Review Article :

ORBITAL IMPLANTS

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Once the eye is removed, attention is directed toward restoring orbital volume, achieving satisfactory prosthetic motility, and attaining a comfortable and aesthetically acceptable socket.

In order to achieve the best cosmetic result following enucleation or evisceration proper orbital implant should be used. The size, shape, and composition of the orbital implant are all important considerations.

The volume of the enucleated eye can vary from 7 to 9 mL,and averages 7.9 mL[1-3]. The volume deficit after enucleation or evisceration is corrected by both the orbital implant and the ocular prosthesis.

Ideally the orbital implant replaces the majority of the volume deficit, while leaving sufficient space for the ocular prosthesis. One should not expect the prosthesis to provide more that 4.2 mL of volume replacement. Excessively large implants are more likely to become exposed or extrude, and leave little room for a prosthesis. This makes prosthesis fitting difficult, and the resulting prosthesis is often too thin to give the appearance of a deep anterior chamber. An excessively small implant will not adequately restore the volume deficit in the socket. This causes enophthalmos and a deep superior sulcus. The residual deficit would have to be addressed by a large prosthesis. Larger prostheses can be uncomfortable and usually do not move well.In all cases, the largest implant possible will reduce the risk of postoperative enophthalmos and superior sulcus depression.

Classification of Orbital Implants

- **Non-integrated** — No direct or indirect integration of the synthetic implant with the orbital structures or with the prosthesis. Ex.PMMA or Silicone spheres.
- **Semi-integrated**— Indirect (mechanical) integration of the synthetic implant with the orbital structures but not with the prosthesis. Ex. Allen implant.
- **Integrated**— Indirect (mechanical) integration of the synthetic implant with the orbital structures and with the prosthesis. Ex. Cutler's implant.
- **Bio-integrated**— Direct (biological) integration of a natural or a synthetic implant with the orbital structures with or without integration with the prosthesis. Ex. Hydroxyapatite , Porous polyethylene, Aluminium oxide.
- **Biogenic** —An autograft or allograft of a natural tissue with direct (biological) integration with orbital structures but not with the prosthesis. Ex. Dermis-fat graft, Cancellous bone.

Non-Integrated Implants—these are buried in the socket and have no motility.

Semi Integrated Implants— these were introduced to try to improve prosthetic eye movement. These implants and small protrusions on the anterior surface but were completely covered by conjunctiva.

The irregular surface fit into depressions on the back surface of the prosthesis, transmitting movement to the prosthesis. These

implants require a skilled custom fitting of the prosthesis to avoid pressure on the conjunctiva covering the elevations on the implant, which may cause discomfort or exposure of the implant[6,7].

Integrated Implants—these were made to try to improve prosthetic motility. These were implants that were partially buried, but had a socket exposed that a peg attached to the back surface of the prosthesis would fit into. This would couple the prosthesis directly to the implant and result in near-normal motility. Unfortunately, these implants had a very high rate of infection and extrusion. These integrated implants were abandoned, and buried implants regained popularity.

Bio- Integrated Implants— From the time of introduction of integrated orbital implants following initial clinical work by Perry, the coralline hydroxyapatite received FDA approval in 1989 thus beginning a new era in orbital implants.

Hydroxyapatite, a complex calcium-phosphate salt Ca_{10} $(PO_4)_6$ $(OH)_2$, is a component of human bone. The porous hydroxyapatite implant was processed from a specific genus of reef building coral. The implant becomes incorporated into the orbital tissue thus minimizing the chance of displacement and extrusion, apart from providing better motility. The regular system of interconnecting pore resembles the Haversian system of human bone and provides a framework for fibrovascular ingrowth. Because of its rough surface, the hydroxyapatite implant is wrapped in donor sclera or other materials.The wrapping material is also essential to anchor extraocular muscles to the implant. A recent innovation is a coated hydroxypapatite implant to which the muscles can be directly sutured without additional wrapping.

Motility peg insertion provides an indirect attachment of the implant to the prosthesis, enhancing prosthesis motility[9]. Pegging of hydroxyapatite implant can sometimes be performed as early as 6months after the initial surgery in patients desirous of having a better prosthesis motility, pending confirmation of vascularization[10]. Pegging ,may, however, increase the risk of implant exposure and infection[11].

