Vitrectorhexis for anterior capsulotomy in an intumescent cataract

Intumescent cataracts can present as challenges in cataract surgery because of lenticular changes, including an abnormally friable or dense lens capsule and increased intralenticular pressure from liquefied cortex. This can cause difficulties during capsulorhexis with a risk of its uncontrolled extension, which can lead to complications including zonular rupture, posterior capsule rupture, lens drop, and intraocular lens (IOL) dislocation.[1]

Several techniques have been described for capsulorhexis in intumescent cataracts, including the can-opener[1] and phacocapsulotomy techniques.[2] Another technique called *vitrectorhexis* was originally described by Wilson in 1994 to address the more elastic lens capsules in pediatric cataract surgeries and reduce the risk of a "run-away capsulorhexis."[3] This method uses a vitrectomy hand piece to create the anterior capsulotomy. Vitrectorhexis also has been used in spherophakia in children and penetrating eye injuries in adults.[4,5] However, no previous publications, to our knowledge, have reported this technique in an adult intumescent cataract.

This correspondence describes the use of vitrectorhexis to create an anterior capsulotomy during extraction of an intumescent cataract with a fibrotic anterior capsule (**Video 1**, available online). This technique can potentially serve as an alternative method to create a capsulotomy in these challenging surgical cases when initial capsulorhexis methods are ineffective.

Written consent was obtained from the patient to publish the details of this case. A 45-year-old female with proliferative sickle cell retinopathy and prior vitrectomy with silicone oil tamponade presented with gradually reduced vision in her right eye over the past 4 years. Visual acuity (VA) was light perception in that eye. Physical examination showed a white intumescent cataract (Fig. 1**A**), and phacoemulsification with IOL insertion was planned.

Topical 10% phenylephrine was used to dilate the pupil, and topical 1% tetracaine was used as a local anaesthetic. A paracentesis was made in the superotemporal cornea, and trypan blue was used to stain the lens capsule for 15 seconds. The anterior chamber was filled with a dispersive ophthalmic viscosurgical device (OVD; Viscoat, Alcon, Geneva, Switzerland), and a clear corneal incision was made temporally with a keratome.

A 27-gauge needle was used to puncture the centre of the anterior lens capsule and aspirate cortical material to decompress the lens. An irrigation and aspiration hand piece was used to aspirate additional cortical material, and the anterior chamber was maintained with OVD. Trypan blue was reapplied for 40 seconds to further stain the lens capsule to improve visualization of the anterior lens capsule.

An anterior capsulotomy was attempted using the capsulorhexis forceps and cystotome (Fig. 1**B**). Capsulotomy scissors were also used to incise the anterior capsule. However, continuous curvilinear capsulorhexis (CCC) was unsuccessful because of the fibrotic capsule, which prevented it from tearing in a predictable manner. To avoid radial extension of the capsule, a 23-gauge anterior vitrectomy probe was subsequently introduced to create an anterior capsulotomy bimanually, with an irrigation probe introduced through the paracentesis to maintain the anterior chamber (Fig. 1**C**). The anterior vitrectomy settings used were a cut rate of 4000 cpm, intraocular pressure of 55 mm Hg, vacuum of 350 mm Hg, and aspiration flow rate of 12 mL/minute. The vitrector port was directed sideways, facing the capsule edges, to cut the edges and create a circular capsulotomy of 4 mm diameter (Fig. 1**D**). The cutting was performed with small bites to prevent radial extension of the capsulotomy. Additional dispersive OVD was introduced into the anterior chamber, and then phacoemulsification and irrigation and aspiration were used to aspirate the soft white lens (Fig. 1**E**).

The capsular bag was filled with OVD, and a one-piece monofocal IOL (Alcon Acrysof SA60AT) was inserted into the bag (Fig. 1**F**). The vitrector was used to smooth the edges of the capsulotomy, and residual OVD was removed from the capsular bag. Acetylcholine (Miochol-E, Novartis Pharmaceuticals, Cambridge, Mass.) was injected intracamerally, and both wounds were hydrated. No intraoperative complications occurred.

