Chapter 18
Intraocular Lens Exchange

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Background

Primary intraocular lens (IOL) implantation after lensectomy was established as an acceptable alternative to aphakia in pediatric cataract surgery after the Infant Aphakia Treatment Study (IATS) showed no significant difference in visual outcomes at age 5 years with those implanted with an IOL in infancy and those left aphakic with contact lens correction [1]. Especially in patients where contact lens use may be challenging for various ophthalmologic, behavioral, or socioeconomic reasons, early IOL implantation may be the preferred alternative to aphakia in facilitating compliance with refractive amblyopia management. While optimal targets for postoperative refraction after cataract extraction have been discussed in previous chapters, there is a known increase in axial elongation acutely after pseudophakia resulting in varying degrees of myopic shift reported in literature [2, 3]. Given the difficulty in predicting the precise amount of myopic shift after primary IOL implantation, it is not uncommon for these children to have significant anisometropia, especially in cases of unilateral cataracts. As surgical techniques and medical technology have advanced, attention has shifted from simply determining when pediatric cataract surgery should be performed and more toward optimizing refractive outcomes. A retrospective case series of 15 eyes undergoing IOL exchange for refractive indications demonstrated successful visual rehabilitation with predictable

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targeted postoperative refractions after this technique [4]. IOL exchange has therefore become an increasingly popular option for managing severe anisometropia and associated intolerable aniseikonia in pseudophakic children, which can further facilitate amblyopia management.

Case 1

An 8-year-old girl with history of infantile unilateral cataract presented for consideration of refractive options for aniseikonia. She had initially undergone lensectomy with posterior capsulotomy, anterior vitrectomy, and primary IOL implantation at age 1.2 months, with placement of an intracapsular MA60MA IOL with initial targeted postoperative refraction of +6.00 D. She had initially worn contact lenses successfully and was compliant with penalizing amblyopia therapy. At time of presentation, her best corrected visual acuity was 20/30 in this eye with a manifest refraction of −8.50 +0.25 ×170 (spherical equivalent −8.5 D) due to axial length elongation of 6.3 mm; visual acuity was 20/20 in the contralateral, unaffected eye with a manifest refraction of −1.75 +0.25 ×085 (spherical equivalent −1.50 D). However, she had grown increasingly intolerant to contact lens wear with frequent eye rubbing and suffered from significant aniseikonia with spectacle wear, so her parents were interested in surgical options to correct the high myopic shift in this eye given her excellent corrected visual acuity.

Clinical examination of the affected eye was significant for a three-piece IOL placed within the capsular bag, with fusion of the peripheral anterior and posterior capsules but a clear visual axis through the anterior/posterior capsulotomies. She had normal intraocular pressures and fundus examination throughout her clinical course. After informed consent was obtained, the patient and parents elected for intracapsular intraocular lens exchange, with surgery performed as discussed below. A replacement three-piece +10.5 D IOL was placed in the ciliary sulcus using posterior optic capture with a target refraction of −3.00 D. There were no intraoperative or postoperative complications. Manifest refraction at 1 month postoperatively was −4.50 +1.50 ×015 (spherical equivalent −3.75 D) and at 6 months postoperatively was −4.00 +0.75 ×040 (spherical equivalent −3.50 D), and the patient was able to tolerate spectacle wear at this time.

Comment In this case, the patient's decision to proceed with IOL exchange was a largely refractive decision that was supported by her excellent visual potential due to compliance with amblyopia therapy, relatively young age, increasing contact lens intolerance, and aniseikonia with spectacles. There were no instigating factors such as IOL dislocation or subluxation that would necessitate more prompt IOL removal; an intracapsular three-piece IOL was easily exchanged for another three-piece IOL placed in the ciliary sulcus with posterior optic capture following the steps as outlined below.

Step-by-Step Guide for Surgery

Preoperative Considerations

Specifics of the original cataract surgery are crucial in the planning of IOL exchange. If the original cataract surgery was performed by another surgeon, it is best to obtain operative note records in order to know type and strength of IOL implanted. Careful slit lamp biomicroscopy examination and/or high-resolution ultrasound biomicroscopy is incredibly helpful in determining preoperative positioning of the haptics and how much capsular bag support remains (both anterior and posterior capsule). Furthermore, if the original cataract surgery was a significant amount of time prior to planned IOL exchange, the peripheral capsular bag may be fibrotic or phimotic with the anterior and posterior capsules tightly fused; this can increase the difficulty of completing the IOL extraction without damaging the remaining capsular bag. Presence of a Soemmering ring can further complicate IOL exchange and make intracapsular placement of a new IOL very difficult. If any doubts exist regarding the integrity of the capsular bag for intracapsular IOL placement, it may be safer to plan for sulcus placement of a three-piece IOL with posterior optic capture, if possible, for refractive stabilization.

