

Sulcus Fixation of an IOL Using Scleral Tunnels

This strategy achieves secure sutureless intrascleral haptic fixation.

BY SOM PRASAD MS, FRCS(Ed), FRCOPHTH, FACS; AND GABOR G.B. SCHARIOTH, MD

In-the-bag implantation is the ideal IOL insertion technique; however, it is not always possible. Complications of cataract surgery, especially in the presence of weak zonules, may make it impossible to securely implant an IOL into the capsular bag or in the sulcus because the success of either of these positions depends on remaining capsular fragments for support. Alternative strategies have been used, including suture fixation of posterior chamber IOLs and scleral suturing techniques, with varying results. We have recently determined that, in our hands, sutureless intrascleral haptic fixation, as demonstrated in a video available at <http://eyetube.net/v.asp?surijo>, is the safest alternative to in-the-bag IOL implantation in complicated cases.

Good results with suture fixation have been reported as far back as 2 decades ago.¹⁻³ However, this technique has its own set of concerns, mainly questionable long-term stability and structural longevity of the suture materials compared with that of the anatomic structures to which they are fixed. If the sutures break down, late failure and IOL subluxation or dislocation may result. Both anterior chamber and scleral-sutured IOLs have their own sets of complications and overall yield similar outcomes.³ For instance, scleral suturing requires complex maneuvers, with results that may be dependent on surgical skills.⁴

There have also been good results with modern flexible open-loop anterior chamber IOLs, but concerns about secondary glaucoma and endothelial cell loss remain, especially in eyes that may have been subjected to trauma or complicated surgery. Similarly, concerns about iris-fixated lenses are valid; they are not the best

This technique provides stable long-term fixation and results in a well-centered lens with minimal or no tilt.

choice when posterior chamber support is inadequate and an intact iris diaphragm is lacking. They can possibly trigger suture erosion, iris chafing, secondary intraocular inflammation, and cystoid macular edema.

Our sutureless technique for posterior chamber IOL fixation permanently incarcerates the lens haptics inside scleral tunnels.⁵ This intrascleral haptic fixation technique combines the control of a closed-eye system with the postoperative axial stability of the IOL and is equally suitable for implantation of posterior chamber three-piece IOLs or refixation of a subluxed three-piece IOL. Our technique provides stable long-term fixation and results in a well-centered lens with minimal or no tilt. It potentially offers early rehabilitation with good visual outcomes and minimal long-term compromise.

SURGICAL TECHNIQUE

Indications. There are three indications for sutureless intrascleral haptic fixation. First, if a three-piece IOL already in the eye becomes subluxed or dislocated, it can be secured in the sclera using this method. Second, for traumatic subluxed lenses or those caused by congenital conditions such as Marfan syndrome, a pars plana vitrec-

tomy and lensectomy can be followed by scleral fixation of the IOL using this technique. Third, in eyes in which cataract surgery is complicated with loss of the capsular bag or massive zonular loss, this is a good method of securing an IOL in the posterior chamber. In the latter case, sutureless intrascleral haptic fixation may be performed at the primary operation or as a secondary procedure, making it equally applicable to eyes that have been left aphakic.

Preparation. Because of the varying indications for which this method of IOL placement can be used, preliminary steps differ from procedure to procedure. The principle is to first make sure the IOL is in the anterior chamber without any vitreous presenting before completing the standard steps outlined below. When dealing with an IOL dislocated into the posterior segment, for example, perform a standard three-port pars plana vitrectomy, during which the IOL is grasped and lifted into the anterior chamber. For a subluxed lens, a pars plana vitrectomy and lensectomy is followed by IOL injection through a corneal incision and into the anterior chamber. For aphakic eyes, a conjunctival peritomy is done followed by a corneal incision and injection of a three-piece posterior chamber IOL. For eyes with complications sustained during cataract surgery, a deep anterior vitrectomy is done and an appropriate IOL is placed into the anterior chamber.

Fixation sites. If the conjunctiva has not been opened, a 360° peritomy—or alternatively two localized 40° peritomies made 180° apart—is done. Two points are marked at a distance of 1.5 mm behind the limbus and 180° from each other. Two sclerostomies are made with a 24-gauge needle or cannula. The angle of insertion is parallel to the iris plane.

