

IOL Fixation Techniques

BY EFREM D. MANDELCORN, MD, FRCSC; JONATHAN PRENNER, MD;
AND CHARLES C. WYKOFF, MD, PhD

In the absence of capsular support, the ophthalmic surgeon is faced with a number of choices for implantation of an intraocular lens (IOL). Myriad techniques have been described for fixation of an IOL either to the iris or the sclera in the ciliary sulcus.

When faced with a preoperative assessment for IOL placement in cases of zonular weakness or iatrogenic capsular rupture, the ophthalmic surgeon should first do a careful slit-lamp examination looking for adequate anterior capsular support to place an IOL in the ciliary sulcus. This is likely the least complex of all techniques and is the simplest to perform. If slit-lamp examination is inconclusive, intraoperative examination of the anterior capsule, either from direct visualization with the microscope and pupil enlargement with a secondary instrument or by endoillumination from a pars plana approach, should be attempted. If only partial anterior capsule remains, a combination approach may also be considered, in which one haptic is supported by the remaining capsule and the other is sutured to the sclera or iris.¹

If there is inadequate anterior capsular support, options include placement of an anterior chamber IOL, an iris claw lens, or a posterior chamber IOL, sutured either to the iris or sclera in the ciliary sulcus.

IOL OPTIONS

Early anterior chamber IOLs were commonly used in treatment of aphakia in the early 1980s. Over the next decade, data began to emerge that suggested that these rigid closed-loop anterior chamber IOLs often led to pseudophakic bullous keratopathy from endothelial cell loss, inflammatory cystoid macular edema (CME), and angle-structure damage including peripheral anterior synechiae and uveitic glaucoma hyphema syndrome.^{2,3} With the advent of new open-loop anterior chamber IOLs, which mitigate many of the previous complications of closed-loop anterior chamber IOLs,⁴ however, surgeons now often use anterior chamber IOLs as a first-line IOL for surgical treatment of aphakia. Anterior



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chamber IOLs are relatively easy to insert and require short operating times. Some studies, however, have demonstrated better postoperative visual acuity with posterior chamber IOL fixation.⁵

Proponents of posterior chamber IOLs over anterior chamber IOLs point to the fact that a posterior chamber IOL carries less risk of corneal endothelial damage simply because it is placed in a more physiologic location, further from the cornea.⁶ One of the main criticisms of sutured posterior chamber IOLs, however, is their late dislocation from tissue erosion.⁷ Moreover, tissue erosion with exposure of the suture through the conjunctiva introduces the risk of late endophthalmitis.⁸ Because of this, patient selection for an anterior chamber IOL vs a sutured posterior chamber IOL is important. If possible, a sulcus-supported posterior chamber IOL is preferable because it is the easiest to carry out surgically and it avoids the risks associated with anterior chamber IOLs and sutured posterior chamber IOLs. It is important to remember that only 3 to 4 clock hours of capsule for each haptic are often enough for support. In patients with known Fuchs endothelial dystrophy or guttata, low endothelial cell count, significant peripheral anterior synechiae, or CME, a sutured posterior chamber IOL should be considered over an anterior chamber IOL. Some argue that in younger patients, sutured posterior chamber IOLs are less likely to produce endothelial cell loss, angle inflammation, and angle damage, and are therefore a better choice in the long term.

Iris-sutured posterior chamber IOLs have certain advantages over transsclerally sutured posterior chamber IOLs. They require less surgical time because the procedure is often more simple to perform. Iris-sutured



Figure 1. The IOL is fixated with two double-armed 9-0 prolene sutures passed through the sclera with an ab interno approach.

IOLs carry the risks of postoperative inflammation (CME, uveitis) and iris atrophy with pigment-dispersion syndrome. They occasionally cause poor pupillary dilatation; this is, however, controversial. In contrast, a transsclerally sutured posterior chamber IOL should not contact the iris if properly fixated and should therefore have no associated risk of iris atrophy with pigment dispersion, CME, or chronic uveitis. Transsclerally sutured posterior chamber IOLs, however, are often more technically challenging to implant and require longer operating times, increasing the risk of intraoperative suprachoroidal hemorrhage and postoperative inflammation or infection.

