

PEARLS FOR THE YAMANE TECHNIQUE

A RUNDOWN OF THE STEPS INVOLVED IN PERFORMING THIS SUTURELESS TECHNIQUE FOR IOL FIXATION IN THE ABSENCE OF CAPSULAR SUPPORT, AND PEARLS FOR MASTERING IT.

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BY ZAINA AL-MOHTASEB, MD

A few pearls for the Yamane technique.

The small-incision, sutureless, transconjunctival scleral fixation technique first described by Yamane et al¹ for use in eyes with absence of capsular support involves the creation of small-gauge sclerotomies and a small clear corneal incision, resulting in a fast visual recovery and a low risk of postoperative hypotony. A few pearls can help surgeons overcome the challenges of performing this technique.

PEARL NO. 1

Technically any three-piece IOL can be used in the Yamane technique; however, we have found that IOLs with PVDF haptics are durable and resistant to kinking and breaking. For this reason, the CT Lucia 602 (Carl Zeiss Meditec) is our preferred IOL for this procedure.

PEARL NO. 2

Loosely attach each 30-gauge needle and do not use a luer-lock syringe. This will avoid the possibility of experiencing difficulty detaching the syringe.

PEARL NO. 3

Fill syringes with a small amount of balanced saline solution and make sure to irrigate the needle before the scleral pass. This can help to avoid air bubbles that can interfere with the view for needle insertion during haptic fixation.

PEARL NO. 4

Use an anterior chamber maintainer to ensure a firm eye during the creation of the sclerotomies.

PEARL NO. 5

If the IOL is poorly centered or tilted, the three most common causes are:

- The needle insertions are not 180° apart;
- The needle insertions are not the same distance from the limbus; or
- The scleral pathways vary in length and/or direction.

If the needle insertion points are different distances from the limbus or are not 180° apart, one of the haptics must be reinserted into the eye and refixedated with a new needle pass. If the scleral tunnels are of different lengths, one or both haptics can be trimmed and recauterized to improve centration.

1. Yamane S, Sato S, Maruyama-Inoue M, Kadosono K. Flanged intrascleral intraocular lens fixation with double-needle technique. *Ophthalmology*. 2017;124(8):1136-1142.



BY SIMON CHEN, MD

The steep learning curve is worth the effort.

The Yamane double needle technique for IOL fixation to the sclera is a useful procedure that, in general, provides reliable and

predictable outcomes. Compared with many other IOL scleral fixation techniques, it is relatively quick to perform. Because no sutures are

used to fixate the IOL, the long-term risks of suture breakage and late IOL dislocation associated with suture fixation techniques are avoided.

There is a relatively steep learning curve for this procedure, but the result is worth the effort. Here are my top tips for performing the Yamane double needle technique for scleral IOL fixation.

TIP NO. 1: MARK THE NEEDLE ENTRY SITES AT THE START OF THE CASE

Dry the conjunctival surface with a Weck-Cel sponge (Beaver-Visitec International) before using a surgical marking pen to make marks 2 mm behind the limbus located 180° apart for the initial needle passages. Additional marks are made 2 mm away from the initial incisions to indicate the length of the intrascleral tunnel and entry point into the eye. Avoid making incisions less than 2 mm from the limbus, as a more anterior location increases the risk for the IOL to cause iris chafing and pigment dispersion.

TIP NO. 2: USE AN IOL WITH PVDF HAPTICS

PVDF haptics are more resilient to bending and breaking during surgical manipulations than PMMA, polyamide, or polypropylene haptics, the materials most commonly used in three-piece IOLs. The CT Lucia 602 is an example of an IOL that incorporates PVDF haptics.

For urgent cases when there is insufficient time to obtain a CT Lucia 602, you may need to use a different IOL. Also, in some cases you may want to reposition a subluxated or dislocated IOL instead of exchanging the IOL. One of the most commonly used three-piece IOLs, the MA60AC (Alcon), can be used with the Yamane technique, but due to its more brittle PMMA haptics, it is prone to haptic breakage or bending during surgical manipulation. This can lead to IOL decentration or tilt, increasing the risks of optical aberrations or IOL iris chafing and pigment dispersion.

