

Working With the Small Pupil

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Not a surgery day passes that we, as surgeons, do not perform cataract surgery on an eye with a small pupil. I was curious how expert surgeons managed such a mundane problem. The first question is, "How small is a small pupil?" Certainly, one that will not dilate more than 2 or 3 mm is small. But, in reality, a small pupil should be defined as any pupil of inadequate size that a surgeon believes he might struggle with when performing the procedure. Four surgeons and I share comments on this common problem.

—William J. Fishkind, MD, Section Editor

KEVIN M. MILLER, MD

I have not changed my approach to working with small pupils much over the last several years. I am more aware of alpha-1 receptor blockers, particularly Flomax (Boehringer-Ingelheim Pharmaceuticals, Inc., Ridgefield, CT), but my approach to handling the small pupil sequelae of these systemic agents is unchanged.

There are many approaches to the patient with an intraoperative miotic pupil.¹ My primary approach is to work within the confines of a small pupil and use nothing more than a slow, careful technique and viscomydriasis. In cases of intraoperative floppy iris syndrome I also turn down the aspiration flow rate.

My favorite interventional approach is still the technique Gerald T. Keener, MD, and I described in 1994—that of pupil stretch.² This technique was simultaneously described by Luther L. Fry, MD, from Garden City, Kansas, in an ASCRS video and by Dennis D. Shephard, MD, from Santa Maria, California in a separate journal article.

To gain the most effect, a pupil must be stretched from limbus to limbus using two Kuglen hooks (Bausch & Lomb, Rochester, NY) or iris color buttonhooks. Most surgeons fail to obtain an adequate dilation because they do not stretch the pupil out to the limbus. It helps to hold the pupil at the limbus for 5 seconds to maximize the dilation effect (Figure 1).

After stretching the pupil in one direction through the phaco incision, the surgeon should withdraw and re-enter one hook through the paracentesis and stretch



Figure 1. Dr. Miller horizontally stretches the pupil from limbus to limbus.

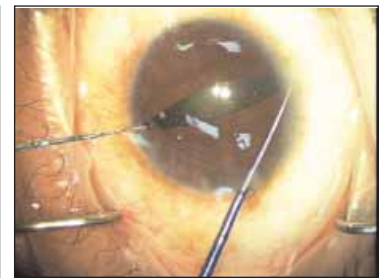


Figure 2. Dr. Miller vertically stretches the pupil from limbus to limbus.

the pupil a second time in the 90°-away meridian. Again, it helps to hold the pupil at the limbus for several seconds (Figure 2).

Once the hooks are withdrawn, additional viscoelastic is injected, preferably a high-viscosity viscoelastic such as Healon GV (Advanced Medical Optics, Santa Ana, CA) or Discovisc (Alcon Laboratories, Fort Worth, TX), and this maneuver will viscodilate the pupil even further.

Although they are old techniques, stretch pupilloplasty and viscomydriasis are still my favorite surgical tricks.

JEROME H. LEVY, MD

Because I perform many phacoemulsifications in one day, I usually use the nuclear flip and phaco technique originated by David Brown, MD, from Fort Myers, Florida, as this method reduces the time of each procedure and tires me less as the day goes forward.

This technique turns out to be excellent for small pupil

phacoemulsification, as the nucleus winds up being emulsified anterior to the iris and the small pupil, giving the surgeon excellent visualization. The nuclear flip technique has been described many times by Brown,³ and although in most cases it is fairly easily accomplished (even in small pupils) with one slow maneuver after hydrodissection, it does not always happen so simply.

Recently, I have devised some techniques for moving the nucleus into the iris plane in small pupil phacoemulsification, when the nuclear flip is not easily achieved. The surgeon can first use two Kuglen hooks to widen the small pupil to be able to create a reasonably sized capsulorhexis. When the nuclear edge does not then pop up during hydrodissection, it is not a good idea to try to force it to occur or to strengthen the hydrodissection to attempt the same. Either of those maneuvers may likely tear, or actually rupture, the posterior capsule. In general, it is never a good idea to try to force anything in phacoemulsification surgery.

“I have devised some techniques for moving the nucleus into the iris plane in small pupil phacoemulsification, when the nuclear flip is not easily achieved.”