Scleral tunnel preparation. The same cannula can be used to create two limbus-parallel tunnels at approximately 50% scleral thickness, starting from the ciliary sulcus sclerostomies and extending 3 to 4 mm, at which point the cannula emerges from the sclera. A 23-gauge microvitrectoretinal (MVR) blade can also be used to create these tunnels and may better facilitate scleral dissection due to its sharpness and blade configuration. The two tunnels extend in the same clockwise direction; if the sclerostomies are at the 12- and 6-o'clock positions, the superior tunnel extends clockwise toward the 2-o'clock position and the inferior tunnel from the 6- and toward the 8-o'clock position. The tunnels can be made before or after IOL placement and externalization of the haptics through the sclerostomies.

IOL placement. If a suitable IOL is not already in place (eg, subluxed IOL in situ), a standard three-piece IOL with a haptic size of 13.5 mm is inserted into the anterior chamber. The trailing haptic should be left



Figure 1. Custom-designed Scharioth forceps facilitate haptic passage into scleral tunnels.

temporarily externalized through the corneal incision. While the IOL is injected into the eye, it is possible to carefully grasp the tip of the leading haptic with a pair of 25-gauge straight-end gripping forceps. The same forceps can then be used to pass through the superior sclerotomy and grasp the trailing haptic to externalize it through one sclerotomy, and leave it externalized.

If this maneuver is difficult, transition to a bimanual approach using a paracentesis, and introduce forceps into the anterior chamber. Grasp the haptic, enabling it to pass on to the 25-gauge forceps, which are inserted through the sclerostomy to permit a controlled maneuver. The trailing haptic is then moved into the anterior chamber, and the 25-gauge end-gripping forceps are used in a similar manner to pull the trailing haptic through its sclerotomy. Once both haptics have been externalized, they are drawn tight and the IOL is centered. If the scleral tunnels have not yet been created, follow the description in the preceding section.

Securing the IOL. The same 25- or 23-gauge forceps are passed through each scleral tunnel respectively, and the haptic tip is again grasped and pulled through clockwise, securing the haptic within the scleral tunnel. Alternatively, the haptic may be fed into the scleral tunnel hand-over-hand. Custom forceps such as Scharioth forceps (Figure 1) for intrascleral haptic fixation (DORC, Zuidlands, Netherlands) allow easier and more atraumatic placement of the haptics into scleral tunnels. Accurate placement of the scleral tunnels and of the appropriately chosen diameter of the haptics within them is essential to achieve good IOL centration without torsion. The pupil is then constricted with Miochol-E (Novartis Pharma AG, Stein, Switzerland) to check for any presenting vitreous.

Closure. Any pars plana ports created for a posterior vitrectomy or lensectomy are sutured, and the conjunctiva is then closed with diathermy or 8-0 vicryl. If there is any doubt about the competence of the corneal incision, it should be sutured as well.

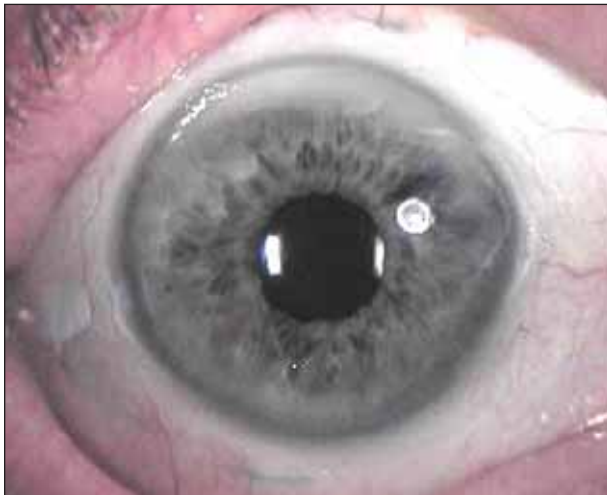


Figure 2. An IOL fixated with haptics in scleral tunnels.

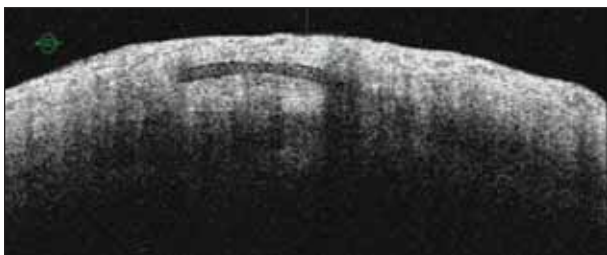


Figure 4. Anterior segment OCT showing the haptic incarcerated in the scleral tunnel.