METHODS OF FIXATION

Many methods of transscleral fixation have been described. One method involves securing a nonfoldable IOL with a double-armed 10-0 prolene suture on a curved long needle (CIF-4; Ethicon, Somerville, NJ) that is passed through a scleral groove and grasped in the barrel of a 25-gauge needle through a groove on the opposite



Figure 2. Each of the needles of the 9-0 prolene suture is passed back through the small hole in the conjunctiva, through the sclera, and out through the corneal tunnel incision. This maneuver buries the prolene underneath the conjunctiva.

side. Knots are buried in the scleral groove.⁹ Another method uses an MA60 AcrySof IOL (Alcon Laboratories, Inc., Fort Worth, TX) and secures the haptics with 10-0 prolene and then fixates it to the sclera by tying to knot to itself.¹⁰ The knot is buried under partial-thickness scleral flaps. In cases of dislocated posterior chamber IOLs, vitrectomy should be performed first to retrieve the IOL and stabilize it in the anterior chamber. The surgeon can then externalize and tie a knot around the haptic. The haptic tip can be heated using a diathermy needle to create a notch on the haptic and decrease the risk of the knot slipping off. After reinsertion of the haptic into the eye, the suture should be retrieved through the sclerotomy and secured with a second suture 1.25 mm posterior to the limbus under a scleral flap.¹¹ This technique avoids the difficulties with looping the haptics intraocularly, which is another surgical option.

TECHNIQUES

Sutured posterior chamber IOL. Methods of transsclerally suturing posterior chamber IOLs that have been described include both ab interno and ab externo techniques for placement of sutures through the ciliary sulcus to fixate the IOL. In sutureless microincisional vitrectomy surgery, one technique eliminates the need for conjunctival cutdown or scleral flaps, thereby minimizing the need for additional sutures at the end of the case. This method has been described¹² and will be highlighted in this article (see video, "Scleral Sutured IOL with Corneal Tunnels"). The traumatic cataract in the video was removed with pars plana lensectomy techniques using

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Scleral Sutured IOL with Corneal Tunnels

By Efreem Mandelcorn, MD

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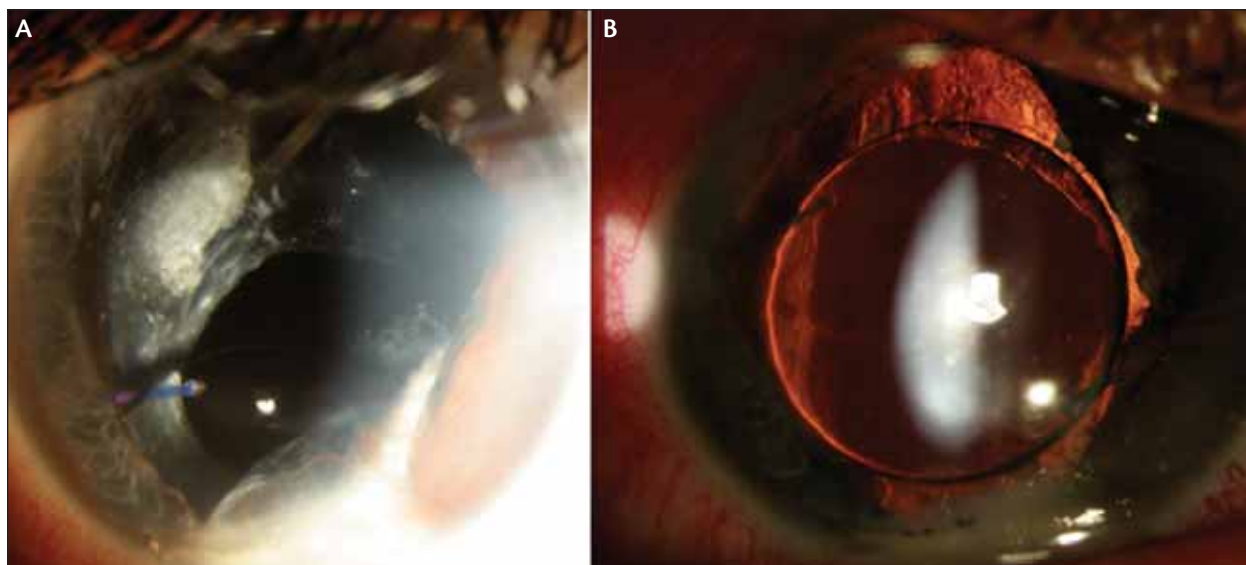


Figure 3. A man aged 51 years with a history of trauma 39 years ago who had undergone multiple surgeries presented with a subluxed posterior chamber IOL (A). The patient underwent iris fixation of his subluxed lens using the Siepser slip-knot technique with good postoperative centration of the lens as shown by retroillumination (B).

only 23-gauge instruments. An incision in the lens equator was made using the 23-gauge trocar blade, and the lens was removed using the 23-gauge vitreous cutter with low cut rate and low aspiration (“dense” mode on the Constellation Vision System [Alcon Laboratories, Inc.]). The lens was also hydrodissected prior to its removal, which the authors feel is an often overlooked step in pars plana lensectomy that facilitates efficient removal of cataract in these cases.