Implant exposure (1-15%) seems to be a major complication with hydroxyapatitie implant[12]. The vastly different results are attributed to variations in the surgical procedure. Proper implant sizing and meticulous wound closure seem to minimize the risk of implant exposure. The use of hydroxyapatite significantly raises the cost of surgery. Less expensive synthetic bioceramic implant[13] made with aluminium oxide has advantages similar to hydroxyapatite.

Porous polyethylene is another bio-integrated implant material[14].The 400-micron large pore size of this material allows fibrovascular ingrowth. The latest technique of saline impregnation of the implant may accelerate fibrovascular ingrowth. Porous polyethylene is sufficiently pliable to allow direct suturing of the extraocular muscles and thus does not need to be wrapped. Its rough anterior surface,however, is a consideration to wrap. Wrapping the implant by the conventional technique (with one large posterior window and four anterior windows for recti) may delay implant vascularization. The recent scleral cap technique where the anterior surface of the implant is covered with a 10-12 mm diameter disc of donor or autologous sclera[15]may provide an additional barrier to minimize the risk of implant exposure without interfering with fibrovascular ingrowth .

A new material formed by a combination of porous polyethylene with bioglass seems to provide improved vascularity.

A titanium peg (called the "motility coupling post") preplaced in a porous polyethylene implant is a newer concept. The

motility coupling post is placed at thetime of surgery and is simply exteriorized after 4-6 months, thus eliminating a second procedure of implant drilling[16] .

A review of the current trends in the management of anophthalmic socket after enucleation and evisceration from the American Society if Ophthalmic Plastic and Reconstructive Surgery, revealed that high density porous polyethylene implants are most popular for enucleation and evisceration. Most orbital implants are not wrapped and most surgeons prefer not to place a motility peg or post in the implant.

Biogenic Implants— Dermis-fat grafts can also be used in both enucleations and eviscerations, either as a primary or secondary implant.

Dermis-fat grafts are free grafts, and as their survival dependson a vascular recipient bed. These grafts are particularly useful when there is pre-existing conjunctival shortage. When the graft is placed in the socket, the conjunctiva is sutured to the edges of the dermis, rather than over the top as it would be with a buried spherical implant. This effectively increases the amount of conjunctiva available in the fornices. The extraocular muscles should be sutured to the edge of the dermis, not only for optimum motility, but also to bring the long ciliary arteries along with the muscles into contact with the dermis.

Implant Size:

Proper implant sizing is crucial. Implant that provides about 65-70% of volume replacement is ideal, the remaining 35-30% being contributed by the prosthesis.

A smaller implant has a higher tendency to displace or migrate and develop superior sulcus deformity. A larger implant is known to improve both cosmesis and motility.

However, an inappropriately large implant may produce tension on the conjunctival wound and result in wound gape and implant exposure.

Implant sizing has mostly been empirical and is often decided in the operating room. Generally, a 16-18 mm implant is used in infants, 18-20 mm in older children, and 20-22 mm in adults. There are implant sizers that may help gauge the appropriate size.

A recent trend is to use the axial length of the fellow eye (axial length in mm - 2 = implant diameter in mm) to choose the implant size[17] One should remember to deduct an additional 2-mm from the axial length if the implant is traditionally wrapped but not when the scleral cap technique is used.

Implant Wrapping:

Implant wrapping has certain specific advantages. It provides an additional barrier with reduced risk of implant exposure; enables easy attachment of extraocular muscles, thus providing for better prosthesis motility; entails a smooth external surface thus making the process ofimplant insertion easier; and helps volume augmentation by adding 1 to1.5 mm to the implant diameter[18] .

Donor sclera is the most popular wrapping material. Donor processed pericardium and fascia lata are commercially available.Autologous sclera can also be used if enucleation is done for an indication other than a suspected tumor. Other autologous material that have been used are temporalis fascia and fascia lata. Popular synthetic wrapping materials are polyglactin-910 mesh, polytetrafluoroethylene sheet etc.

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