Since IOL exchange is often done for refractive purposes assuming there are no abnormalities with the original IOL (e.g., IOL dislocation or subluxation) that would necessitate more prompt IOL removal, special consideration must be given to the refractive target of the new implant. The targeted postoperative refractive can vary depending on the patient's age, refractive/visual status of the other eye, and indication for IOL exchange (e.g., debilitating aniseikonia vs sizable myopic shift). For example, a younger child within the amblyogenic age may benefit from a target closer to emmetropia or to the contralateral eye refraction, but one must account for whether further axial elongation may still occur and how much anisometropia can be tolerated. Biometry may also be difficult or imprecise in these cases, especially if unilateral pseudophakia or other ocular comorbidities triggered an axial myopic shift. In these cases, intraoperative biometry may be used to confirm appropriate IOL selection.

During any informed consent discussion of the risks, benefits, and alternatives to IOL exchange surgery, the necessity of postoperative refractive correction must be mentioned. As one primary indication for IOL exchange surgery is intolerance to contact lenses and/or aniseikonia or significant anisometropia with glasses, many patients and parents may believe that no glasses or contact lenses will be necessary postoperatively. Furthermore, it must be mentioned that amblyopia management will continue postoperatively, but that the goals of IOL exchange are often more to facilitate tolerance of refractive correction and amblyopia therapy. Depending on biometry and patient factors, the patient may be a candidate for other refractive options, including piggyback IOL or laser refractive surgery, which can also be discussed with the patient and family (as described in other chapters).

Operative Steps

The specific steps important to intracapsular exchange of an acrylic IOL implant are as follows:

1. One or two paracentesis incisions (approximately 120–180° apart) should be positioned in a way to allow access to both IOL haptics with good hand position (each generally 60–90° from a haptic).
2. Viscoelastic should first be injected into the anterior chamber to maintain the anterior chamber and prevent any IOL or vitreous prolapse.
3. Since visualization of the peripheral capsular bag and positioning of the haptics are crucial for IOL removal while preserving the integrity of the capsular bag, consider placement of iris hooks if the pupil is poorly dilated. An iris manipulating instrument (e.g., Kuglen hook) may also be used to temporarily visualize the peripheral capsular bag and haptic placement.
4. Using viscoelastic on a 27G needle, slide the needle with bevel side up underneath the anterior lens capsule edge at the haptic-optic junctions. Inject viscoelastic gradually to gently dissect the anterior capsular edge off of the IOL. Switching to viscoelastic on a blunt cannula, attempt to further inject viscoelastic both anterior and posterior to the haptic in order to dissect the capsular bag away from the haptic.
5. Using a lens manipulating instrument (e.g., Kuglen or Sinskey hook) placed at the haptic-optic junction, gently rotate each haptic out of the capsular bag and into the anterior chamber. Inject viscoelastic anterior/posterior to the IOL centrally as well as further peripherally within the capsular bag to release the haptics as needed during this process. If the initial IOL was placed in the ciliary sulcus, copious viscoelastic can be used to inflate the sulcus to prolapse the IOL into the anterior chamber for extraction.
6. A clear corneal incision should be created approximately 90–120° away from a paracentesis, generally close to the width of the radius of the prior IOL (usually 2.4–2.8 mm depending on how flexible the IOL material is) (Fig. 18.1). If a rigid IOL that cannot be cut with intraocular scissors was initially placed, consider a large superior scleral tunnel incision in order to remove the IOL in one piece while also minimizing incision-induced astigmatism.
7. Using lens-holding intraocular forceps (e.g., GRIESHABER® Maxgrip® forceps, Alcon, USA) through a paracentesis and lens-cutting intraocular scissors (e.g., Packer/Chang IOL cutters, MicroSurgical Technology, USA) through the corneal incision, cut the IOL into two halves within the anterior chamber (Fig. 18.2).
8. Gently extract the two halves of the IOL through the main incision using the lens-holding forceps and/or fine-tipped forceps, being careful to rotate each half through the incision following the curve of the IOL optic/haptic. Avoid grabbing the end of the haptic in order to prevent pieces from breaking prior to extraction of the entire IOL (Fig. 18.3).

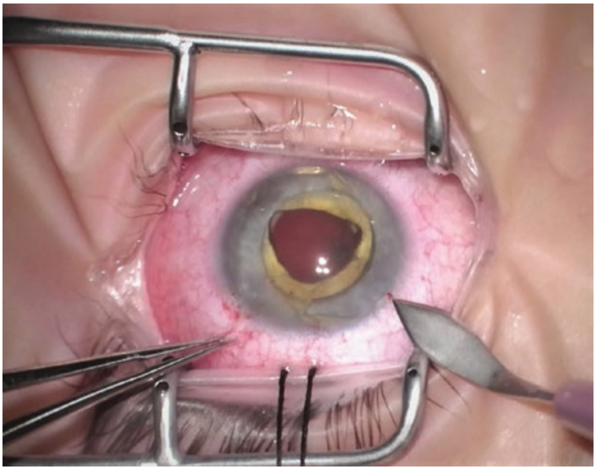

Fig. 18.1 Creation of a clear corneal incision approximately 120° away from a paracentesis incision after the IOL has been prolapsed into the anterior chamber