—Jerome H. Levy, MD

One technique when working with small pupils to rapidly move the nucleus to the iris plane to allow easy quick phacoemulsification when the flip does not readily happen, is as follows: When the surgeon realizes that the nuclear flip is not easily occurring, he should stop further efforts. Without adding much more viscoelastic, the surgeon should use a cystotome, placing it in the anterior chamber and into the anterior portion of the nucleus just left of the center, and then move the instrument to the right so that the nucleus moves slightly in that direction, possibly exposing the left nuclear rim (although that is not necessary and may be unlikely with a small pupil). The surgeon should then use a Pisacano spatula (SightReach Surgical, Kensington, MD) or another similar spatula, placing it through the secondary incision, which is on the left. Next, the surgeon maneuvers the spatula so that it touches the anterior nucleus near, but to the left of, the cystotome and then sweeps it to the left (pulling, but not ripping, any anterior capsule rim along with it), so that it then can lift the left nuclear rim into the iris plane. In the same

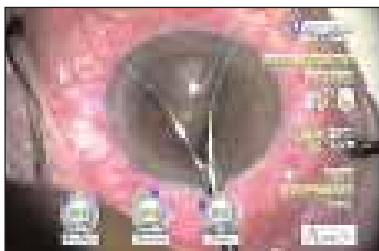


Figure 3. Dr. Fishkind uses the Beehler Dilator with splines and hook to stretch the iris.

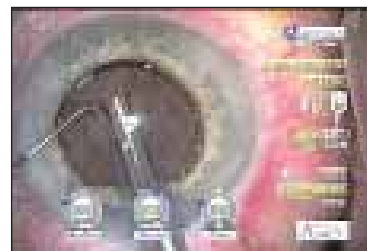


Figure 4. Dr. Fishkind places the Morcher Ring. Note the absence of the ring inferiorly, permitting access for phacoemulsification to proceed.

move, the surgeon will be sweeping the small pupil's iris pupillary margin, with the anterior capsule rim, to the left. This maneuver keeps the capsulorhexis intact. The surgeon should apply viscoelastic with his right hand under the now-lifted left nuclear rim, keeping it lifted, and remove the spatula. Then, he can use the same spatula to easily and very safely lift the nucleus through the capsulorhexis and the small pupil to the iris plane for quick emulsification, with excellent visualization.

ROXANA URSEA, MD

Seeing a patient with poor dilation in the office prompts me to employ careful surgical planning. Taking into consideration the pupil size and its possible causes (eg, pseudoexfoliation syndrome with zonular weakness, history of uveitis, history of miotic use, previous trauma or ocular surgery, iridodialysis, iridoschisis, anterior segment dysgenesis, or iris sphincter fibrosis), each pre- and intraoperative step can be addressed to reduce complications and achieve a good outcome. As routine, 3 days before surgery, I discontinue any miotics and start NSAIDs to prevent intraoperative pupillary constriction.

I use a smaller microkeratome than usual and make a longer clear corneal temporal incision to minimize the risk of iris prolapse. High-molecular-weight viscoelastic such as Healon 5 (Advanced Medical Optics) helps with viscodilation and when placed over the subincisional iris, creates more room for the phacoemulsification tip. No irrigation during the insertion or removal of the phaco tip helps to keep the iris inside. If iris prolapse occurs, I decompress the anterior chamber by removing viscoelastic through the paracentesis and use an iris sweep to reposition it.

If posterior synechiae are contributing to the small pupil, I use the viscoelastic syringe's cannula to swipe underneath these adhesions and gently break them. To further enlarge the pupil, I place Grieshaber iris retractors, (Grieshaber & Company AG, Schaffhausen,

Switzerland) gradually increasing the stretch on each of the iris retractors to avoid overstretching the pupil. The retractors can also secure the anterior capsule or a Capsular Tension Segment (Morcher GmbH, Stuttgart, Germany) in case of zonular dialysis. If the zonules look compromised, I avoid anything that could overpressurize the globe (preoperative block, overfilling the eye with viscoelastic, keeping the bottle too high). In such cases, I feel much safer using the Morcher Capsular Tension Ring (Morcher GmbH). Since its introduction, it has become my preference, as it is safe, easy to insert, and stabilizes and keeps the capsular bag stretched throughout the procedure.