At the 1-day and 1-week postoperative appointments, VA improved to counting fingers at 1 foot from light perception preoperatively. The IOL was centred in the capsular bag, but dense posterior capsular opacification remained that could not be cleared completely during surgery because of the risk of posterior capsule rupture. No silicone oil was present in the anterior chamber. At the 1-month postoperative appointment, a neodymium:yttrium-aluminum-garnet (Nd:YAG) laser posterior capsulotomy was performed to remove the central posterior capsular opacification. After the capsulotomy, VA improved to counting fingers at 5 feet, which remained limited because of prior retinal detachment in this eye. No other postoperative complications were noted.

This report is the first to describe vitrectorhexis use for anterior capsulotomy in an adult with intumescent cataract. White cataracts can present challenges in cataract surgery because of the increased intralenticular pressure and changes to the lens capsule that may make it more friable, elastic, or dense. These properties can cause difficulties during capsulorhexis creation by increasing the risk for anterior capsule tears that extend peripherally.

In this case, despite improving visualization of the capsule with trypan blue and aspirating liquefied cortex, neither the forceps, cystotome, nor capsulotomy scissors provided adequately controlled tearing of the lens capsule. This may be

https://doi.org/10.1016/j.jcjo.2022.10.006
ISSN 0008-4182

Can J Ophthalmol Volume ■, Number ■, ■ 2022

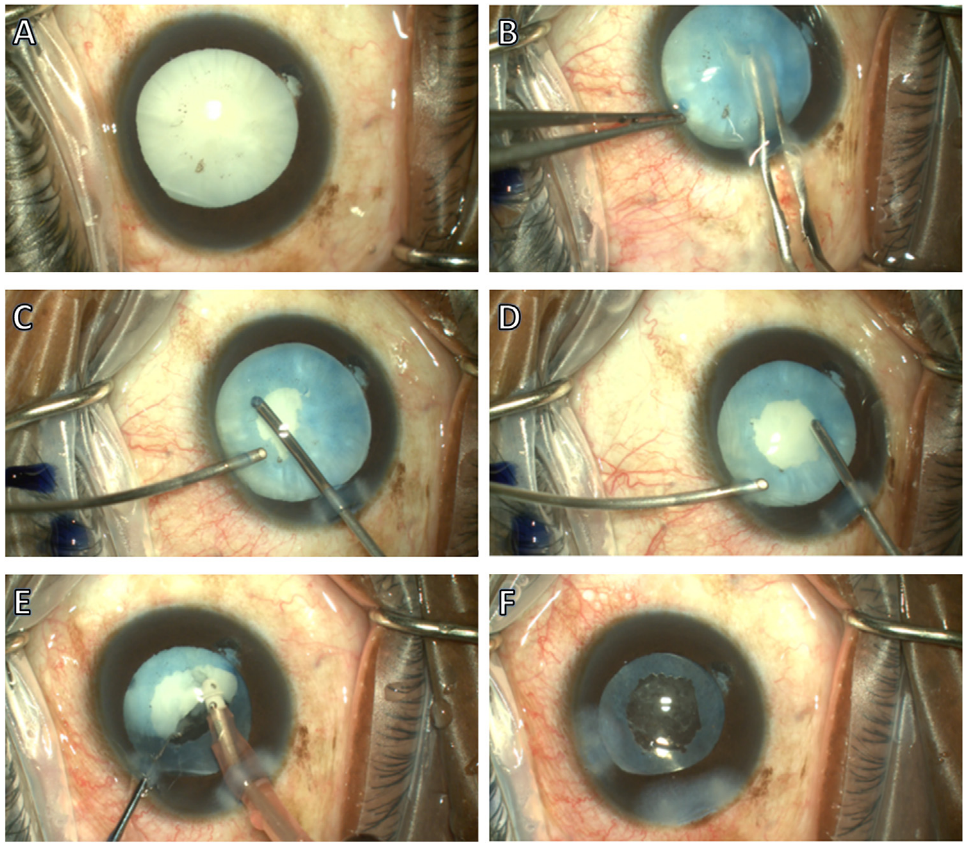

Fig. 1—Cataract surgery using the vitrectorhexis technique: (A) intumescent cataract at the beginning of surgery; (B) handling of the fibrotic lens capsule using capsulorhexis forceps; (C) creation of the anterior capsulotomy using the vitrectomy probe; (D) completion of the 4 mm capsulotomy; (E) irrigation and aspiration of the soft lens cortex and nucleus, assisted by chopper; (F) implanted one-piece intraocular lens in the capsular bag.

