Pearls for Refractive Lens Exchange

Advances in laser and IOL technology are increasing the safety and efficacy of this procedure.

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The removal of the crystalline lens for refractive purposes is described by a number of terms, the most common being *refractive lens exchange* (RLE). Other names include *clear lens phacoemulsification*, *clear lensectomy*, *clear lens extraction*, *clear lens replacement*, *clear lens exchange*, and *presbyopic lens exchange*. Regardless of the terminology used, this procedure can be a safe and effective treatment option for patients desiring refractive correction. Advances in femtosecond laser technology and IOL design will likely continue to increase its acceptance.

There are several essential components to successful RLE. These include appropriate patient selection; precise keratometry; optical biometry for IOL power calculation; successful completion of surgical steps such as incision construction, capsulorrhexis creation, and IOL implantation in the capsular bag; and the management of preoperative astigmatism. This article describes our approach to RLE, detailing pre-, intra-, and postoperative pearls for ensuring optimal visual outcomes and patient satisfaction.

PATIENT-RELATED PEARLS

Patient selection. Suitable patients for RLE are individuals who are motivated for the procedure with a healthy tear film, cornea, and retina. Presbyopic hyperopes who want to reduce their dependence on reading glasses are great candidates for RLE. When one is first beginning to perform RLE, it is best to avoid the procedure in low myopes and to be conservative with patients whose occupations involve frequent night driving. It is also advisable to avoid performing RLE in patients who are fussy or obsessive.

Patient counseling and preoperative work-up. Proper and detailed counseling must be done for all patients undergoing RLE. The preoperative work-up should include a comprehensive anterior and posterior segment examination, measurement of intraocular pressure, corneal topography for corneal evaluation, and optical coherence tomography for retinal and macular evaluation.

IOL POWER CALCULATION PEARLS

Noncontact optical measurement using partial coherence interferometry (IOLMaster; Carl Zeiss Meditec) is an important tool for measuring axial length, corneal curvature, and anterior chamber depth.

Among the available IOL formulas, we have found the Holladay 2 to be the most accurate for IOL power calculation, as it takes into account disparities in anterior segment and axial length by incorporating white-to-white corneal diameter and lens thickness into the formula. Surgeons can also consider using the Hoffer Q formula for comparison in eyes less than 22 mm in length.

SURGICAL TECHNIQUE PEARLS

A meticulous surgical technique is crucial for all cases of RLE. We prefer to make a clear corneal incision at the steep axis to minimize or eliminate preexisting astigmatism. Toric or multifocal toric IOLs can be used for patients with preoperative astigmatism greater than 1.00 D. The capsulorrhexis should be circular, well-centered, and slightly smaller than the IOL optic diameter to maximize the effective lens position. A chondroitin sulfate-based dispersive ophthalmic viscosurgical device (OVD) such as Viscoat or DiscoVisc (Alcon) should be used to coat the corneal endothelium to minimize endothelial cell loss and to achieve a clear cornea day 1.

Surgeons should be careful when performing phacoaspiration of a soft cataract, as these cases are particularly challenging. It is obvious that, in any RLE case, the surgeon always needs to be most careful to avoid posterior capsular rupture and zonulolysis. These complications can compromise in-the-bag IOL implantation and IOL centration, two essential components when implanting premium (multifocal or toric multifocal) IOLs.

The simplest strategy for management of very soft cataracts is good cortical cleaving hydrodissection (Figure 1A) and multilayered hydrodelineation to prolapse the lens into the iris plane and allow gentle aspiration with the phaco needle. In a soft cataract, after initial complete hydrodissection, the surgeon should create several multilayered hydrodelineation planes from the periphery inward, like the layers of an onion.

