Anophthalmos is the absence of the globe and ocular tissues from the orbit. The majority of cases of anophthalmos are seen following evisceration or enucleation. Congenital anophthalmos is rare and due to the arrest of embryogenesis during formation of the optic vesicle. An orbital implant is typically placed at the time of evisceration or enucleation. An ocular prosthesis is fitted subsequently.

The components of a functionally and aesthetically acceptable anophthalmic socket include:

- A satisfactory central implant (Figure 1)
- An adequate, epithelium-lined socket (Figure 2)
- Eyelids of normal length, appearance and tone
- Well fitted prosthesis (Figure 3)

All these factors enable good transmission of motility from implant to overlying prosthesis.

Anophthalmic socket in children

Certain additional factors need to be considered in management of anophthalmia in children. Enucleation/evisceration in childhood lead to underdevelopment of bony orbit with secondary facial asymmetry (Figure 4). It is important to place a large orbital implant (20–22 mm; not less than 18mm preferably). Autogenous dermis fat graft is another option as these grafts are known to grow along with the growing orbit.

Congenital anophthalmos (true anophthalmos/ extreme microphthalmos) is rare. There is associated shortening of the palpebral aperture making it often impossible to insert a regular prosthesis in the socket. Tissue expansion is required to stimulate growth of bony orbit so as to decrease midface asymmetry which is disfiguring especially in unilateral cases. Various surgical options for congenital anophthalmic socket include:

- Insertion of conformers followed by implantation of non-expanding orbital implants. These have to be changed a few times in order to expand the palpebral fissure and bony orbit until a suitable prosthesis can be retained.
- Inflatable balloon expanders which need to be regularly filled with saline solution.
- Expandable hemispherical and spherical hydrogel expanders (Figure 5).
- 3D osteotomies for small bony sockets

Socket expanders

A hemispherical implant is sutured on the conjunctiva to expand palpebral fissure. The treatment should ideally commence as early as possible. These implants are available in diameters of 6, 8 and 9 mm when dry that expand to 11, 14 and 18mm respectively when fully hydrated (within 30 days).

After the socket is adequate to fit a prosthesis, orbital expansion is commenced using the spherical expanders. These are surgically placed in the deep orbital cavity and the overlying tissue covered in two layers. They are available in
various sizes that expand to a final volume of 2-5.5ml. This needs to be eventually replaced by spherical acrylic implants of increasing size.

**Some common problems of an anophthalmic socket**

- Enophthalmos & superior tarsal sulcus deformity (Figure 6)
- Implant extrusion / exposure
- Socket laxity - shelved inferior fornix
- Contraction of socket and associated abnormalities
- Migration of implant

**Enophthalmos & superior tarsal sulcus deformity**

This results from poor orbital volume. This can be a result of inadequate volume replacement (small/no implant) at the time of surgery or subsequently due to atrophy of fat and inferior migration of implant.

Enophthalmos can be corrected by placement of a secondary orbital implant if no implant was placed at the time of primary surgery. Dermis fat graft (DFG) is an option in patients with associated surface contracture. Other options in the presence of a primary implant include fat grafting and subperiosteal implants.

Superior sulcus deformity also implies a loss of orbital volume. It may be further augmented by traction of fascial attachments of superior rectus to levator complex and sagging of lower eyelid.

Sulcus deformity can be corrected by implantation of fascia lata / sclera / bone / fat/ alloplastic material in upper eyelid.

**Implant extrusion/ exposure**

In the early post operative period, an implant may get exposed/extrude due to inadequate surgical closure or infection (Figure 7). Late exposures are a result of fibrous contraction or pressure atrophy of tissues overlying the implant (Figure 8).

In a small exposure, conservative treatment can be tried or the defect closed if possible. However, in persistent or large exposures or frank extrusion, the implant needs to be removed and replaced. In a clean socket, this can be done as a single stage, replacing the extruded implant with a smaller implant and adequate closure of tissues in layers. If the socket is infected, it may be better to remove the implant and wait for the infection to settle. A secondary implant can be later placed. Careful dissection of the orbital tissues and good haemostasis is important for good surgical results in a secondary implant.

If there is conjunctival shortening, fascia lata or sclera can be used to cover the defect. Tenons and conjunctiva is anchored to anterior graft surface in discrete layers. If possible, conjunctiva should be mobilised to cover the patch graft to ensure grafts viability. A scleral graft may be sandwiched between tenons and conjunctiva as this decreases the chance of scleral melt.

**Lax socket or inferior fornix shelving**

Lax socket results from shifting of tissues within the orbit. With time there is involutional relaxation of the supporting tissues of the inferior eyelid. Also, the weight and pressure effect of the prosthesis causes laxity of the lid resulting in inability to retain the prosthesis.

