

Stabilizing the capsular bag and expanding the pupil with a pupil expansion device

We describe a surgical technique for management of zonular instability and pupillary miosis using a pupil expansion device (Malyugin ring) in patients who need cataract surgery. In this technique, the pupil expansion device is first used in the usual fashion. After a capsulorhexis has been created, lateral scrolls of the pupil expansion device are released and repositioned to entrap both the anterior capsulorhexis and the pupil margin at the against-the-wound meridian (3 o'clock and 9 o'clock position) to fixate the unstable capsular bag to the iris. Phacoemulsification is performed, and the ring is removed after intraocular lens implantation. With this method, capsular stabilization and pupil expansion are achieved simultaneously with the same instrument.

Financial Disclosure

No author has a financial or proprietary interest in any material or method mentioned.

Zonular weakness has been associated with an increased incidence of intraoperative complications. There is an additional challenge for successful lens removal and intraocular lens (IOL) implantation in the presence of zonular weakness and pupillary miosis.^{1, 2, 3, 4}

Many devices and techniques have been introduced to manage zonular weakness and pupillary miosis during cataract surgery, and some surgeons use a combination of these to address zonular weakness and pupillary miosis. We report a new surgical technique that uses the Malyugin device (Microsurgical Technology) to manage both zonular weakness and pupillary miosis.

Surgical Technique

Corneal incisions are made as in routine cataract surgery, and the anterior chamber is filled with an ophthalmic viscosurgical device (OVD). The pupil expansion device (6.25 mm) is then injected through the main incision (temporal) and is positioned where the scrolls engage the pupillary margin. A continuous curvilinear capsulorhexis (CCC) is made just inside the pupil margin using a bent 30-gauge needle or a capsulorhexis forceps.

Following the CCC, the anterior chamber is refilled with OVD. The lateral scrolls of the device are released from the iris and reengaged with both pupil and capsulorhexis margins to stabilize the capsular bag by fixating it to the iris. To engage the scrolls, the Malyugin device is retracted toward the pupil center with

a Lester hook and then repositioned with a gentle downward force to catch the capsulorhexis edge ([Figure 1](#)).

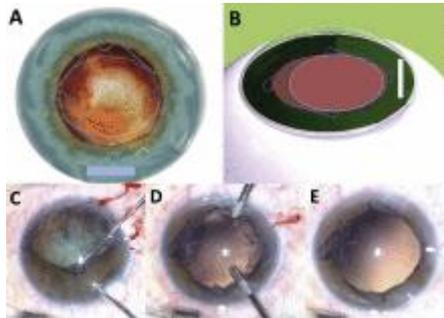


Figure 1

Modified pupil expansion device insertion. *A* and *B*: Schematic views showing entrapment of both pupil margin and capsulorhexis with lateral scrolls at 6 o'clock and 12 o'clock and pupil margin–edge engagement at 3 o'clock and 9 o'clock (main wound is temporal). *C*: Re-engagement of the lateral scroll with the pupil and capsulorhexis margins with a Lester hook. *D* and *E*: Oval configuration of the capsule toward the lateral scroll before and after cortical cleanup.

Hydrodissection, phacoemulsification, irrigation/aspiration, and insertion of the IOL in the bag are performed, and the pupil expansion device is removed. A capsular tension ring (CTR) is implanted as usual at any time after the capsulorhexis. However, to facilitate cortical material cleanup, the CTR should be implanted “as late as possible but as soon as necessary” ([Video 1](#), available at <http://jcrsjournal.org>).^{5, 6}

Discussion

Small pupils present a considerable challenge to cataract surgeons as they obscure visualization during the surgery. Fortunately, several intraoperative techniques and devices are available, including iris retractor hooks, stretching techniques, and pupil dilator rings (Malyugin ring), and these enable surgeons to achieve adequate pupil dilation.⁷

Zonular insufficiency is another predisposing factor for ocular complications during cataract surgery.⁸ Several surgical devices to manage zonular instability have been introduced, including the CTR to support the bag by maintaining the

circular contour of the bag and distributing the forces equally over all zonular fibers,⁹ the Ahmed segment and Cionni ring to fixate the capsular bag to the sclera,¹⁰ and microhook retractors to stretch and stabilize the loose capsule–zonule complex.¹¹

The Malyugin device is a square-shaped implant made of 5-0 polypropylene with 4 circular scrolls. It has 2 sizes: 6.25 mm and 7.00 mm. Its implantation and explantation are easily performed with an injector through the main incision. In conventional use, the device's scrolls engage the pupil margin to expand the pupil.¹²

To address both small pupil and zonular weakness during cataract surgery, it is helpful to use a combination of devices (eg, the pupil expansion device and capsular hooks). However, implanting/explanting the devices in these techniques requires more manipulation and usually limits the surgeon's maneuvers in the eye, particularly in the case of a shallow anterior chamber.

We used the pupil expansion device to stabilize the capsular bag and expand the pupil at the same time in cases with weak zonular fibers and a poorly dilated pupil. Dilating the pupil while simultaneously stabilizing the zonular fibers is important for safe and successful cataract surgery. In this technique, a well-dilated pupil is achieved by implantation of the pupil expansion device, which provides adequate visualization for a properly sized capsulorhexis. Following the CCC and after entrapment of both capsulorhexis and pupil margins by the device's scrolls, adequate capsular bag stability is achieved along with pupillary dilation, enabling the surgeon to perform phacoemulsification safely.

Initially, we entrapped both iris and capsulorhexis margins within all 4 scrolls. Although no complications occurred, the placement of the scrolls was difficult and the tension of the capsule edge seemed high.

Subsequent to the first cases, the sterilization method was modified to reduce the force to the capsulorhexis margin. Instead of 4-scroll engagement of the capsulorhexis edge, the pupil expansion device was implanted in a manner to capture both capsulorhexis and pupil margins at 2 scrolls only; the remaining 2 scrolls engaged the pupil margin. This allows easier engagement of the scrolls and better adjustment of the force to the capsule edge. Although 2-scroll engagement causes ovalization of the capsulorhexis toward the capsulorhexis-

engaging scrolls, it does not interfere with the chopper or ultrasound needle maneuver.

We believe this technique using the pupil expansion device is simple, fast, and effective in preventing complications during cataract surgery in cases with concurrent zonular weakness and small pupils, as in the pseudoexfoliation syndrome.