TIP NO. 3: USE AN A-CONSTANT OF 119.1 WITH THE CT LUCIA 602

For the CT Lucia 602 IOL, I use an A-constant of 119.1 with the Barrett Universal II formula. This

combination has provided predictable refractive results comparable to those obtained in routine primary cataract surgery. If there is more than 1.00 D of corneal astigmatism, I perform limbal relaxing incisions to improve postoperative UCVA.

TIP NO. 4: PERFORM THOROUGH ANTERIOR VITRECTOMY

Always perform a thorough anterior vitrectomy before IOL implantation. This is important to avoid vitreoretinal traction that can cause retinal tears or retinal detachment during the IOL fixation maneuvers.

TIP NO. 5: USE APPROPRIATE INSTRUMENTATION

Appropriate intraocular instrumentation is required to handle the IOL haptics during needle docking. I use 23-gauge micro-holding forceps (MicroSurgical Technology).

TIP NO. 6: ANGLE THE NEEDLES FOR HAPTIC FIXATION

When the needles for haptic fixation are inserted, they should be angled 5° to 10° downward from the iris plane and 20° from the limbus to minimize haptic bending during insertion and postoperative iris chafing. During the learning curve, consider using a Yamane Double-Needle Stabilizer (Geuder) to facilitate accurate needle entry positions and paths.

TIP NO. 7: USE APPROPRIATE NEEDLES

It is important to use an appropriately sized needle that will accommodate the IOL haptic. I use an Ultra Thin Wall 30-gauge needle (TSK Laboratory) for these cases because they have a larger lumen than regular 30-gauge needles. The haptics of some IOLs will not fit well into the smaller lumen of a regular 30-gauge needle. If a 30-gauge TSK needle is unavailable, a regular 27-gauge needle can be used instead. The disadvantage of using a 27-gauge needle is that the scleral entry wound is larger. Therefore, when the haptic tip is melted,

the surgeon must create a wider flange to secure the haptic in position. A larger flange will be more likely to protrude above the scleral surface and potentially erode through the conjunctiva, so extra care is needed to push the flange flush into the sclera. The flange may have to be trimmed with scissors if it is too large. If in doubt, check that the haptic will fit into the needle before implanting it into the eye.

TIP NO. 8: EXTERNALIZE THE HAPTICS SIMULTANEOUSLY

I like to externalize both haptics simultaneously because this places symmetrical tension forces on the haptics. If the haptics are externalized one after the other, they are subjected to uneven tension forces, which can cause one haptic to be stretched more than the other and potentially lead to IOL decentration.

TIP NO. 9: MELT THE HAPTIC TIPS

After externalizing the haptics, I take the needle off one haptic, melt the tip, and push it into the scleral tunnel. Next, I withdraw the needle from the second haptic and then melt it. This method of sequentially removing the haptics from the needles minimizes the risk of a haptic slipping back into the eye.

When the haptic tip is melted, the resulting bulb should not be made too wide. Only a small bulge is needed to anchor it into the sclera. If the bulge is too big, it will protrude above the scleral surface and potentially erode through the overlying conjunctiva. Ensure that the haptic tips lie below or flush with the scleral surface by pushing them firmly into the scleral tunnel with the tip of 0.12-mm forceps or similar.

TIP NO. 10: IF NECESSARY, CENTER THE IOL

Make sure the IOL is centered at the end of the procedure. If it is not centered, action should be taken to center it by either stretching or shortening one or both haptics or by repeating the needle passage through the sclera to make new scleral tunnels.



ALANNA NATTIS, DO, FFAO

Consider starting with an assistant.

Instability of the capsular bag, violation of the posterior and/or anterior capsule, and loss of lens fragments are, thankfully, uncommon complications during cataract surgery. Nevertheless, because of the possibility of these complications, we need alternative methods of placing and fixing an IOL.

Since its introduction in 2014, the Yamane technique has provided an important and elegant method of IOL fixation.¹⁻⁵ As in any surgical procedure, proper preparation and the ability to adapt and make small alterations in technique help to ensure efficient and successful IOL fixation. For assistance in learning this challenging technique, mentorship,

skills workshops, and adjunctive guidance from videos on Eyetube can be great resources.