Horizontal lid laxity needs to be managed by eyelid tightening by doing a lateral tarsal strip procedure. This may be combined with fornix formation sutures to increase the depth of inferior fornix. In cases of fornix shelving without associated lid laxity, only fornix formation sutures can be put.

Fornix formation can be done by either closed method or with open method (Figure 9).

**Socket contracture**

[4,5,6]
A contracted socket is essentially a socket in which prosthesis of an adequate size cannot be fitted. The contracture can be graded according to severity and various classifications are used for it.

Causes of socket contraction are:

Early causes:
- Loss of conjunctiva / tenon’s due to trauma/surgery/irradiation
- Inadequate dissection at primary surgery
- No conformer in early post-operative period
- Poor prosthesis (ill fitting or rough)

Late causes:
- Chronic infection / inflammation (blepharitis, meibomitis, conjunctivitis, Canaliculitis, dacryocystitis)
- Migration/extrusion of an implant
- Multiple socket surgeries
- Non use of prosthesis for long periods
- Over-sized / ill fitting prosthesis

A meticulously done primary surgical procedure (evisceration/enucleation) is most important in preventing socket contracture. A conformer must be placed post operatively and then replaced after 6 weeks by prosthesis of adequate size.

Evaluation of a contracted socket should include:
- Eyelid position and tension
- Status of socket lining
- Position of prosthesis

Associated abnormalities that need to be assessed are:
- Fibrous bands (Figure 10)
- Symplepharon formation
- Granulomas (Figure 11)
- Anophthalmic ptosis
- Entropion
- Eyelid laxity and ectropion

Management
1. Localized symplepharon & fibrous bands can be managed by Z-plasty or V-y plasty.
2. Mild socket contraction: there is shortening of the inferior fornix (Figure 12). Prosthesis is still retained. Lash entropion may occur. It can be corrected by:
   - Weis procedures (tarsal fracture)
   - Correction of laxity
3. Moderate socket contraction: Inferior & superior both fornices are shortened. Inferior fornix is of greater importance. Signs & symptoms of moderate socket contraction are:
• Inability to retain prosthesis
• Poor motility of prosthesis
• Non-closure of eye
• Loss of normal lid fold
• Persistent discharge and irritation
• Enophthalmos with posteriorly displaced prosthesis if associated volume loss

Management: modification of prosthesis can be tried initially by trying a smaller prosthesis. If this is not possible, surgical management includes adequate scar excision and mucous membrane grafting to increase the surface area of the socket. Lip or buccal mucosa (Figure 13) is preferred (40-50% excess of the defect created after dissection of conjunctiva). In addition fornix formation sutures are required. Conformer is placed at the end and replaced by artificial eye later.

• Amniotic membrane grafting for contracted socket: can be used as a substitute for mucous membrane.
  • Easy availability
  • Lack of donor site morbidity
  • Antifibroblastic activity
  • Antimicrobial activity

However, AMG is only a substrate, not a substitute graft. While some authors claim comparable results of AMG vs MMG, other studies have shown higher rates of recurrence with AMG.

In moderate contracted socket with loss of orbital volume, dermis fat graft (Figure 14) is a better option for a single stage surgery. Else the surgery can be done in 2 stages i.e. placement of an orbital implant followed by MMG at a later stage.

Severe socket contracture: is difficult to correct. Mucosa is often inadequate (Figure 15).

• Split thickness skin grafts (Figure 16) may be tried alone or combined with buccal mucosa.

4. In severe / recurrent scarring contracted sockets, flaps with intact vascular supply such as radial artery forearm flap are an option with minimal risk of loss of viability of the forearm.
  - In desperate cases, orbital /spectacle prosthesis is the only option.
  - Other abnormalities that need to be evaluated and corrected along with socket contraction are:

**Lash margin entropion:** occurs due to contracture of fornices or cicatricial tissue near lash margin (Figure 17). It is managed by:
  – Tarsal rotation procedure (Weis)
  – Marginal mucous membrane graft.

**Anophthalmic ectropion:** results from poor prosthesis or lower lid laxity. Managed by:
  - Initially prosthetic correction- less bulky prosthesis
  - Lower lid tightening at either the lateral or medial canthal tendon depending on laxity.
  - Correction of eyelid retraction by recession of IR/ grafting of mucus membrane tissue in inferior fornix

**Anophthalmic ptosis:** results from
  • Superotemporal migration of implant
• Cicatricial tissue in upper fornix.
• Damage to levator or its nerve.
• Ptosis may be secondary to enophthalmos or volume deficiency.
• Lower lid laxity

Management: Mild ptosis (Figure 18)
– Prosthesis modification
– Fasanella servat
– Moderate ptosis
– Levator tightening
– Frontalis suspension – less satisfactory.

References