

Sclerally Sutured PCIOLs: Part II

Surgical pearls on the transscleral fixation of this lens type.

BY ROGER F. STEINERT, MD

Three primary options exist for IOL fixation in the absence of capsular support: a transsclerally sutured posterior chamber IOL (PCIOL), a peripheral iris-sutured PCIOL, and a flexible open-loop anterior chamber IOL. If both the posterior capsule and the iris are disrupted or absent, then sutured transscleral PCIOLs are the only lens option. This article describes the techniques for transscleral suture fixation of a PCIOL.

SURGICAL PEARLS

Many different techniques for the placement of transsclerally sutured PCIOLs have been presented in the literature.¹ Sclerally sutured lenses can be sutured from the inside out (*ab interno*) or by passing the needles from the outside of the eye inward (*ab externo*). A combination of scleral and iris sutures has also been described.² Transscleral sutures may be oriented verti-

cally, obliquely, or horizontally, although direct 3- and 9-o'clock horizontal fixation is inadvisable because of the danger of suturing through the long ciliary arteries and nerves at these locations. It is important to perform an extensive anterior vitrectomy in most cases before placing a sutured PCIOL in order to avoid vitreous incarceration and subsequent retinal traction and detachment.

A common error with sclerally sutured PCIOLs is placing the haptics too far posteriorly. The goal is to have the haptics rest in the ciliary sulcus. Anatomical studies³ have shown that the ciliary sulcus is only 0.83 mm posterior to the limbus in the vertical meridian and just 0.46 mm posterior to the limbus in the horizontal meridian. The surgeon can detect when he is passing a needle too anteriorly by iris movement that occurs as the needle penetrates the peripheral iris stroma near the angle. In order to determine the correct location for the needle to penetrate the external sclera,

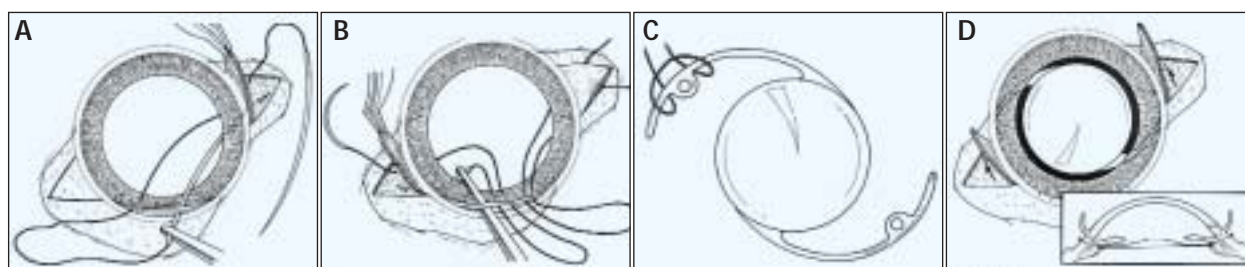


Figure 1. The *ab interno* technique with four-point fixation requires scleral flaps. The first double-armed suture on the long Ethicon CIF-4 needle is placed first (A). The second double-armed suture on the CS 160 or equivalent needle is placed 180° away. This maneuver requires the surgeon to place the needle holder's tip inside the anterior chamber, while taking care to avoid causing endothelial trauma (B). The suture is placed around the haptic hole with a girth hitch loop (C). The surgeon places the IOL in the eye, cuts the sutures, and ties them tightly. He then replaces the scleral flap and sutures the conjunctiva closed (D). (Reprinted with permission from Steinert RF, Arkin MS. Secondary intraocular lenses. In: Steinert RF, ed. *Cataract Surgery: Techniques, Complications, and Management*. 2nd ed. Philadelphia: WB Saunders; 2004.)

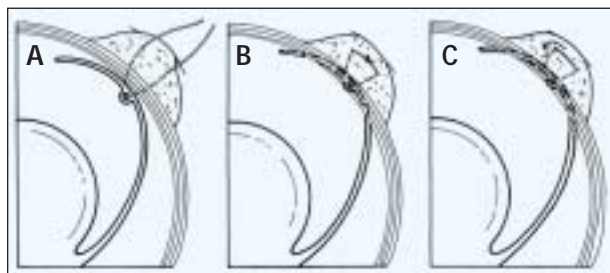


Figure 2. For the two-point fixation variant, the suture placement is identical to that in Figure 3, except that the surgeon passes the second needle of each double-armed suture through the haptic's positioning hole before passing it through the sclera 1.5 to 2.0 mm lateral to the first needle penetration site (A). The knot is tied tightly; four single throws utilizing a slip-knot technique are advisable to achieve a low-profile knot that will also be secure (B). Rotating the knot below the scleral surface leaves only a smooth loop of suture on the scleral surface that is then covered with conjunctiva (C). (Reprinted with permission from Steinert RF, Arkin MS. Secondary intraocular lenses. In: Steinert RF, ed. *Cataract Surgery: Techniques, Complications, and Management*. 2nd ed. Philadelphia: WB Saunders; 2004.)

the surgeon must be mindful that the aforementioned anatomical studies are based on a strict perpendicularity of the needle relative to the scleral wall. If the surgeon passes the needle through the scleral wall at an oblique angle (usually tilted toward the iris plane), then the external scleral point will need to be located more posteriorly in order for the interior scleral point to be at the level of the ciliary sulcus.