Cataract surgeons performing the Yamane technique should be comfortable with performing vitrectomy—both anterior and pars plana—as it is critical that the IOL and/or surgical instruments do not become entangled with vitreous.¹⁻⁵ Additionally, adjusting one's seating position may be helpful during the haptic-docking part of the surgery, to facilitate smooth maneuvering of the IOL. Precise IOL fixation is key in this technique; use of a toric marker and calipers to help mark 0° and 180° needle insertion sites can be useful.¹⁻⁵

It can also be helpful to perform initial cases with an assistant or even a retina surgeon present to help perform a safe, comprehensive vitrectomy prior to IOL fixation. If you have any doubt that you may not be able to perform the procedure successfully, there is no harm in referring the case to a surgeon with more experience, if it is felt that this would lead to a better outcome.

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BY KAMRAN M. RIAZ, MD

A thin-walled 30-gauge needle is a must.

Here are some helpful tips for those thinking of adopting the Yamane technique.

TIP NO. 1: PRE- AND INTRAOPERATIVE MARKING

Given the need for precise placement of the docking needles, I treat the Yamane procedure as though I were placing a toric IOL. Preoperatively, with the patient in the sitting position, I mark the eye at the 3, 6, and 9 clock positions, to account for likely cyclotorsion. At the start of the case, I use a toric marker to reinforce the 3 and 9 clock positions, as these will be critical marks to use for the 2-mm measurement posterior for the docking points of the needles.

TIP NO. 2: PLACEMENT OF INCISIONS

Figure 1 shows suggested locations for the corneal and scleral tunnel incisions. I make my main incision slightly to the left of the 12 clock position. This allows me to grasp both the leading and trailing haptics of the IOL slightly more easily and ergonomically, as the IOL will settle in a more favorable position with this left-leaning incision. The paracentesis wounds should be made just superior to each of the previously placed marks.

TIP NO. 3: LOCATION OF NEEDLE ENTRY

I mark 2 mm posterior for the dive point and then 2 mm counter clockwise for the entry point. I

make the entry point slightly closer (< 0.5 mm) to the limbus to allow the curve of the IOL to adjust. When the 30-gauge needle enters, I tunnel slightly away from the limbus and then dive into the eye.

TIP NO. 4: IOL CHOICE

Although IOL power calculation is as important as in any cataract surgery, the choice of IOL when the Yamane technique is used is especially consequential. In particular, the material construction of the haptics may dictate whether cautery is successful. Generally PVDF haptics are amenable to cautery and will consistently form the desired shape. In the United States, only one IOL with PVDF haptics is available, the

CT Lucia 602. One can also use a standard three-piece IOL with acrylic haptics, but the procedure may be extremely challenging—especially for surgeons who do not perform many of them—and fraught with potential problems during intraocular manipulation, such as a kinked haptic causing malpositioning or even a haptic-optic break with posterior migration of the IOL.

TIP NO. 5: ULTRATHIN-WALLED NEEDLE

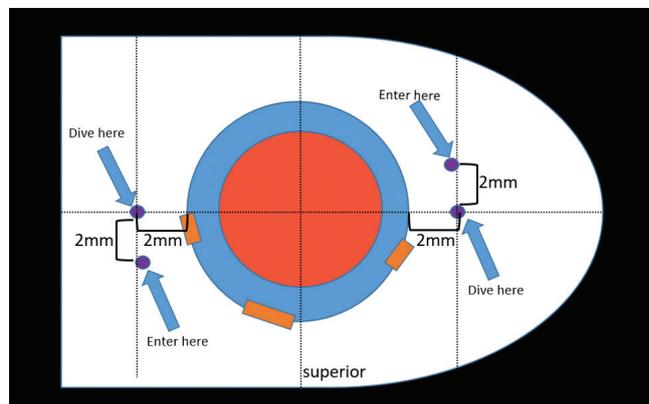
To match the outer diameter of the haptics, the inner lumen of the needle must be sufficiently large to adequately dock the haptics. A 25- or 27-gauge needle may be a consideration, although these would require the use of a correspondingly large scleral tunnel wound that may leak postoperatively. I use a 30-gauge needle constructed with a thin wall. This is the only needle I am aware of that has an inner lumen of sufficient diameter to enable externalizing the IOL haptics. A regular 30-gauge needle will not work.

TIP NO. 6: INTRAOCULAR FORCEPS

Threading the haptics into the needle lumen is a delicate maneuver. This work is greatly facilitated by using microforceps (25-gauge or smaller) with either a horizontal grasping action (most popular) or overhand vertical grasping. Both types of forceps work well, but the overhand vertical forceps may make the ergonomics easier. I prefer Shah forceps (Vitreq/Beaver-Visitec International). These disposable 27-gauge microforceps are constructed with a small needle-shaped tip, yet they provide sufficient grip of the haptics during delicate maneuvers.

