8 Post-operative Management and Visual Rehabilitation in Pediatric Cataract

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The difference between the paediatric eye and the adult eye is much more than the eye size. Children have ongoing visual development and nervous plasticity resulting in risk of amblyopia. In addition to effective surgery, meticulous operative care and visual rehabilitation is crucial for favourable outcome. The lack of compliance poses additional challenges.

Visual rehabilitation includes refraction correction and amblyopia management. In cases where the intraocular lens was not implanted, aphakic correction can be corrected by various modalities such as aphakic glasses, contact lenses, epikeratophakia. Situations where the intraocular lens was contraindicated and not implanted include the following:

- Very young child (minimum age for IOL implantation depends on laterality and surgeon preference).
- Ocular factors like uveitis, microphthalmia, persistent foetal vasculature.

In cases of primary intraocular lens implantation, visual rehabilitation encompasses management of the residual refractive error.

8.1 Aphakia Correction

See Fig. 8.1.

8.2 Aphakic Glasses

Aphakic glasses are commonly used for the correction of bilateral aphakia in children. They are also useful in children who are contact lens intolerant or as back up. Disadvantages of aphakic glasses include restriction of visual field to approximately 30°, heavy weight, distortion of image and prismatic effect. It is not recom-

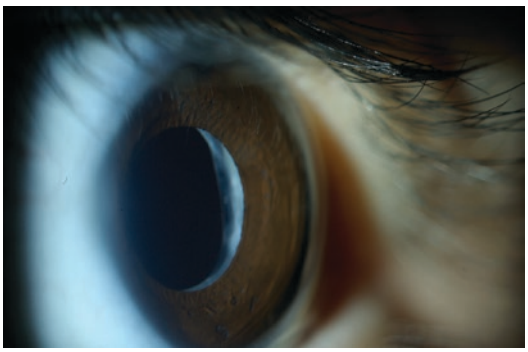

Fig. 8.1 Aphakia

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mended for unilateral aphakia due to marked retinal image size disparity.

Due to increased trend towards primary IOL implantation and contact lens, the availability and advancement of technology for high power plus lens (>10 D) have declined. Primarily, three types of aphakic glasses are available [1]. Ultraviolet protection should be added to these lenses.

1. Lenticular lenses: These lenses have the prescribed power at the centre of lens surrounded by ring of little or no power. Although they are inferior to other lenses, they are the only option when requiring >20 D.
2. Aspheric lenticular lenses: They have aspherical central area lenses surrounded by ring of little or no power. Available 10–20 D, they are optically superior to lenticular lenses.
3. Multidrop lenses: They have spherical central zone that flattens into aspherical zone which further blends with ring of no power. The lens resembles the aspheric lenticular lenses without the noticeable ring. Far superior to other options, it is only available in the range of +10 to +16 D (Fig. 8.2).

Frame selection is very important in paediatric age group. Whenever possible the child should be included in decision making for the frame. The bridge of the frame should carefully conform in shape to that of the child. Cable temples (earpieces) which wrap around the back of the ear and spring hinges are recommended.

Fig. 8.2 Child with aphakic glasses

8.3 Contact Lenses

Studies have shown that better binocular vision and stereopsis can be obtained in patients who show excellent compliance with contact lens postoperatively [2]. In fact, aphakia with contact lens rehabilitation is the most common approach to the treatment of unilateral congenital cataract in infants less than 6 months [3]. The major advantage is the easy adjustability with the changing refractive error. Good lens fit, care, and hygiene compliance can prove to be an excellent alternative to primary IOL implantation, though inability to adhere these requirements can lead to hazardous consequences.

Contact lens in paediatric patients is demanding for adults/caregivers. Problems include difficult insertion and removal, poor compliance with long term use, loss of lenses, ocular irritation and infection. Compared to an adult, the paediatric conjunctival fornix is shallower, the globe is smaller, the sclera is steeper, the cornea is smaller and steeper. Coupled with changing refraction, increasing axial length, progressive corneal flattening, contact lens practice is much more challenging in paediatric patients.

Target refraction depends on the age of the patient:

- Less than 1 year of age: overcorrect by 2.0 D to get −2 D (which means near-point correction at 50 cm.)
- 1–2 years old: −1 to −1.5 D
- 3 years old and above: Bifocal glasses (near add +3).