The surgeon has the option of creating scleral flaps so that the polypropylene suture knot is buried, thereby avoiding exposed suture ends. Caution is recommended to

retract exposed barbs, should they occur postoperatively, in order to eliminate a possible entry track for microorganisms or the epithelium. If the suture knot is rotated, as in the technique of Stephen Lane, MD, of St. Paul, Minnesota, then no scleral flap is needed.

PCIOLs made specifically for suturing to the sclera feature eyelets on their haptics to aid suture fixation, and they have large-diameter optics (7 mm) to compensate for possible decentration. Some commonly used models of sclerally sutured IOLs include the CZ70BD (Alcon Laboratories, Inc., Fort Worth, TX) and the C540MC (CIBA Vision, Duluth, GA).

The ab interno technique for the transscleral suture fixation of a PCIOL typically utilizes polypropylene suture material. A long needle is required for the pass across the anterior chamber; the Ethicon CIF-4 and Ethicon STC-6 (Ethicon Inc., Somerville, NJ) are common choices. The surgeon passes the needles under the iris and aims for the ciliary sulcus. A girth hitch may be used to attach the polypropylene suture loop to the IOL haptic (Figure 1). Alternatively, the surgeon may tie the sutures to the haptic, to the haptic's eyelets, or proximal to one of the haptic's eyelets. The needles exit the eye under the previously dissected scleral flaps, and the sutures are tied. Alternatively, to avoid dissecting the scleral flaps and avoid the potential for later erosion of the flap and conjunctiva (with resultant exposure of the suture ends), the surgeon may pass the suture through the positioning hole in the haptic and rotate the knot below the scleral surface (Figure 2). The ab interno technique is adaptable to foldable IOL implantation as well, which allows suture fixation of the IOL while retaining a small incision. Minimizing the incision size is particularly important if capsular support is lost during primary cataract surgery through a small, clear corneal incision.

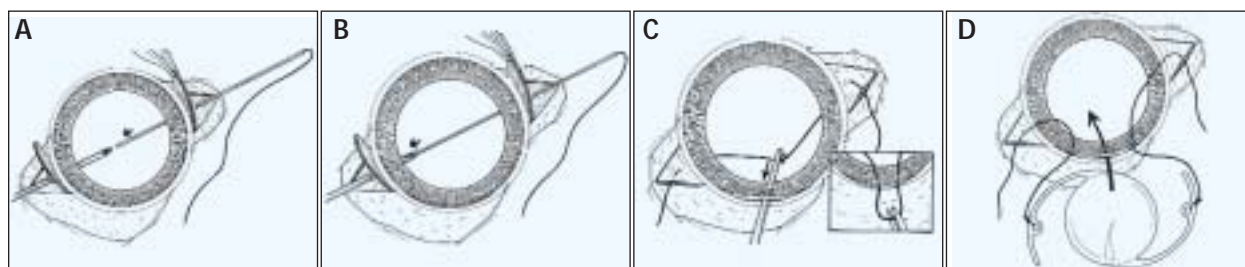


Figure 3. For the single-suture, ab externo Lewis technique, the surgeon passes a straight needle with a suture under scleral flaps from one side while a hypodermic needle enters the eye 180° away (A). The solid needle is "docked" into the hollow needles, and the two needles are withdrawn to the left so that the suture then traverses the anterior chamber (B). A Kuglen or similar hook draws the suture out of the main incision (C). After cutting and tying the suture to the IOL's haptic, the surgeon inserts the lens in the eye and secures each end of the suture to the sclera by making a midscleral pass and then tying the suture to itself (D). (Reprinted with permission from Steinert RF, Arkin MS. Secondary intraocular lenses. In: Steinert RF, ed. *Cataract Surgery: Techniques, Complications, and Management*. 2nd ed. Philadelphia: WB Saunders; 2004.)