due to capsular changes that make it friable and weak. In these situations, using a vitrector may provide better control in creating a capsulotomy. Initial studies of this technique in children reported that it was possible to create curvilinear and continuous capsulotomies without radial tears.[3] The anterior-chamber pressure also can be maintained with OVD during the vitrectorhexis.

In pediatric cataract surgery, a vitrector also can be used for a primary posterior capsulotomy (PCC). Although this may have been helpful to remove the posterior capsule fibrosis during surgery, it was not attempted in this case because of the patient's history of vitrectomy and silicone oil tamponade. Although the silicone oil was removed in a prior surgery, we did not want any residual silicone oil to migrate into the capsular bag and anterior chamber intraoperatively. Furthermore, given the fibrosis and residual silicone oil, a posterior approach to PCC should be taken, which is best performed by a vitreoretinal surgeon. Additional considerations with performing a PCC in a nonvitrectomized eye include the risks of cystoid macular edema, vitreous prolapse, vitreous traction, and uncontrolled extension of the posterior capsulotomy.

One advantage of vitrectorhexis compared with phacocapsulotomy is that the anterior capsule tear is better controlled because the vitrectomy probe only cuts one side of the capsular opening at a time. Conversely, the phacocapsulotomy technique punctures a relatively larger hole in the anterior capsule, theoretically allowing a tear to begin from any edge around the hole and making it less predictable.[2] Additionally, the sudden force from directing the phaco probe downward or the vacuum pulling the lens upward could potentially cause zonular dehiscence.[2]

Despite the better control of vitrectorhexis compared with phacocapsulotomy, both techniques should be used with care because they can leave jagged edges that are not as stable as manual CCC edges and can lead to radial tears. However, with experience, consistent round capsulotomies can be created.

Although there are several approaches to address intumescent cataracts, particularly during capsulorhexis creation, we propose the vitrectorhexis as another safe and effective tool in the cataract surgeon's armamentarium when faced with a lens that does not respond to traditional capsulorhexis techniques.

Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jcjo.2022.10.006.

Bryan M. Wong,[*] Jason M. Kwok,[*,†] Sherif El-Defrawy,[*,†] Rosa Braga-Mele[*,†]
*University of Toronto, Toronto, ON; †Kensington Eye Institute, Toronto, ON.

Originally received Jul. 1, 2022. Final revision Sep. 9, 2022. Accepted Oct. 7, 2022.

Correspondence to:
Rosa Braga-Mele, MD; rbragamele@rogers.com.

References

1. Assia EI, Apple DJ, Barden A, Tsai JC, Castaneda VE, Hoggatt JS. An experimental study comparing various anterior capsulectomy techniques. Arch Ophthalmol 1991;109:642–7.
2. Teng CC. Phaco capsulotomy: a technique to prevent the Argentinean flag sign. Clin Ophthalmol 2017;11:1937–40.
3. Wilson ME, Bluestein EC, Wang XH, Apple DJ. Comparison of mechanized anterior capsulectomy and manual continuous capsulorhexis in pediatric eyes. J Cataract Refract Surg 1994;20:602–6.
4. Resch MD, Balogh A, Sándor GL, Géhl Z, Nagy ZZ. Vitrectorhexis in penetrating eye injuries in adults. Eur J Ophthalmol 2019;29:689–93.
5. Al-Haddad C, Khatib L. Vitrectorhexis and lens aspiration with posterior chamber intraocular lens implantation in spherophakia. J Cataract Refract Surg 2012;38:1123.

Footnotes and Disclosure

The authors have no proprietary or commercial interest in any materials discussed in this correspondence.