There are three main type of contact lens to correct paediatric aphakia [4]:

1. Silicone elastomer (SE).
2. rigid gas permeable lens (RGP),
3. Hydrogel/Silicone hydrogel lenses.

In Singapore, the most commonly used contact lens to correct paediatric aphakia is an SE lens—the SilSoft (Bausch & Lomb). This was

also used in the Infant Aphakia Treatment Study in the United States [5]. It has a high oxygen permeability (Dk = 340) and can be worn on an extended-wear basis. (The manufacturer recommends that the lens be removed for cleaning and disinfection at least once every 30 days and then left out of the eye overnight.) This wearing schedule is advantageous for young children, who often have a low tolerance for the insertion and removal of contact lenses. These SE lenses are limited for higher power (+23, +26, +29, +32 diopters [D]), 3 base curves (7.5, 7.7, 7.9 mm), and only 1 diameter (11.30 mm). Most aphakic infants are initially fitted with lenses that have a base curve of 7.5 mm. Lower-power SE contact lenses are available in 1 D increments (+11.50 D to +20.00 D), five base curves (7.5–8.3 mm), and 2 diameters (11.30, 12.50 mm). Some very young infants need higher power than what is available with the SE lenses. In addition, SE lenses have a limited capacity to correct corneal-induced astigmatism that exceeds 2 D in magnitude. The hydrophilic surface coating on SE lenses deteriorates over time, allowing its underlying hydrophobic surface to be exposed, which results in reduced wettability and accumulation of lipid-mucin deposits, thereby necessitating frequent lens replacement [6]. Silicon lenses are more costly, do not provide ultraviolet protection and can be uncomfortable initially (Fig. 8.3).

Fig. 8.3 Silsoft contact lens

In contrast to SE lenses, RGP lenses can be customised to achieve virtually any power, base curve, or diameter. This means that they are more suitable for microphalmic eyes, small corneal diameters, 9.5 mm and those not within the power or base curve range of silicone lenses. For the high plus powers needed to correct paediatric aphakia, RGP lenses are commonly made from Menicon Z (Menicon, Nagoya, Japan) with a Dk = 189 or hexafocon B (Bausch & Lomb) with a Dk = 141.2, 7 The advantages of RGP lenses include availability in a wider range of powers, increased ability to correct corneal astigmatism (up to 6 D), better durability, and lower cost. RGP lens may be ordered with UV blockers. The primary disadvantage of RGP lenses is that for the high plus powers needed to correct paediatric aphakia, their effective oxygen permeability is not optimal for extended wear and hence they need to be removed daily. The lens replacement rate was approximately 50% higher for RGP lenses when compared to SE lenses [5].

There are many disadvantages associated with the use of soft lenses like hydrogel lenses for paediatric aphakia [7]. The major problem is corneal hypoxia. The combination of the low Dk and the large centre thickness in high plus power means that these lenses have very low oxygen transmissibility (Dk/t), leading to complications like corneal vascularisation, stromal oedema. Silicone hydrogel lenses provide a marked increase in oxygen supply to the cornea compared to hydrogel lenses. However, these lenses, especially if worn on an extended-wear basis, can accumulate high levels of lipid deposition and be associated with clinical complications such as superior epithelial arcuate lesions, mucin balls and contact lens related papillary conjunctivitis.

Contact lens fitting can be initiated during the cataract surgery by taking corneal measurements using handheld topography or keratometry. Postoperatively, the aphakic child should be fitted as soon as possible. Most infants require the

11.3-diameter lens due to their small fissures. Premature infants may need much steeper base curves, such as 7.50 or 7.70. The lenses are fitted and allowed to settle for 15–20 min before doing fluorescein evaluation. A "steep" lens produces distinct central pooling of fluorescein whereas a "flat" lens results in an absence of fluorescein centrally. An ideal fit is obtained with the following:

- 1–2 mm movement on blink
- Minimal apical clearance
- Minimal bearing in the intermediate zone
- Peripheral edge clearance
- Moderate nasal edge lift
- There is no encroachment upon the limbus
- The optics are within the pupil

Preoperative biometry can also be used to estimate contact lens power for distance if an accurate refraction cannot be obtained initially [8]. These are the methods: (1) 30 D contact lens (32 D minus 2 D overcorrection for near vision based on IATS protocol); (2) regression-estimated contact lens power of 84.4–3.2 × axial length; and (3) IOL power calculated using the Sanders-Retzlaff-Kraff (SRK/T) regression formula with a modified A-constant (112.176) with mean prediction error of −4.0, −1.0, and −2.0 D respectively.