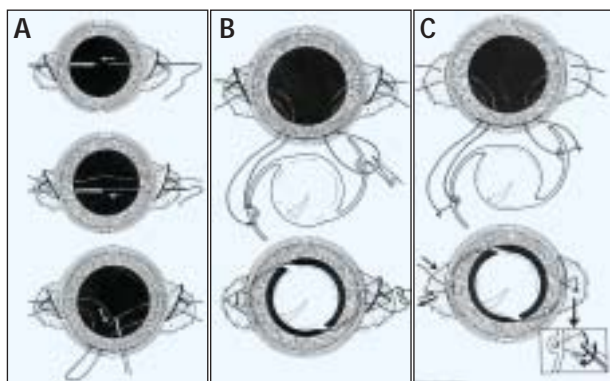


Figure 4. The double-suture variant of the Lewis ab externo technique begins similarly to the single-suture technique, except that the suture's entry point under the scleral flap is displaced to one side (top). The second suture is passed parallel to the first, with 1.0 to 1.5 mm between the two sutures (middle). Care must be taken to keep the sutures taut and thereby avoid crossing them or confusing which suture originates from each scleral site; a Kuglen hook or similar instrument simultaneously withdraws the suture loop through the previously prepared principal incision (bottom) (A). To achieve four-point stable fixation, the surgeon ties the cut sutures to the haptic on either side of the eyelet (top). The surgeon then places the IOL in the posterior chamber while keeping the sutures taut to avoid entanglement. The ends are then tied under the scleral flaps, and the conjunctiva is closed over the flaps (bottom) (B). In this variant of the double-suture ab externo technique, the goal is to achieve a loop of suture where the knot can be rotated beneath the sclera, thus avoiding the necessity of a scleral flap and the potential for late erosion of the knot or suture ends. The cut ends of each suture are passed through the haptic positioning hole and tied (top). As the IOL is positioned in the posterior chamber, one end of the suture on each side is pulled so that the knot passes through the sclera to the external eye, where it is cut off (bottom). The surgeon then ties together the remaining suture ends and rotates the knot beneath the sclera (inset) (C). (Reprinted with permission from Steinert RF, Arkin MS. Secondary intraocular lenses. In: Steinert RF, ed. *Cataract Surgery: Techniques, Complications, and Management*. 2nd ed. Philadelphia: WB Saunders; 2004.)

The principal advantages of the ab interno, inside-to-outside approach are that it is more straightforward and possibly faster than the ab externo, outside-to-inside technique. The ab interno approach is also easier to perform in conjunction with penetrating keratoplasty. The disadvantages of this technique include the fact that the surgeon must pass the needle under the iris without direct visualization and that he must rely on

the indentation of the iris, with visualization of the pressure of the needle from behind the iris, to ensure the correct placement of the suture in the ciliary sulcus.

Lewis⁴ first described the ab externo technique of passing the scleral needles from the outside inward (Figure 3). The sutures used for the procedure are 10–0 polypropylene, with a long straight needle such as the Ethicon STC-6 (Ethicon Inc.). Alcon Laboratories, Inc., produces the Pair Pack Fixation Suture, which is a hybrid combining an SC-5 straight needle on one end and an AUM-5 corneal needle on the other. This suture is specifically designed for the outside-to-inside technique of sclerally sutured PCIOLs. The surgeon passes the long, straight needle perpendicularly through the sclera (usually under partial-thickness scleral flaps), approximately 0.75 mm posterior to the limbus. Inside the eye, the needle should penetrate at the ciliary sulcus. The needle is then “docked” inside the tip of a 25-, 27-, or 28-gauge hollow needle, which the surgeon has passed through the ciliary sulcus on the opposite side, also with an outside-to-inside technique. After the long straight needle with the 10–0 polypropylene is docked within the hollow needle, the latter needle is withdrawn with the solid needle inside of it. In this way, the surgeon pulls the polypropylene suture across the eye. He then uses a hook to pull the suture out through a superior limbal wound. The suture is cut, and each end is tied to a haptic of the IOL. After placing the IOL into position, the surgeon secures the scleral sutures to the sclera.

This procedure can be performed with two sutures per haptic if the surgeon desires four-point fixation to ensure stability (Figure 4A and B). The surgeon ties the sutures to the haptics and buries the external knot under a scleral flap. The alternative procedure, illustrated in Figure 4C, allows the rotation of the knot in order to avoid the necessity for scleral flaps and the potential of late exposure of the suture ends; the anti-rotational stability of true four-point fixation is not achieved, however.

The advantage of the outside-to-inside approach is a greater assurance of the location of internal scleral penetration at the ciliary sulcus. Taking precise measurements and avoiding the highly vascularized pars plicata can minimize bleeding. In addition, the anterior chamber remains closed during the needle passes, thereby decreasing the duration of ocular hypotony. The disadvantages of the ab externo approach are that it takes longer than the ab interno approach and that it is not applicable with the open-sky situation of penetrating keratoplasty. In addition, if the surgeon performs more than one suture pass, it may be confusing to keep track of the origins and courses of the various suture ends.