TIP NO. 7: ANTERIOR CHAMBER MAINTAINER

Use of anterior or posterior chamber infusion is essential for maintaining adequate working space inside the eye. If I am working with a retina colleague, I like to have the infusion left in place inferiorly. When I work as a solo surgeon, an anterior chamber maintainer helps immensely.



Courtesy of Kamran M. Riaz, MD

Figure 1. Suggested locations for corneal and scleral tunnel incisions.

TIP NO. 8: WHICH HAPTIC TO EXTERNALIZE FIRST?

There is debate among surgeons who perform the Yamane technique about which haptic to externalize first. Traditionally, the leading haptic is first, but a growing number of surgeons advocate externalizing the trailing haptic first. The trailing haptic is typically more difficult than the leading haptic, so the thought is to do the difficult haptic first and then work on the easier one. Surgeons who have had difficulty externalizing the trailing haptic second may want to consider switching for their next cases.

TIP NO. 9: USE THE NEEDLES TO YOUR ADVANTAGE

Once the needle is placed in the eye (either one), it may be easier to fixate the haptic and move or rotate the needle to thread the haptic, rather than solely relying on hand-holding the haptic with microforceps to thread the needle. A gentle rotation of the needle may facilitate threading of the haptic. When the trailing haptic is externalized second, the second needle can be used to nudge the IOL away from the surgeon while simultaneously the trailing haptic is grasped and then the needle is threaded. This may create a favorable angle to thread the slightly more challenging trailing haptic.



BY KAROLINNE MAIA ROCHA, MD, PHD

Key steps and a modified approach.

Sutureless intrascleral fixation of a posterior chamber IOL in the setting of a compromised posterior capsule has become a popular surgical technique because of the procedure's

shorter duration and reduced risk for intraoperative complications compared with previous options. The intrascleral posterior IOL fixation with double-needle technique has a favorable safety profile,^{1,2}

but a new set of intraoperative skills is needed in order to master the technique.

Here are some key steps and a modified approach³ to help you optimize the procedure.

MARKING

Perform conjunctival marking using a toric marker and calipers. To assure precise haptic placement, mark the limbus at the 6 and 12 clock positions using a toric marker and place a secondary mark 2 mm from the limbus. From the inferior mark, measure and place a third mark 2 mm inferonasally, and from the superior mark, measure and place a fourth mark 2 mm superotemporally.

IOL HAPTICS

The haptics of the three-piece IOLs routinely used for secondary implantation are made of PMMA. With these IOLs, the trailing haptics are susceptible to breakage or bending during manipulation. IOLs with PVDF haptics are the best choice for

performing this technique, as they are easier to maneuver within the anterior chamber and less susceptible to breaks.

THE DOUBLE-NEEDLE TECHNIQUE

Verify that the IOL haptic fits into the thin-walled 30-gauge needle before inserting the needle into the anterior chamber. Mount the TSK needle on a tuberculin syringe and bend it approximately 75°, bevel up. Create two angled scleral tunnels parallel to the limbus at the marked locations and externalize the haptic using microforceps. A short scleral tunnel may result in IOL dislocation, whereas a long tunnel can lead to intraoperative distortion of the cornea. The bevel should face the direction of the haptic approaching the needle to assist its passage through the needle.

ENSURE PROPER IOL CENTRATION

Once both haptics are externalized, mark the tips 1 mm from the end using calipers before performing cauterization. This ensures that the flanged haptics are symmetrical and decreases the risk of tilt and decentration. Next, fixate the cauterized flanges into the scleral tunnels. Small flanges risk IOL dislocation, especially during wound healing, and larger flanges are difficult to push into the scleral tunnel and have a higher risk of postoperative extrusion.

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BY ERIC ROSENBERG, DO, MSCENG

Yamane for novices by a (relative) novice.

Very quickly one learns why details matter in the placement of a scleral fixated IOL.

When I perform the Yamane technique, I begin by marking the cornea at the 12, 3, 6, and 9 clock positions. This marking of the cornea, I have learned, is an easy and important step because any deviation from a radial axis will offset the sclerostomy wounds and produce lenticular astigmatism secondary to tilt. Symmetry is key.

