eye movements (Figure 4-c). 3 cases (15%) had fair results, while 2 (10 %) had explanted implant because of thin tenon fascia and conjunctival necrosis and needed further procedures to improve cosmesis.

Table 1: Age range of the patients

Age group	No. of cases=23 n (%)
12-16	2 (8.7 %)
16-24	10(43.5 %)
24-35	8(34.8 %)
35-50	3 (13%)
>50	None

Twenty one eyes (93.1 %) retained the acrylic implants for the follow up period ranging from 20-28 months. Two eyes extruded the implants one after 4 months and the other after 6 months and needed re-intervention.

Complications

Ptosis. Although it was not always recorded in the hospital notes we assume that almost all patients in the series had at least a minimal ptosis preoperatively as a feature of the postenucleation socket syndrome.

In seven patients (30%) the preoperative ptosis was not corrected by orbital implantation and prosthetic adjustment alone. Six (26.1%) of these required ptosis surgery. There was no correlation between the severity of the ptosis and the age of the patient.

Shallow fornices, Five patients (21.7%) with normal fornices before implantation developed a shallow fornix postoperatively.

Other complications, three patients (13%) developed conjunctival implantation cysts-two in the centre of the socket and one in the upper fornix. All were removed easily with direct closure of the conjunctiva.



Figure 4: postoperative view (above) of a female and final view (below).



Figure 5: Preoperative view (above) of a middle aged and final postoperative view (below).



Figure 6: Preoperative view (above) of a child and postoperative view (below).

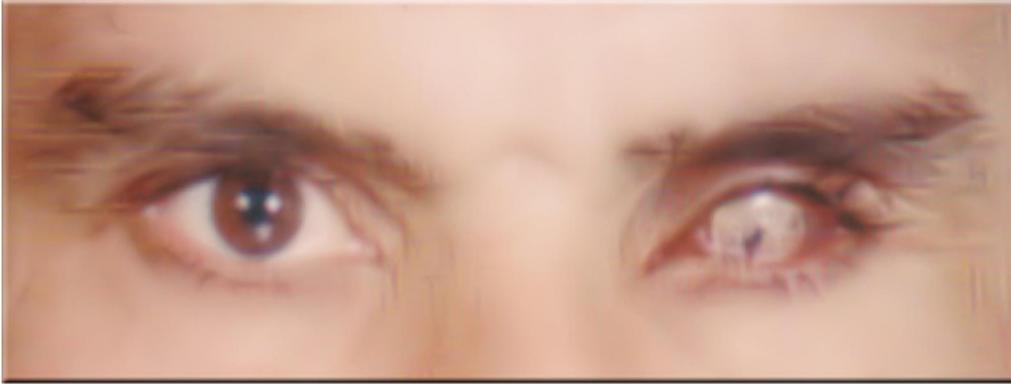


Figure 7: Preoperative view (above) of a man and postoperative view (below).



Figure 8: Preoperative view (above) of a girl and postoperative view (below).

4. Discussion

Today the vast majority of patients all around the world wear ocular prosthesis made of acrylic.^{5,6}

Poly methyl methacrylate PMMA⁹ is a transparent thermoplastic available for use as ocular prosthesis, replacement intraocular lenses when the

original lens has been removed in the treatment of cataracts and has historically been used as hard contact lenses. PMMA has a good degree of compatibility with human tissue, much more so than glass. Although various materials have been used to make nonintegrated implants in the past, polymethyl

methacrylate (PMMA) is one of the implants of choice.

Several techniques have been used in fitting and fabricating artificial eyes. Empirically fitting a stock eye, modifying a stock eye by making an impression of the ocular defect¹⁰, and the custom eye technique¹¹ are the most commonly used techniques. The fabrication of a custom acrylic resin eye provides more esthetic and gives precise results because an impression establishes the defect contours, and the iris and the sclera are custom fabricated and painted.

Reconstruction of the empty socket is a challenging job. Unfortunately due to lack of awareness both among patients and ophthalmologists the socket is left empty for many years and sometimes decades¹². The patients when reached to the young adult age of marriage or job search look around to improve appearance. This was obvious from the fact that 80% patients belonged to the age group 16-35 years.

According to my experience no implant which fulfills specific requirements of this group of patients and can be available at an affordable cost has been designed.

The conformers were placed to prevent contraction of the socket until the prostheses were placed. Conformers are transparent and fenestrated with multiple holes for the following advantages:

- a. Allow delivery of the eye drops to the socket.
- b. Allow appearance of any abnormalities like blood and discharge.

Selection of the correct size of acrylic ball is important. Too large an implant results in a shallow socket, poor fornices, and an increased risk of extrusion. Ocular prostheses should be at least 4 mm thick to achieve a realistic appearance, and this may not be possible if the convex posterior wall of the socket extends too far forward. A proptotic artificial eye may hinder lid closure, causing upper lid retraction, or the large implant may limit movement of the levator, causing ptosis. Too small an implant will not correct enophthalmos and a deep sulcus in the upper lid. Extrusion is usually associated with oedema, haemorrhage, infection, or poor surgical technique and occurs most commonly within six months of surgery. The extruded primary implants in our series followed recent trauma and were probably due to oedema.

Mild ptosis following enucleation is often corrected once the fulcrum over which the levator acts is raised by insertion of an implant. Inadequate size of implant fails to achieve this. Some ptoses do not improve and a few are made worse, probably owing to operative trauma to the levator and postoperative oedema. Postoperative ptosis may be improved by building up the prosthesis either on its

anterior surface or upper rim. The failures are treated surgically. Levator resection is suitable for any ptosis with a levator function of more than 4 mm. Less levator function that this should be treated with a brow suspension.

The occurrence of conjunctival implantation cysts is well documented after enucleation surgery.¹³ They may occur within the orbit close to the implant or on the surface as in our series. They usually caused discomfort as they enlarge and may make wearing of the prosthesis impossible. Cysts close to the conjunctival surface are usually easy to remove.

The results of this study is agreed with that of Saeed who reported that Primary orbital implantation with adequate sized Allen type acrylic implant, after tension-free closure of Tenon and conjunctiva gives fairly acceptable cosmetic results.¹⁴

A series¹⁵ of 22 cases has been published reporting good results with reconstruction of the anophthalmic contracted sockets with radial forearm flaps. Some of their patients received spherical or conical hydroxiapatite implants. This procedure is more complicated, extensive and expensive, whereas our procedure is more simple and cost effective.

Conclusion

The use of acrylic implants for artificial eye proved to be efficient and inexpensive with excellent cosmesis. The procedure is simple with easy learning curve to oculoplastic surgeon. Great patient satisfaction was noted regarding the eye movements and final new look.

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