The compliance and success of contact lens treatment of aphakia depends on the caregiver/parents. They need to be educated and trained in lens insertion, lens removal, lens cleaning and care. It is crucial for them to understand and recognise complications such as infection, torn lenses, poorly fitting lens so that they can bring the child for requited medical care. Compliance to visits cannot be overemphasised.

8.4 Epikeratophakia

Epikeratophakia (or epikeratoplasty) is a surgical procedure in which a lamellar graft is sutured onto the surface of the recipient cornea to reproduce the effect of a highly positive contact lens [9]. This procedure has generally not been very successful for infantile aphakia due to graft failure. The only theoretical indication is unilateral aphakia where intraocular lens implantation is contraindicated and yet the patient is contact lens intolerant.

8.5 Management of Residual Refractive Errors After Intraocular Lens Implantation

Paediatric cataract surgery is associated with several sources of postoperative refractive error [10]. These include planned refractive error based on age or fellow eye status, loss of accommodation, and unexpected refractive errors due to inaccuracies in biometry technique, use of IOL power formulas based on adult normative values, and late refractive changes due to unpredictable eye growth (Fig. 8.4).

On average, the eye grows 4.5 mm in the first 2 years of life. From the age of 2–6 years, growth is slower but still substantial at 0.4 mm per year. We aim to correct the residual refractive errors with spectacle lenses or contact lenses. The target refraction is as follows:

1. in children less than 1 year: aim for mild myopia −2 D,
2. in children 1–2 year: aim for myopia −1 to −1.5 D,
3. Emmetropia for distance, Near add +3 for children 3 years and above (Fig. 8.5).

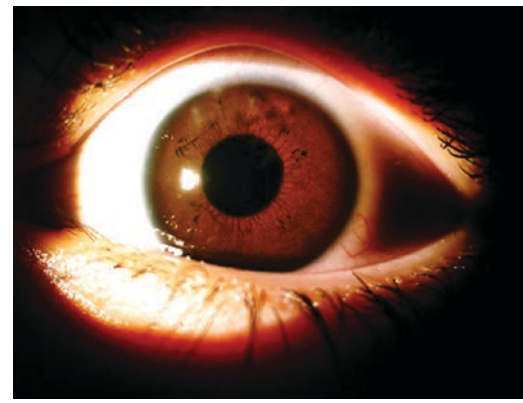

Fig. 8.4 Paediatric pseudophakia

Fig. 8.5 Left IOL implantation with bifocal spectacle lens correction

In unilateral cases, the fellow eye must not be forgotten. Refractive errors like significant hyperopia, myopia and astigmatism need to be corrected with optical aids.

8.6 Amblyopia Treatment

In paediatric cataract, amblyopia is the result of preop deprivation and postop anisometropia. The treatment goal is to provide a clear retinal image as soon as possible and to correct ocular dominance by patching good eye. Timely treatment is critical. The amount of patching depends on the age when retinal image was cleared. Likewise, if an older child presents with a unilateral cataract, the prognosis for improvement depends on the age at which the opacity developed. If it has been present since early infancy, the prognosis is poor, because of amblyopia, even if the surgery is successful in itself [11].

The IATS regimen for patching is as follows:

- Patching of the good eye 1 h per day per month of age until the child is 8 months old starting the second week following cataract surgery.
- Patch all hours that the child is awake every other day or one-half the child's waking hours every day for children more than 8 months old.
- If compliance is poor and patching of less than 15 min for 3 months has been achieved, use occlusion contact lens (Fig. 8.6).

Fig. 8.6 Child with left amblyopia

8.7 Summary

Advancement in surgical techniques and methods of optical rehabilitation has substantially improved the functional and anatomic outcomes of paediatric cataract surgeries in recent years. In cases where primary IOL implantation is not done, contact lenses and aphakic glasses are viable options. In cases of primary IOL implantation, residual refractive errors need to be corrected. In all cases, amblyopia management is critical.

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