DISCUSSION

Research and intuition appears to support the logic that the location of the crystalline lens in the phakic eye is the location in which we should seek to install a lens implant. The insertion of a scleral-fixated IOL requires great surgical skill and lacks an anatomical safety net to prevent an insufficiently secured implant from sinking into the vitreous space. Scleral-sutured lenses can have good results but require complex intraocular maneuvers and run the risk of IOL tilting and late suture breakage. Polypropylene sutures in pediatric patients have been described undergoing spontaneous breakage with trauma and subsequent IOL dislocation up to 9 years after insertion.⁶ Recurrent dislocation caused by broken sutures is well known.^{7,8} Intrascleral or other intralaminar fixation is an established technique in retinal, strabismus, and corneal surgery (eg, Intacs; Addition Technology, Inc., Des Plaines, Illinois). With this technique, there is no expected scleromalacia. However, as with any scleral surgery, sutureless intrascleral haptic fixation should be used with caution in patients with preexisting primary, autoimmune, or infective inflammatory conditions involving the sclera.

Our technique uses the eye's existing anatomy to



Figure 3. High-magnification postoperative view showing haptic incarcerated in sclera.

secure the IOL; it avoids the use of sutures and is safe to perform with most commonly available IOL models, obviating the storage or purchase of unfamiliar lenses. A three-piece IOL is a prerequisite, as one-piece lenses tend to have thick haptics and often a square cross-section.

Sutureless intrascleral haptic fixation may be more appropriate for younger adults and pediatric patients in whom anterior chamber lenses risk long-term corneal endothelial damage. The use of sutured scleral fixation may lead to greater inflammation and, more important, the possibility of late subluxation and retinal damage. Intermediate-term results are encouraging.⁹

We recommend avoiding diathermy as long as possible; once applied to the sclera, permanent structural damage weakens the sclera and alters its histologic structure.¹⁰ One of the main concerns with sutured scleral fixation of IOLs is late exposure of sutures and breakage, which occurs even when the scleral flaps cover the suture in the early postoperative period. We believe that late scleral contraction, particularly when diathermy is used, is the main reason for exposure of sutures. Therefore, we advise avoiding the use of scleral flaps when using transscleral fixation. Further, scleral tunnels used for haptic fixation must be uniform and narrow to avoid late IOL tilt. Postoperative appearance shows well-centered IOLs (Figures 2 and 3), and anterior segment ocular coherence tomography (OCT) shows the haptic secured firmly in the scleral tunnel (Figure 4).

CONCLUSION

This technique simplifies scleral fixation of IOLs and potentially avoids some of the associated complications. A standard three-piece IOL can be used, thus avoiding

TAKE-HOME MESSAGE

- This technique avoids the use of sutures and is safe to perform with most commonly available three-piece IOL models.
- Sutureless intrascleral haptic fixation may be more appropriate for younger adults and pediatric patients in whom anterior chamber lenses risk long-term corneal endothelial damage.
- Eyetube direct link: <http://eyetube.net/v.asp?surijo>



the need to acquire IOLs with specially prepared haptics. It can be used in a range of situations and thus should prove a valuable addition to the armamentarium of both anterior and posterior segment surgeons. ■

Som Prasad, MS, FRCS(Ed), FRCOphth, FACS, practices in the Eye Department, Arrowse Park Hospital, Wirral University Teaching Hospitals, NHS Foundation Trust, United Kingdom. Dr. Prasad states that he has no financial interest in the products or companies mentioned. He may be reached at tel: +441516047193; fax: +441516047152; e-mail: sprasad@rcsed.ac.uk.

Gabor G.B. Scharioth, MD, is a Senior Consultant at the Aurelios Augenzentrum, Recklinghausen, Germany, and practices at the University of Szeged, Hungary. Dr. Scharioth did not provide financial disclosure information. He may be reached at gabor.scharioth@augenzentrum.org.

