

Managing small pupils: A step-wise approach

How pupil expansion device protects the iris during cataract surgery

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By Boris Malyugin, MD, PhD

Take home

Boris Malyugin, MD, PhD, explains how he uses a step-wise approach to manage small pupils, starting with an intracameral injection of phenylephrine or epinephrine and eventually working up to pupil expanders.

By Boris Malyugin, MD, PhD, Special to *Ophthalmology Times*

Moscow—Despite the different treatments available to protect the iris during cataract extraction, performing surgery on an eye with a small pupil remains technically challenging. This is due, in part, to the different mechanisms causing small pupils, as well as the surgeon's skill and experience in managing this condition.

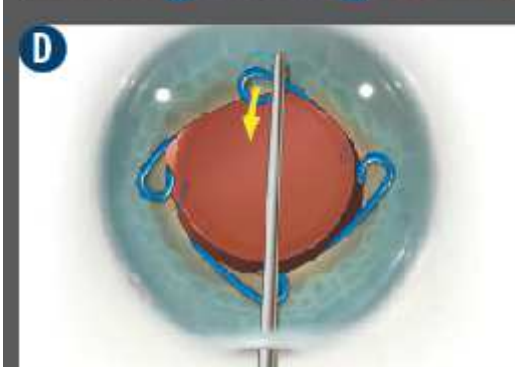
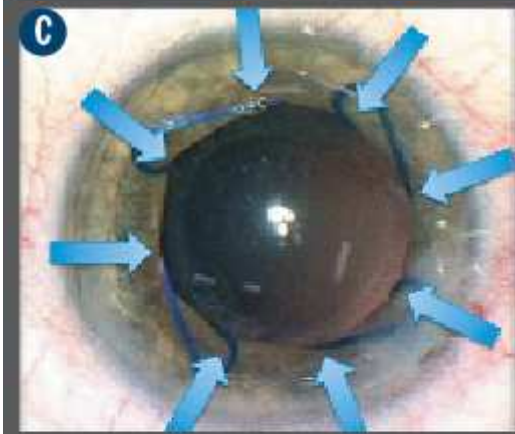
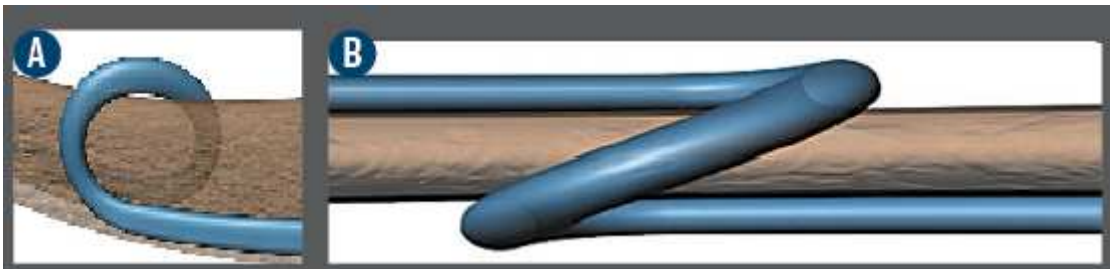
Complications can occur more commonly during small-pupil phacoemulsification surgery. These include increased risk of iris damage, iris bleeding, iris prolapse from one or more wounds, anterior capsule damage, incomplete evacuation of the cortical material, and difficulties with placing and aligning the IOL in the bag.^{1,2} In my practice, a step-wise approach is used to manage small pupils, starting with an intracameral injection of phenylephrine or epinephrine and eventually working up to pupil expanders.

Various pupil expansion devices are available, such as metal or plastic hooks, iris rings, and expanding devices. One device (Malyugin Ring, MicroSurgical Technology) was developed to give surgeons a reliable device that is easy to use, expands the pupil up to 7 mm, and protects the iris from damage.

Complications of small-pupil cataract surgery

Aside from being technically challenging, working with a pupil smaller creates a greater risk for certain complications. In addition, the recommended default pupil diameter for femtosecond cataract surgery is 5 mm—thus, small pupils are typically contraindicated for this technology.^{3,4}


Performing cataract surgery on an eye with a small pupil can cause iris bleeding, iris prolapse into a wound, and incomplete evacuation of any cortical material. Additionally, iris chafing can contribute to increased postoperative inflammation and iris defects that can create cosmesis concerns.




A B Rendition of one of the scrolls and how it secures the iris. Side view of a scroll and the paper-clip action (left). Top view of a scroll securing the iris margin (right).

C The Malyugin Ring gives eight points of fixation to secure the iris.

D Disengaging the distal scroll first during removal. The thin profile makes the Malyugin Ring easy and safe to manipulate during surgery.

 Device insertion and removal
<http://bit.ly/1rpYIGS>

 Animation of device use
<http://bit.ly/1ryk8bC>

(Images courtesy of Boris Malyugin, MD, PhD)

Patients with intraoperative floppy iris syndrome (IFIS) may experience progressive pupillary constriction during surgery. This greatly increases the

chance of the iris prolapsing into the side port or phaco incisions, or becoming trapped in the ultrasound tip.

A small anterior capsulorhexis can also result if the surgeon is working with a small pupil. This raises the risk of anterior capsule damage from the chopper or ultrasound tip, and heightens the probability of postoperative capsular phimosis.

The surgeon may also have trouble with appropriate visualization during the procedure due to a reduced red reflex and inability to see the peripheral capsule adequately. As a result, the ophthalmologist may have trouble ensuring the lens and haptics are placed completely in the bag, and it may be difficult to see any toric markings on the IOL optics to confirm proper alignment.