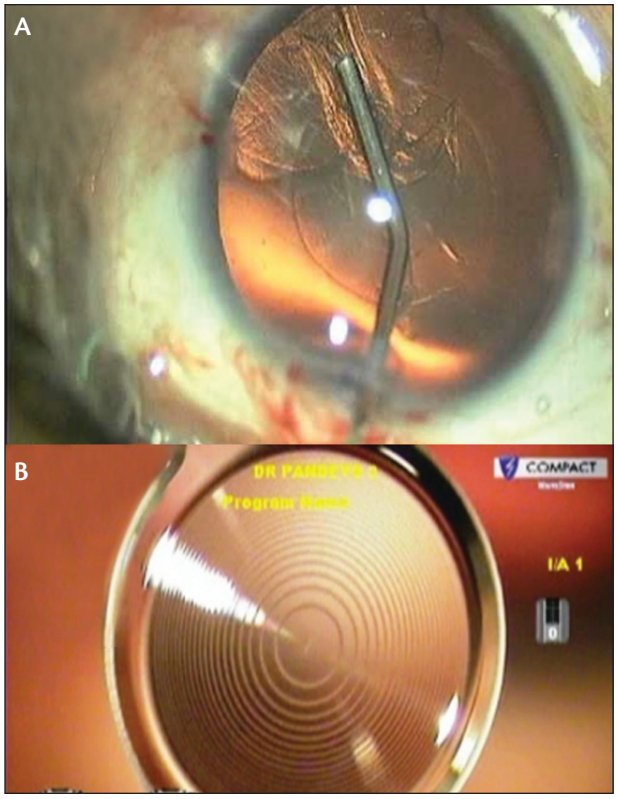

Figure 1. Cortical cleaving hydrodissection (A) and multifocal IOL implantation (B) were performed as part of a case of RLE.

A golden ring sign indicates that hydrodelineation has been performed successfully. In a very soft lens, the volume of the injected balanced saline solution will push the overlying material out of the bag. With subsequent hydrodelineation maneuvers, a significant part of the lens will be prolapsed into the anterior chamber, from which it can be aspirated easily with moderate vacuum and fluidics settings.

Bimanual irrigation and aspiration is helpful to achieve meticulous cortical clean-up. This step is vital, as even small amounts of posterior capsular opacification can inordinately degrade visual acuity in these refractive surgical patients.

Multifocal IOLs should be implanted in the capsular bag (Figure 1B). If a toric or toric multifocal IOL is implanted, the surgeon should be careful to remove all OVD behind the IOL optic, and the IOL axis should be precisely aligned to achieve an optimal visual outcome.

For video demonstrations of RLE with toric IOL implantation and with multifocal IOL implantation, respectively, visit eyetube.net/?v=ohogo and eyetube.net/?v=odoso.

eyetube.net/?v=ohogo

eyetube.net/?v=odoso

INTRAOPERTIVE COMPLICATIONS PEARLS

If the anterior capsulorrhexis is torn, the surgeon should use low fluidics parameters to avoid extension of the tear. If the posterior capsule is torn, the surgeon should try to convert the tear to a circular posterior capsulorrhexis. IOL implantation may be attempted in the capsular bag in the presence of a posterior capsulorrhexis. If a posterior capsulorrhexis cannot be achieved, then sulcus implantation of a three-piece IOL with optic capture in the bag behind the anterior capsulorrhexis can be attempted. Do not forget to adjust the IOL power in this event.

Meticulous vitrectomy should be done to clear any vitreous in the iris margins. Preservative-free triamcinolone acetonide can be used to help visualize vitreous strands in the anterior chamber.

POSTOPERATIVE MANAGEMENT PEARLS

RLE with multifocal IOL implantation is usually done in the second eye within 1 to 2 weeks after surgery in the first eye to facilitate neural adaptation.

Problems of glare and halos during nighttime are typically minimal with modern multifocal IOL designs. If the patient feels these disturbances are significant, however, they can be managed with a number of strategies. Weak pilocarpine or brimonidine eye drops can be prescribed, or the patient can be fitted with minus or polarized lenses. Another possibility is to have the patient brighten the dashboard lights in his or her car for night driving.

Refractive surprise after RLE can be managed with LASIK or piggyback IOL implantation.

CASE REPORT: RLE AND PRIMARY PIGGYBACK IOL IMPLANTATION FOR HIGH HYPEROPIA

Case presentation. A 50-year-old man presented with complaints of poor vision without glasses. The refraction in his right eye was +8.00 +1.75 X 20°; the near addition was 2.50 D. The patient was interested in obtaining freedom from near and distance glasses. Preoperative keratometry

TAKE-HOME MESSAGE

- RLE can offer substantial benefits to patients with high hyperopia, presbyopia, or soon-to-be clinically significant cataracts who request refractive surgery.
- A motivated refractive surgery patient with a healthy tear film, cornea, and retina may be a suitable candidate for RLE.
- The preoperative work-up for RLE should include a comprehensive anterior and posterior segment examination, measurement of intraocular pressure, corneal topography for corneal evaluation, and optical coherence tomography for retinal and macular evaluation.