1. Girard LJ. Pars plana phacoprosthesis (aphakic intraocular implant): a preliminary report. *Ophthalmic Surg.* 1981;12(1):19–22.
2. Hannush SB. Sutured posterior chamber intraocular lenses: indications and procedure. *Curr Opin Ophthalmol.* 2000;11(4):233–240.
3. Kwong YY, Yuen HK, Lam RF, Lee VY, Rao SK, Lam DS. Comparison of outcomes of primary scleral-fixed versus primary anterior chamber intraocular lens implantation in complicated cataract surgeries. *Ophthalmology.* 2007;114(1):80–85.
4. Evereklioglu C, Er H, Bekir NA, Borazan M, Zorlu F. Comparison of secondary implantation of flexible open-loop anterior chamber and scleral-fixed posterior chamber intraocular lenses. *J Cataract Refract Surg.* 2003;29(2):301–308.
5. Gabor SG, Pavlidis MM. Sutureless intrascleral posterior chamber intraocular lens fixation. *J Cataract Refract Surg.* 2007;33(11):1851–1854.
6. Buckley EG. Hanging by a thread: the long-term efficacy and safety of transscleral sutured intraocular lenses in children (an American Ophthalmological Society thesis). *Trans Am Ophthalmol Soc.* 2007;105:294–311.
7. Por YM, Lavin MJ. Techniques of intraocular lens suspension in the absence of capsular/zonular support. *Surv Ophthalmol.* 2005;50:429–462.
8. Wagoner MD, Cox TA, Ariyasu RG, et al. Intraocular lens implantation in the absence of capsular support; a report by the American Academy of Ophthalmology. (Ophthalmic Technology Assessment) *Ophthalmology.* 2003;110:840–859.
9. Scharioth GB, Prasad S, Georgalas I, Tataru C, Pavlidis M. Intermediate results of sutureless intrascleral posterior chamber intraocular lens fixation. *J Cataract Refract Surg.* 2010; 36(2):254–259
10. Schwartz A, Rathbun E. Scleral strength impairment and recovery after diathermy. *Arch Ophthalmol.* 1975;93(11):1173–1177.

(Continued from page 37)

THE DARK SIDE OF INNOVATION

Robert H. Osher, MD, has devoted his career in ophthalmology to referral cataract surgery. In preparation for his Charles D. Kelmen Innovator's Lecture at the ASCRS meeting in 2009, Dr. Osher edited a video that depicted some of the unexpected complications he encountered during attempted surgical innovations. Although he was unable to show the video during his lecture due to time constraints, he has kindly offered to post it on *CRST Europe's* sister site, www.eyetube.net. The video is available at <http://eyetube.net/videos/default.asp?nageen>.

Horizontal gape suture. This stitch is a trapezoidal mattress suture that begins by passing the needle of a 10-0 nylon suture radially through the posterior roof and then exiting within the incisional tunnel (Figure 2).⁶ The needle is reloaded and passed parallel to the incision through the anterior floor, exiting within the tunnel. This needle is reloaded a third time, passing a radial bite from within the tunnel up through the posterior roof. The bites through the posterior roof are slightly closer together than the bites through the anterior floor, resulting in a trapezoidal configuration. The sutures are cinched and tied, bringing the anterior floor to the posterior roof and giving back tissue for a watertight enclosure.

Extreme cases may require a patch graft. However, this discussion is beyond the scope of this article. ■

Robert H. Osher, MD, is a Professor of Ophthalmology at the University of Cincinnati, Medical Director Emeritus of the Cincinnati Eye Institute, Editor of the Video Journal of Cataract and Refractive Surgery, and a member of the CRST Europe Global Advisory Board. He states that he is a consultant to multiple companies but acknowledged no financial interest in the products mentioned herein. Dr. Osher may be reached at tel: +1 513 984 5133, ext. 3679; e-mail: rhosh-er@cincinnatieye.com.



James M. Osher, MD, is a Resident in the Department of Ophthalmology at the University of Cincinnati, Ohio. Dr. Osher states that he has no financial interest in the products or companies mentioned.



1. Osher RH. Shark fin: a new sign of thermal injury. *J Cataract Refract Surg.* 2005;31(3):640–642.
2. Sugar A, Scherzter RM. Clinical course of phacoemulsification wound burns. *J Cataract Refract Surg.* 1999;25:688–692.
3. Osher RH, Injev V. Thermal study of bare tips with various system parameters and incision sizes. *J Cat Refract Surg.* 2006;32:867–872.
4. The internal flare: a new incision for cataract surgery. *J Cat Refract Surg.* Submitted for publication.
5. Osher RH. Gape stitch. *Video Journal of Cataract and Refractive Surgery.* 1990;VI(3).
6. Osher RH. Thermal burns. *Video Journal of Cataract and Refractive Surgery.*