As for the phacoemulsification technique itself, I prefer vertical chopping. If feasible, I flip the nuclear halves and phaco them within the safety zone. I avoid horizontal chopping and stay away from the “unknown” zone, beyond the pupil margin.

“It is important that whatever pupil enlargement technique is used, the pupil be kept above the minimum diameter throughout the surgery.”

—Mark H. Blecher, MD

MARK H. BLECHER, MD

First, the surgeon needs to know the minimum size pupil he can consistently work with given his particular cataract extraction technique. Next, they have to enlarge the pupil to that size, whether by pharmacologic or physical means. In addition, it is important that whatever pupil enlargement technique is used, the pupil be kept above that minimum diameter throughout the surgery. It is undesirable to be halfway through the phacoemulsification procedure and have the pupil constrict to a degree that makes the surgery more dangerous and more difficult.

I employ a vertical chopping technique that is very space efficient. I can work within a 4-mm pupil, as both of my instruments do not need to operate beyond that diameter.

The surgeon must decide early on whether he can work with the pupil as is, or if he requires assistance. I am not a big fan of depending on viscoelastic to enlarge the pupil and keep it that way. Some surgeons find Healon V (Advanced Medical Optics) helpful, but it has other issues (such as clogging the phaco tip, which can lead to wound burns) and is variably effective. The same is true for stretching. I have used all available pupil-stretching instruments and find that they can

work, but again not dependably, and not always for the entire duration of the case. I do not use intracameral epinephrine, because of concern for potential systemic side effects.

If after giving my routine dilating drops over a sufficient period of time (at least 30 minutes), and placing my regular viscoelastic (Amvisc Plus, Bausch & Lomb, Rochester, NY), the pupil is not larger than 4.0 to 4.5 mm, I then employ iris hooks. These are easy to insert, relatively fast, dependable, and in my opinion, less traumatic to the eye than pupil stretching. The hooks are available in disposable or reusable varieties. I use a 25-gauge short needle to make stab incisions at the limbus through which to place the hooks. I use five hooks distributed in an asymmetric pentagonal fashion, with the short side beneath the clear corneal incision. The hooks are removed just prior to removing the viscoelastic at the end of surgery.

WILLIAM J. FISHKIND, MD

Surgeons need simple, quick, safe, and reliable methods to deal with the small pupil.

I have a two-spline Beehler Pupil Dilator (Moria, Antony, France) sterilized and available at all times. It will pass easily through a 2.8-mm incision. When I sit down to perform the surgery, if I feel the pupil is small, I will not hesitate to use this instrument to enlarge it, as it is easy to use. The proximal hook engages the subincisional iris. The splines are slowly advanced with the tips engaging the distal pupillary iris. They are extended until the pupil is stretched, limbus to limbus, at three points. The splines are then withdrawn; the hook is advanced to free the iris and is rotated 90°. The surgeon next withdraws the entire instrument from the wound. The only caveat is that the splines must be lifted slightly over the capsule to prevent inadvertent tears of the peripheral capsule (Figure 3).

The exception to the use of this dilator is the small pupil secondary to Flomax usage. In this unique circumstance, stretching the pupil will aggravate the flaccidity of the iris and leads to amplified iris prolapse, billowing, and potential direct damage from the phacoemulsification tip.

In these cases, I use a Morcher Pupil Dilator (Morcher GmbH). This PMMA ring is inserted through a 2.8-mm incision with an injector. The surgeon places the distal part of the ring against the pupil, and with gentle injection, the ring follows the pupil's contour until fully extended. Next, the surgeon pushes the proximal ring free of the inserter with a Sinsky hook (Katena, Inc., Denville, NJ). The ring expands the pupil for 270° allowing access to the cataract where it is absent. It holds the

iris taught, minimizing iris prolapse (Figure 4).

After, phacoemulsification, I/A, and IOL insertion, the ring is easily removed engaging the proximal positioning hole with a Sinsky hook, disengaging it from the iris, and removing it through the incision.

These two techniques work nearly all the time and are the primary modalities I use to deal with the omnipresent small pupil. ■

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