Pearls for Phacoemulsification in Small Pupils

Several techniques and devices can be used to manage these challenging cases.

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Eyes with small pupils present a challenge to cataract surgeons. A pupil that fails to dilate can obscure visualization during all stages of phacoemulsification, making surgery more difficult and increasing the incidence of complications such as nucleus drop, vitreous prolapse, and iris tear. Inadequate pupil dilation is often seen in patients with a history of use of miotic agents, chronic uveitis, diabetes mellitus, pseudoexfoliation syndrome, intraoperative floppy iris syndrome (IFIS), iris trauma, and ruberosis iridis.

Fortunately, the availability of several intraoperative techniques and pupil-expanding devices enables phacoemulsification to be performed even in these difficult eyes. Strategies for enlargement primarily depend on the surgeon’s skill level and preference and on the individual intraoperative situation. This article presents pearls for a variety of methods used to facilitate phacoemulsification in patients with small pupils. For a video demonstration of the methods described for phacoemulsification in small pupils, visit eyetube.net/?v=deedq.

VISCOMYDRIASIS

A highly cohesive ophthalmic viscosurgical device (OVD) such as Healon 5 (Abbott Medical Optics Inc.) can be used to manipulate a small pupil intraoperatively. As phacoemulsification progresses and the OVD is washed out of the anterior chamber, the pupil will become small again, at which point reinjection of the OVD can help to redilate the pupil. In such cases, it is important to perform slow-motion phacoemulsification and to maintain minimal turbulence so that the OVD stays within the anterior chamber and is not rapidly washed out. The bottle height must be low to achieve low fluidics and ensure that the OVD stays within the anterior chamber. Remember to remove all of the OVD at the end of the case, especially from under the IOL.

MALYUGIN RING

Pupillary expansion devices such as the Malyugin Ring (MicroSurgical Technology) can also be used to enlarge a small pupil. The Malyugin Ring is a square-shaped implant with four circular loops that hold the iris at equidistant points; it is available in two sizes, 6 mm and 7 mm, and conveniently comes with its own injector. The Malyugin Ring is injected through the main incision, and the four scrolls are placed on the iris to enlarge the pupil. Normally, the three scrolls that emerge first can be engaged fairly easily, and then a second instrument is needed to position all of the scrolls on the iris in an optimal manner. This device provides uniform dilation and protects the iris all around. Phacoemulsification can then proceed as in any normal case.

The main advantages of the Malyugin Ring are that (1) its use does not require the creation of any additional incisions, (2) it is simple to inject, (3) it does not take long to deploy, and (4) it provides a uniformly dilated pupil and protects the iris. In all cases, it is again important to perform careful and gentle phacoemulsification to reduce the amount of stress placed on the zonules. Also, because the pupil can create problems at later stages in the case, we must be careful to perform slow-
motion phacoemulsification and ensure that the procedure goes smoothly. Again, OVD should be used very generously in all of these cases; therefore, it is important to remove all of the OVD from the capsular bag, especially from under the IOL.

At the end of the case, the Malyugin Ring is removed with the injector (Figure 1). The scrolls must first be freed carefully from the iris margin. The iris sometimes becomes edematous during surgery, and, therefore, pulling on the scrolls without freeing them initially has been reported to cause iridotrabeculectomy. Once all of the scrolls are freed, one of the scrolls is engaged in the Malyugin Ring injector, and the ring is withdrawn through the same incision that was used for injection.

**IRIS RETRACTORS**

Iris retractors have been available for a long time and can be used to facilitate phacoemulsification in patients with small pupils. Four iris retractors are used in each case; therefore, the disadvantage of this approach is that four additional paracentesis incisions must be made. Most surgeons prefer to place the iris retractors in a diamond configuration (Figure 2), as this provides greater visualization inferiorly, where most phaco movements take place.

Iris retractors may tend to slip off as the case progresses, especially if the retractor is placed subincidentally. The surgeon should be careful not to rotate the globe too much, as that increases the chances of the iris retractors slipping out. If the retractors do slip out, they should be placed back in again, taking care not to catch the capsule or the iris with the hook.

**PUPIL STRETCH**

In the case of a small pupil due to a thick fibrotic iris, a pupil-stretching technique using two Kuglen hooks can be employed. This technique is most suitable for postuveitic, thick fibrotic irides, which can be mechanically dilated with the use of iris hooks. However, it is important not to stretch the iris too much or apply too much sudden force, as this may cause the iris to tear. Therefore, the increase of force must be gradual. It is a good idea to slightly enlarge the pupil first with pupillary stretching and then use viscomydriasis to enlarge it further.

It has been suggested that the pupillary stretching technique releases prostaglandins and causes increased inflammation, and it should therefore be avoided. The technique does, however, have some role in selected eyes with postuveitic, fibrotic irides. One should also remember not to perform pupillary stretching in patients with IFIS, as this will make the iris even more floppy, causing it to prolapse out of the incision.

**INTRACAMERAL DILATION**

Intracameral injection of preservative-free lidocaine 1% can be used to achieve pupillary dilatation. This technique is not successful in all cases; however, if it does

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**TAKE-HOME MESSAGE**

- A pupil that fails to dilate can obscure visualization during phacoemulsification, making surgery more difficult and increasing the incidence of complications such as nucleus drop, vitreous prolapse, and iris tear.
- Strategies for enlargement primarily depend on the surgeon's skill level and preference and on the individual intraoperative situation.
not work, intracameral lidocaine can be further supplemented with the use of viscomydriasis to achieve a fairly well dilated pupil, and capsulorhexis and phacoemulsification can be performed as in any standard case.

The use of epi-Shugarcaine, a term coined by the late Joel K. Shugar, MD, has been described to help achieve pupillary dilation in patients with IFIS. This combination of buffered lidocaine and epinephrine provides intracameral anesthesia and also helps to overcome the action of alpha-1-blockers such as tamsulosin HCl (Flomax, Boehringer Ingelheim) that are often responsible for IFIS. This approach can also be used as a supplement to other techniques when the pupil is stubbornly small or constricts during phacoemulsification.

**CONCLUSION**

Pharmaceutical agents, intraoperative techniques, and surgical devices can all be used to facilitate phacoemulsification in patients with small pupils. Depending on surgical skill, preference, and scenario, a combination of these techniques and technologies can make it safe to perform phacoemulsification in these difficult eyes.

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