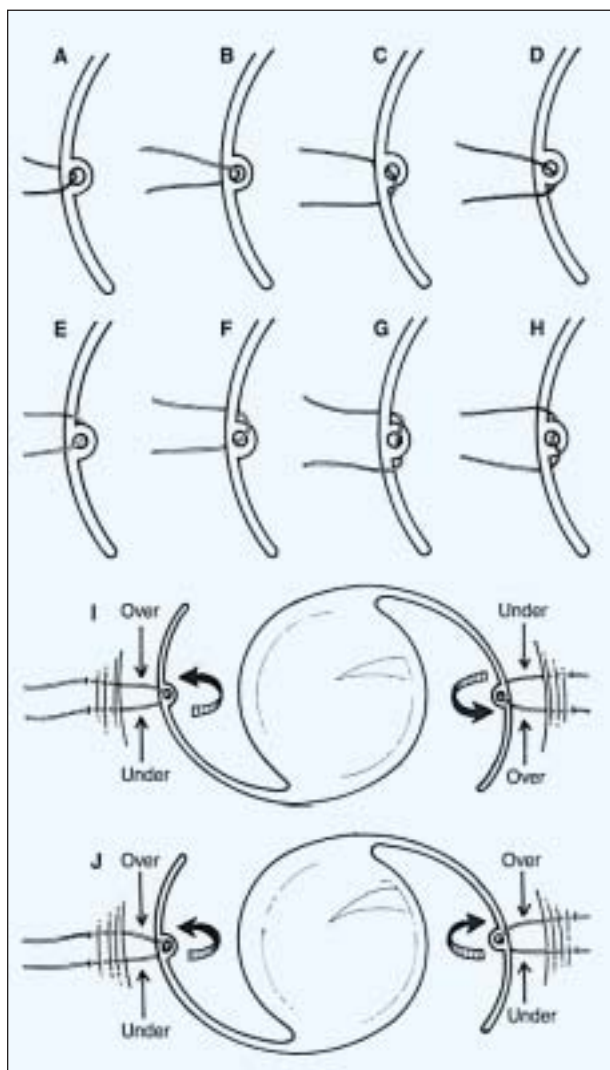


Figure 5. A suture passed through the positioning hole may wrap around the haptic in eight basic configurations. Unless the appropriate pathways are used (A and B), the surgeon's ability to rotate the suture will be impaired or fully prevented by the circuitous route taken by the suture (C through H). Because there are two haptics, a total of 16 configurations are therefore possible. The surgeon should take care to use configuration A on one haptic, and the opposite configuration B on the other haptic. In that manner, the torque of the IOL is resisted; as one haptic starts to rotate in the direction not resisted by the suture loop, the other haptic meets more resistance (arrows) (I). When both suture loops have the same configuration, the suture does not resist the torque of the IOL (arrows) (J). (Reprinted with permission from Steinert RF, Arkin MS. *Secondary intraocular lenses*. In: Steinert RF, ed. *Cataract Surgery: Techniques, Complications, and Management*. 2nd ed. Philadelphia: WB Saunders; 2004.)

IOL tilting is a serious but avoidable complication of sclerally sutured PCIOLs.⁵ If the surgeon elects a double-suture technique with knot rotation, he must be meticulous in achieving a suture orientation that permits easy rotation of the knot (Figure 5A and B) and in avoiding suture configurations that will resist the rotation of the knot (Figure 5C through H). Furthermore, the surgeon should orient the suture pass through the opposite haptics in a direction that will resist the rotation of the IOL out of the iris plane (Figure 5I), rather than allow rotation (Figure 5J).

CONCLUSIONS

Little debate exists that the placement of a standard PCIOL is the method of choice for a secondary IOL in the presence of sufficient capsular support. In cases without capsular support, the decision is more difficult. It is impossible to reach firm conclusions regarding sutured PCIOLs with presently available information. It seems clear that some surgeons have prematurely disregarded modern anterior chamber IOLs, which provide a valuable alternative to sutured PCIOLs for many patients. The visual results for most patients with sclerally sutured lenses are comparable to those with other lens types.

On the other hand, a properly performed scleral suture IOL fixation yields the most anatomically correct alternative in the absence of an intact lens capsule support system. A meticulous surgical technique will reward the surgeon who pursues this approach. ■

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Roger F. Steinert, MD, is Associate Clinical Professor of Ophthalmology at Harvard Medical School and is in private practice at Ophthalmic Consultants of Boston. He holds no financial interest in the products and companies mentioned herein. Dr. Steinert may be reached at (617) 367-4800; rfsteinert@eyeboston.com.



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