Options for increasing pupil size

When treating a patient with a small pupil, a step-wise approach is used to increase and then maintain pupil size. This improves visibility and decreases the risk of complications, such as IFIS.

Step one is to use intracameral mydriatics. Shugarcaine⁵ and epi-Shugarcaine can be used to increase mydriasis and reduce iris flaccidity; epi-Shugarcaine is preferred in patients with history of tamsulosin use.⁶

If the intracameral injection does not provide sufficient mydriasis, I proceed with viscodilatation, posterior synechiolysis, and pupil-stretching techniques, if appropriate. Small pupils that are not due to IFIS can be managed by mechanical stretching of the iris.

Lysing posterior synechia will obviously improve mydriasis. Viscodilatation with gentle hydrodissection can be used to prevent iris prolapse in patients with IFIS. It is important not to overfill anterior chamber and also to avoid pressure spikes. This minimizes the chance of iris prolapse.⁷

When using a viscoadaptive OVD (for instance, Healon5, Abbott Medical Optics), the surgeon should take into account that usually this type of viscoelastic does not stay in the anterior chamber throughout the whole nucleus removal step of the procedure. Subsequently repeated injections may be needed during the

course of the surgery. Decreasing fluidic parameters and aspiration/vacuum rates helps to reduce the rate of OVD aspiration and decreases the chance of iris aspiration into the phaco needle.

The final step is to use pupil expansion devices. These include the following:

- Plastic hooks
- Metal hooks
- 5S iris ring (Morcher GmbH)
- Perfect Pupil (Milvella)
- Graether expander (Eagle Vision Inc.)
- Clarke ring
- Siepser ring
- Malyugin Ring (MicroSurgical Technology)

There are advantages and disadvantages to these devices. The main disadvantage is that they all require additional steps when performing any cataract surgery—lengthening surgery time, increasing costs, and introducing additional instruments into the eye. However, preventing complications related to performing surgery in a small pupil and IFIS outweigh these disadvantages.

Metal or plastic iris hooks can be used to widen the pupil and allow better visualization. The significant advantage is that they allow the surgeon to fixate the iris and the capsule to the limbus. Disadvantages include additional paracenteses, and the possibility of overstretching the iris sphincter and creating iris defects.

Pupil expanders—such as Perfect Pupil, 5S ring, the Graether ring, and the Clarke ring—increase the pupil size, while protecting the iris margin and

preventing iris sphincter overstretching. They can be inserted through the main incision so that multiple additional paracenteses are not needed.

Using the Malyugin Ring

This device offers a number of advantages over previous iris expansion devices. It is available in two sizes: 6.25- and 7-mm diameter rings.⁸ This gives surgeons two options for pupil width. The 6.25-mm ring can be used for most cases. It causes less stress to the iris tissue, is easier to implant and remove, and is better for small eyes.

The 7-mm ring is designed for surgeons who need larger pupils for a specific reason, such as using an IOL with a 6.5-mm optic. Certain phaco techniques can be used easily with this ring size, including the divide-and-conquer and flip methods. It is also the preferred width in IFIS cases to minimize the risk of movement and miosis.

Since the device can be placed through a main incision that is 2.2 mm or larger, it eliminates the need for extra incisions or additional paracenteses for iris hooks. By using a wound-assisted technique for insertion and removal, the ring can be used in a microincision of 1.6 to 1.8 mm. The thin 5-0 polypropylene paperclip scroll design gives eight points of fixation, providing the surgeon a round pupil instead of the square one that is formed with four iris hooks (Figures 1 to 3).

In addition, the device maintains a wide pupil with minimal iris contact compared with other corneal rings. This reduces iris chafing and makes it less likely to damage the iris sphincter.⁹

The thin profile does not cause the iris to “tent.” This minimizes the chance of viscoelastic being trapped beneath it. It is also easier for surgeons to use in shallower anterior chambers. It is thinner than the typical 1 mm thickness of other pupil rings, making it easier to manipulate inside the eye (Figure 4).

There is less chance of corneal contact during insertion, and it does not get in the way of instruments during the procedure, which makes it safer during surgery. The injector is disposable, unlike other iris rings. This eliminates sterile

processing costs. Furthermore, the injector is also used to remove the device, so another instrument is not required.¹⁰

One significant advantage of the device is that it can be used in cases of small pupils with a posterior capsular rupture. The fixation of the ring is very stable and does not need any additional fixation. Nevertheless, to be even more on the safe side, Dr. Amar Agarwal suggested attaching 6-0 polyglactin vicryl suture to the leading scroll of the ring before implantation. In patients with pre-existing opening in the posterior capsule (for instance, penetrating trauma case), this technique gives extra security for the ring throughout surgery and prevents it from dropping into the vitreous cavity.¹¹

Conclusion

With the advent of new medications and technologies, performing cataract surgery on small pupils carries less risk than in the past. Surgeons can now use a step-by-step approach to enlarge the pupil to a safe diameter.

When mydriatics, mechanical stretching, and viscodilatation do not provide a wide enough pupil—particularly in cases of IFIS—pupil expansion devices can be employed. Expanders, such as the Malyugin ring, offer good dilation and iris stabilization while minimizing pupil distortion and iris damage.

The ease of insertion and removal with the disposable delivery system makes the device an especially desirable option when treating small pupils due to IFIS. Surgeons can now be more confident in offering safe cataract surgery to patients with small pupils and those who are taking alpha 1-antagonists, such as tamsulosi

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