Prior to initiating vitrectomy, two double-armed 9-0 prolene sutures are placed through the eyelets of the posterior chamber IOL and secured using a cow-hitch knot. A 7-mm corneal tunnel is made superiorly, and two clear corneal partial thickness corneal flaps are made directly opposite one another. These corneal pockets are back-dissected using a crescent blade. Creation of these corneal flaps is easier prior to the start of vitrectomy because the eye pressure is more physiologic. After completion of the pars plana lensectomy and vitrectomy, the main corneal tunnel is enlarged with a keratome blade as it enters the anterior chamber. The anterior chamber is filled with viscoelastic. The posterior chamber IOL is brought into the field, and each of the four needles are passed from an ab interno approach through the ciliary sulcus approximately 1.5 mm from the limbus in a staggered configuration from the corneal/scleral tunnel (Figure 1). These sutures are then each passed back through the small hole created in the conjunctiva (Figure 2), through partial thickness sclera and out through the corneal tunnel. Placing the

needle through the small hole in the conjunctiva ensures that the prolene suture will be buried under the conjunctiva. The two ends of the prolene suture are each tied with one throw initially to ensure centration of the IOL and then secured with multiple throws. The knots are buried in the corneal tunnel.

Iris Fixation. Iris fixation of a posterior chamber IOL can be particularly useful when a three-piece posterior chamber IOL already present within the eye is simply subluxed or dislocated. In this technique, a vitrectomy is performed to free the dislocated three-piece posterior chamber IOL of vitreous. The optic of the IOL is brought into the anterior chamber so that the haptics are posterior to the iris and the optic is resting on the iris surface. Acetylene chloride can be used to achieve miosis, securing the optic in place. McCannel sutures or modified Siepser slip knots can then be employed to secure each haptic to the iris.

To achieve the modified Siepser slip knot (Figure 3),¹³

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Siepser-Slip Knot

By Charles C. Wykoff MD, PhD

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Figure 4. The superior haptic is captured by a transcorneal suture that goes through the proximal iris, under the haptic, and out through the distal iris.

a 10-0 prolene suture on a CIF4 needle is passed through a paracentesis, through the iris, posterior to the IOL haptic, back through the iris, and then out distally through clear cornea. A Kuglen hook is then used to retrieve the distal end of the suture and to pull it out of the paracentesis to externalize a loop. It must be clear which end of the loop goes to iris and which goes to cornea. The free suture end is then tied around the side of the externalized loop coming from iris by going over the loop twice. Both ends are then pulled and the knot slips into place, securing the haptic to iris. The distal end of the suture is then retrieved with a Kuglen hook, and a loop is again externalized. A locking knot is thrown by passing the free end under the side of the loop that extends to iris and back under the free end. Both ends are again pulled, and the knot is secured. The ends can then be cut short and the knot is complete. The other haptic is secured to iris using the same technique. The optic is then placed into the posterior chamber using a Sinskey hook. The Siepser slip knot is also useful for re-approximating traumatic pupillary defects to restore a normal pupillary contour.

One special situation in which an iris-fixated IOL may be advantageous is when an eye has had complicated retinal detachment repair. In cases of advanced detach-

ment, we will often choose to completely remove the lens and capsule and place silicone oil to repair the pathology. A minimally invasive approach can be utilized subsequent to reattachment in which the oil is removed and an iris-fixated IOL is placed. This technique provides a good option for the management of the truly aphakic oil-filled eye.

A 25-gauge infusion cannula is initially placed into the anterior chamber through the clear cornea temporally to pressurize the eye. Next, a superior clear corneal incision is created using a 4-mm keratome. A viscoelastic substance is instilled to coat the endothelium, and the active viscous fluid extractor is placed into the anterior chamber through the clear corneal incision to remove the silicone oil. A soft-tipped cannula is then used to perform a series of air-fluid exchanges just beneath the iris plane. A three-piece IOL is placed in the eye, ensuring that the inferior haptic is placed behind the iris while the optic is left in the anterior chamber. The superior haptic is then placed beneath the superior iris and the optic is captured in the pupillary axis. A 9-0 prolene suture on a long curved needle is placed in a McCannel style through the proximal clear cornea, under the iris on the proximal side of the haptic, and then out through the distal side of the iris and clear cornea (Figure 4). The needle is cut, and 25-gauge forceps are used to externalize the suture ends via a small inferior paracentesis. The inferior suture is tied with a standard 3-1-1 knot, drawing the iris to the cornea as the knot is completed, and is subsequently cut. The process is repeated to fixate the superior haptic, after which the optic is deposited into the posterior chamber with a Sinskey hook and the infusion is removed. This technique allows the surgeon to perform a number of manipulations while leaving the conjunctiva intact and requires sutures only for the IOL fixation. If the peripheral iridotomy is a concern, an additional McCannel suture can be placed to close it at the same sitting.