With calipers I then measure 2 mm posterior to the limbus and 2 mm temporal and nasal in the superior and inferior directions, respectively. These marks serve as a mental visualization approach with the sclerostomy needles. I then carefully plan my incisions and ultimately make an inferonasal paracentesis wound away from any of the future manipulation

zones, and I place the infusion cannula. Don't forget to flush the line before using it!

Carefully introduce the IOL into the eye and consider its configuration both at resting state and in its injectable form. In each case, I always initially attempt to feed the leading haptic into the 27-gauge or thin-walled 30-gauge needle during the injection of the lens. This ultimately saves a step and avoids fiddling in the anterior chamber. Then I remove the needle-haptic complex and externalize the first haptic. I find it more difficult to have the needle-haptic complex still coupled to the eye, and, therefore, I measure 1 mm at the tip of the haptic and form a bead with cautery to prevent internalization. I've used several IOLs, including the MN60AC (Alcon), AR40 (Precision Lens), and, much more commonly, the

CT Lucia 602. All these lenses have their strengths.

The manipulation of the more difficult trailing haptic always has to be gentle and deliberate. Too much manipulation yields a fishing adventure for the leading haptic—something I wish never to repeat.

Introduction of microforceps into the anterior chamber and externalization of the trailing haptic by leveraging it into the bore of the needle should ensue without too much torqueing of the lens. Use of the microforceps on the proximal haptic while withdrawing the needle ensures proper externalization without causing too much tension on the leading haptic.

Finally, I bead the distal end to the appropriate length, place it flush against the eye, and confirm centration and tilt.



BY STEVEN G. SAFRAN, MD

Adequate vitrectomy and an infusion cannula are must-haves.

For me, the most important aspects of the Yamane technique are ensuring an adequate vitrectomy and placing an infusion cannula. I always use a trocar and perform a pars plana vitrectomy when performing the Yamane technique. The vitrectomy is essential because I am going to be maneuvering behind the iris, and I don't want to be disturbing the vitreous. Additionally, the vitreous must be adequately and completely removed. Even if the eye has had a vitrectomy previously, I make sure that it was adequate and that all vitreous was removed.

An infusion cannula should be in place to control IOP because I don't want to be sticking needles into a soft eye. Doing so will increase the risk of bleeding and choroidal hemorrhage. It is helpful to use an infusion line that is under footpedal control, so that it can be turned on and off as needed during the procedure.

IOL SELECTION

I use the CT Lucia 602 IOL because this lens has PVDF haptics, which are robust and do not kink or break easily. Additionally, even when the haptics of this IOL have been bent acutely, they return to their original configuration.

MARKING AND NEEDLE TUNNEL CREATION

Controlling the entry point into the eye and the length of the tunnels is vital for this technique. It's important to mark the patient carefully and to make sure that the marks are exactly 180° apart and exactly the same distance from the limbus, and that the tunnel length and angle of entry are symmetric. If anything is off, the IOL will be decentered. I put both of my marks exactly 2 mm behind the limbus.

Each tunnel should be about 1 to 1.5 mm in length. An infusion line is useful when making the tunnels. If the eye is at a constant and firm IOP,

I can control the tunnel length and there will be less bleeding. I enter a little acutely with the needle, then create the tunnel, then enter acutely again. The tunnels should be more or less parallel to the limbus; they can be angled ever so slightly posterior, about 5° away from the limbus, but no more than that. For a myopic patient, I may angle the tunnels a bit more than 5°, and a bit less if the patient is hyperopic. This is because the bigger the eye is, the less haptic there will be to work with.

INSERTING THE HAPTICS

The next step is to feed both haptics into the needles. I feed one haptic into one needle, let go of it, then move to the second needle, feed that haptic in, and then rotate them simultaneously. I pull both needles out of the eye at the same time, and as I do that both haptics come out of the eye at the same time. When I do it this way, the lens has to rotate. If the lens doesn't rotate, then one haptic will pull out, but the other haptic won't come out because it hasn't rotated. But if both haptics are rotated by extracting both at the same time, the lens will rotate and both haptics will come out at the same time. With a 30-gauge needle, the haptics will not slip back into the eye. I can just pull the haptics out, let go, and the haptics won't go anywhere.