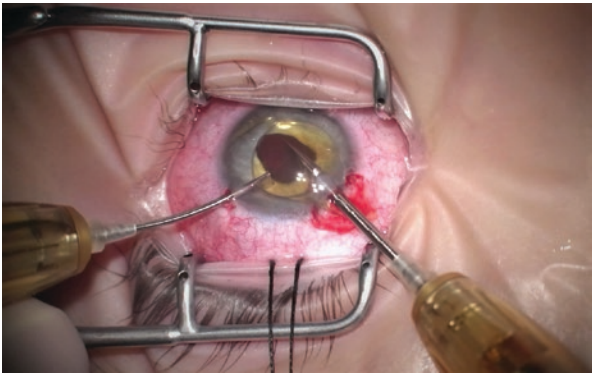

Fig. 18.2 Cutting of the IOL optic into two halves (each containing a haptic) using lens-holding intraocular forceps in the left hand through a paracentesis and lens-cutting intraocular scissors in the right hand through the corneal incision

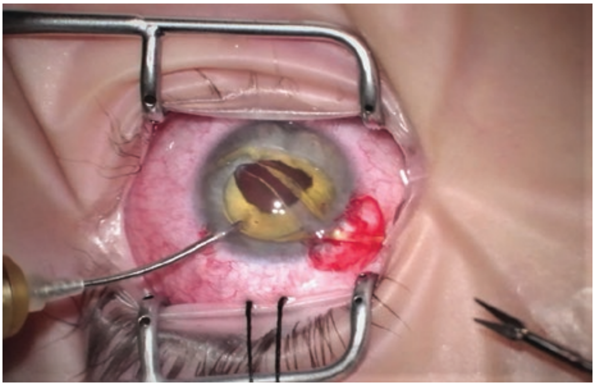

Fig. 18.3 Prolapse of IOL haptic out of main corneal incision using lens-holding intraocular forceps for subsequent extraction of each half of the IOL; at this point, fine-tipped IOL forceps can be used to grasp the optic-haptic junction external to the corneal incision to rotate each half through the incision following the curve of the IOL optic/haptic

9. At this point, inspect the globe for any signs of vitreous prolapse. Perform anterior vitrectomy if needed.
10. The globe is then prepared for IOL insertion by injecting viscoelastic into the sulcus. The incision may need to be enlarged to appropriate size for the IOL inserter.
11. During IOL insertion, care must be taken to ensure the leading haptic does not enter the vitreous cavity and the IOL stays in front of the capsular bag. If the peripheral capsular bag is secure enough for the haptic placement, intracapsular placement of the new IOL can be achieved. However, sulcus IOL placement with posterior optic capture may be more secure.
12. Further irrigation/aspiration and/or vitrectomy may be performed to remove residual viscoelastic or vitreous as needed.
13. All incisions (both paracentesis and larger corneal incisions) should be sutured and checked for a leak. In pediatric eyes, even small paracentesis incisions require sutures.

Postoperative Considerations

In the initial postoperative period, it again should be stressed that refractive correction and amblyopia management must resume as soon as possible. While the refractive outcomes may not be stabilized until a few weeks postoperatively, the overall recovery period should be shorter than the original cataract surgery, so it will be possible to resume spectacle wear with an updated refraction fairly promptly. While children are often highly immunogenic with profound inflammatory responses to any surgery, the postoperative inflammation is again expected to be overall less than for many other intraocular surgeries. However, careful follow-up evaluation for rebound iridocyclitis and cystoid macular edema should be performed if any decline in vision does occur. There has also been evidence showing longer-term endothelial cell loss and subsequent corneal decompensation (>5 years) after IOL reposition or exchange surgeries in pediatric patients [5]. While this risk can be mitigated with judicious use of dispersive viscoelastic intraoperatively, it is worthwhile to discuss this as a risk with the family and continue following these patients to ensure no late corneal complications occur or require further surgical intervention.

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References

1. The Infant Aphakia Treatment Study Group. Comparison of contact lens and intraocular lens correction of monocular aphakia during infancy: a randomized clinical trial of HOTV optotype acuity at age 4.5 years and clinical findings at age 5 years. JAMA Ophthalmol. 2014;132(6):676–82.
2. Lambert SR, Aakalu VK, Hutchinson AK, Pineles SL, Galvin JA, Heidary G, Binenbaum G, VanderVeen DK. Intraocular lens implantation during early childhood: a report by the American Academy of Ophthalmology. Ophthalmology. 2019;126:1454–61.
3. Crouch ER, Crouch ER, Pressman SH. Prospective analysis of pediatric pseudophakia: myopic shift and postoperative outcomes. J AAPOS. 2002;6(5):277–82.
4. Kraus CL, Trivedi RH, Wilson ME. Intraocular lens exchange for high myopia in pseudophakic children. Eye (Lond). 2016;30(9):1199–203.
5. Wang Y, Wu M, Zhu L, Liu Y. Long-term corneal endothelial cell changes in pediatric intraocular lens reposition and exchange cases. Graefes Arch Clin Exp Ophthalmol. 2012;250: 547–55.