CONCLUSION

In summary, IOL fixation techniques are numerous, allowing the ophthalmic surgeon to treat aphakia in many different ways. Anterior chamber IOLs are a good option for certain patients, particularly in light of improved open-loop design with fewer associated post-operative complications. In cases in which a sutured IOL is chosen, iris and scleral fixation are both reasonable options, and much of the decision between these will depend on surgeon experience and comfort.

The algorithm used by these authors when choosing IOL placement for the surgical treatment of aphakia is as follows. We routinely perform a careful preoperative

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Clear Corneal Silicone Oil Removal and Iris Fixated IOL Placement

By Jonathan L. Prenner, MD

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assessment at the slit-lamp, having the patient look in all directions of gaze, to look for any residual anterior capsule behind the iris. We also check for residual capsule using retroillumination with the endoillumination probe during vitrectomy. If there is evidence of adequate capsular support, our preference is to insert a sulcus IOL with no further fixation.

If, on the other hand, there is no capsular support, we often place a posterior chamber implant with suture fixation. In cases of a dislocated IOL in the vitreous, we plan for vitrectomy to retrieve the IOL, followed by iris fixation. This eliminates the need to make large incisions to explant the IOL for exchange with a new lens. If, however, the patient is aphakic preoperatively, we plan for a scleral-fixated IOL using the method described above. The exceptions are patients at high risk for suprachoroidal hemorrhage in which prolonged surgical time would increase this risk, particularly very elderly patients with poor choroidal regulation. In these cases, we would likely place an anterior chamber IOL. ■

Efrem D. Mandelcorn, MD, FRCSC, is a vitreo-retinal surgeon at the Donald K. Johnson Eye Centre, Toronto Western Hospital, University Health Network, and an Assistant Professor in the Department of Ophthalmology and Vision Science at the University of Toronto. He states that he has no financial interests to disclose. Dr. Mandelcorn can be reached via e-mail at efrem.mandelcorn@utoronto.ca.



Jonathan L. Prenner, MD, is an Assistant Clinical Professor at the Retina Vitreous Center, PA, Robert Wood Johnson Medical School of the University of Medicine and Dentistry in New Brunswick, NJ. Dr. Prenner states that he has no financial interests to disclose pertinent to this article. He may be reached via e-mail at jonathanprenner@hotmail.com.



Charles C. Wykoff, MD, PhD, is an Instructor of Ophthalmology, Chief Resident, and Co-Director of Ocular Trauma at the Bascom Palmer Eye Institute, University of Miami Miller School of Medicine. He states that he has no financial interests to disclose. Dr. Wykoff can be reached at +1 305 326 6424; or via e-mail at cwykoff@med.miami.edu.



Rohit Ross Lakhanpal, MD, is a Partner at Eye Consultants of Maryland, PA, and Principal of Timonium Surgery Center LLC. He is also a Clinical Assistant Professor of Ophthalmology at the University of Maryland School of Medicine. He reports no financial or proprietary interest in any of the products or techniques mentioned in this article. He has been a consultant in the past for Bausch + Lomb and Alcon



Surgical. He is the Vice President of the Vit-Buckle Society (VBS). Dr. Lakhanpal is Section Co-Editor of the VBS page in Retina Today and on EYETUBE.NET. He can be reached at +1 410 581 2020 or via e-mail at retinaross@yahoo.com.

Thomas Albin, MD, is an Assistant Professor of Clinical Ophthalmology at the Bascom Palmer Eye Institute in Miami, FL. He specializes in vitreoretinal diseases and surgery and uveitis. He has served as a speaker for Bausch + Lomb and Alcon Surgical and as a consultant for Alcon Surgical. He is the Membership Chair of the VBS. Dr. Albin is Section Co-Editor of the VBS page in Retina Today and on EYETUBE.NET. He can be reached at +1 305 482 5006 or via e-mail at talbini@med.miami.edu.



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