Figure 2. Reference marking is performed at the slit lamp.

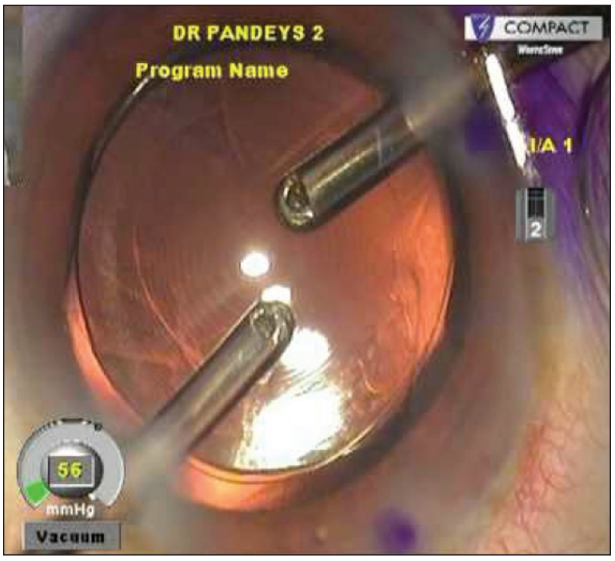

Figure 3. Removal of OVD from the capsular bag and anterior chamber were performed after piggyback IOL implantation.

revealed 1.25 D of corneal astigmatism. The IOL power calculated for the right eye was 34.50 D. At the time of surgery, multifocal and toric IOLs were available only up to 30.00 D. We planned for primary piggyback IOL implantation of a 15.00 D multifocal IOL (Acridiff; Care Group) and a 19.50 D toric IOL (Acrioltoric; Care Group).

The reference marking was done in a seated position at the slit lamp, and axis marking was performed in the operating room (Figure 2).

Phacoemulsification. A sideport incision was made, followed by injection of Viscoat into the anterior chamber to coat the corneal endothelium. The main incision was created at the steep axis (20°). This was followed by a well-centered 5-mm anterior capsulorrhexis, which is crucial for perfect centration of toric and multifocal IOLs. Cortical cleaving hydrodissection was performed, and phacoaspiration was done using low phaco power and fluidics parameters. This was followed by bimanual irrigation and aspiration of cortical matter.

Toric IOL implantation. After filling the capsular bag with OVD (2% hydroxyprolpyl methylcellulose), toric IOL implantation was performed in the capsular bag using an injector. The IOL haptics were dialed into the capsular bag, and OVD was removed from behind the toric IOL using bimanual irrigation and aspiration. Final alignment of the toric IOL was done along the astigmatic axis (20°).

Multifocal IOL implantation. Next, the multifocal IOL was implanted in the capsular bag. Although standard practice is to implant one IOL in the capsular bag and the other in the ciliary sulcus, in this case we implanted both IOLs in the capsular bag, as precise centration and positioning in the capsular bag is a must for an accurate refractive outcome. The OVD was removed from behind the multifocal IOL and from the anterior chamber using bimanual irrigation and aspiration (Figure 3).

Nd:YAG laser-assisted enlargement of the anterior capsulorrhexis opening was performed 8 weeks later to prevent the occurrence of interlenticular opacification. The patient's postoperative UCVA was 6/6 and N5, and he was satisfied with this result. For a video demonstration of this procedure, visit eyetube.net/?v=widen.

CONCLUSION

RLE is a safe and effective procedure that can offer substantial benefits to patients with high hyperopia, presbyopia, or borderline soon-to-be clinically significant cataracts who request refractive surgery. The availability of the femtosecond laser and the variety of lenses being developed will make RLE safer, more effective, and ultimately more widely accepted in the ophthalmic world. ■

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Suggested Reading:
Fine IH, Hoffman RS, Packer M. Refractive lens exchange: the quadruple win and current perspectives. *J Refract Surg.* 2007;23(8):819-824.