Next I grab both haptics with the forceps and push them so that each side is only a little bit out, to see if the lens is centering the way I want it to. If I've done everything symmetrically, the lens should center. If it looks like it's going to center well, I do a small haptic melt on each side and push it into its tunnel, and I'm done.

The haptic melt should not be too big. If it is too big, it will sit on the surface of the eye and not go into the tunnel. I just make a little mushroom tip, and that can be pushed into the tip of the tunnel.

ADDITIONAL POINTERS

Pointer No. 1: Inject OVD before performing the vitrectomy. A vitrectomized eye will not hold an OVD; it will just drop into the back of the eye. I inject dispersive OVD into the eye using the iris and vitreous as a kind of backboard that allows me to press the OVD up against the cornea and create protection for the cornea. In the vitrectomized eye, the IOL will serve as the backboard.

Pointer No. 2: Use self-sealing incisions. Self-sealing incisions are important for the Yamane technique—and any other technique, for that matter. If the eye is leaking, the surgeon will not have control. I make sure that my incisions, even larger incisions, are fashioned so that when I put the infusion line in, they seal themselves or close off.

Pointer No. 3: A redock is my last resort. After I pull both haptics out, I test the centration and tilt of the optic by manipulating the haptics so that there is an equal amount of externalized haptic—about 1 to 2 mm on each side. If everything has been done symmetrically, the lens should center well at this point, and if it does, I will go ahead and melt the haptic tips and be done. If, on the other hand, there appears to be some tilt or decentration, I pull one haptic out a bit more than the other to see if I can compensate and center the IOL. If that does not fix the problem, I melt the side I consider the most optimal and redock the other side. What I mean by *redock* is that I will create a flange on one side to secure it and I make another needle path with the 30-gauge needle, designed to correct for whatever centration or tilt issue is present by compensating for the asymmetry causing the positioning problem. For example, I may make the second pass more anterior, posterior, nasal, or temporal to the first pass as indicated by the centration or tilt issue

to compensate for it and thereby fix the problem. After creating a new needle pass, I pull that externalized haptic back into the eye and dock it again in the lumen of the needle once to externalize it again and create a new haptic position.

I refer to this process as *redocking*. I do this on one side in about 30% to 40% of my cases because I want excellent centration, and with this maneuver I am usually able to improve the lens position to achieve that.

Pointer No. 4: Perform peripheral iridotomy using the vitrector or after the IOL is successfully fixated. This is an important step in order to prevent reverse pupillary block. I generally put the peripheral iridotomy temporally.



BY BERNARDO SOARES, MD, FICO, FRANZCO

Familiarity with the maneuvers and the IOL you choose can go a long way toward mastering this technique.

When we attempt to master a new technique, a considerable amount of practice is required. Clearly that amount depends on the level of difficulty of the new skill. In the early stages of learning a new technique, it is especially important that all learning conditions be ideal. Some suggestions for how to achieve mastery of the Yamane technique for intrascleral fixation are described here.

IOL CHOICE, HAPTIC HANDLING

A crucial step of the Yamane technique for secondary IOL placement is securing the haptics properly in the sclera. Even a small amount of IOL tilt or dislocation can jeopardize the patient's final visual outcome. A considerable amount of IOL and haptic manipulation is required during implantation of the IOL, especially for

new adopters of the technique, and this manipulation can damage or break the haptic or detach it from the optic of the IOL (Figure 2). Manipulation can also cause one or more kinks at the pressure points of the haptics.

Yamane and colleagues initially described performing their technique with the Tecnis ZA9003 three-piece IOL (Johnson & Johnson Vision).¹ I have found that the haptics of this IOL are too easily kinked and are more prone to damage than those of the CT Lucia. The PVDF haptics of the CT Lucia are more forgiving and flexible and therefore better able to withstand manipulation without the creation of haptic deformity.

Regardless of your choice of IOL, for this technique to be successful it is paramount that you know the IOL well and can manipulate its haptics



Courtesy of Bernardo Soares, MD, FICO, FRANZCO

Figure 2. The trailing haptic of this IOL was damaged close to the optic after the leading haptic was placed under the initial scleral needle pass. The remainder of the damaged haptic is still in the injector near the main wound.

adequately. Gaining familiarity with the IOL you choose to use and practicing the maneuvers in the wet lab with it can go a long way to help you in mastering the Yamane technique for sutureless scleral IOL fixation. ■

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