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ORIGINAL ARTICLE

A phacoemulsification chopping technique that attacks the posterior plate

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ABSTRACT

Objective

To describe a technique for nuclear fragmentation during phacoemulsification that addresses the tough posterior plate in 3+ to 4+ nuclear sclerosis.

Surgical Technique

The technique involves creating a central crater, flipping the nucleus out into the supracapsular space, and creating another crater through the posterior surface that will eventually connect with the anterior crater to produce a central hole. The donut-shaped nucleus is then chopped and the fragments are aspirated with greater ease.

Results

The technique was performed successfully in seven eyes of six patients with only minor problems. Phacoemulsification times were longer than usual because of the additional sculpting, but clinical results were not adversely affected.

Conclusion

For dense or hard cataracts for which the surgeon anticipates a tough posterior plate, this technique is a safe alternative to the usual chopping techniques.

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THE PREVALENCE of the brunescent cataract has always been higher in the Asia-Pacific region because of its closeness to the equator. In Manila, Philippines, 43% of cataracts are brunescent compared with 20% in Tampa, Florida and 9% in Rochester, New York.[1] This presents a challenge for the Asian surgeon.

The problem with the brunescent cataract is its thicker dimension. When chopping is done with a 1.5mm chopping tip, as with a Steinert chopper, only the superficial layers are split, leaving a posterior plate.[2]

Different techniques have been described to handle the brunescent cataract. There was a general shift from horizontal to vertical cutting conceptualized by Vladimir Pfeifer of Slovenia and further developed by David Dillman and Louis Nichamin.[2] Horizontal chopping, according to Dr. David Chang, creates a compressive force while vertical chopping creates a shearing force, forming sharp fracture lines like broken glass.[3] He recommended horizontal chopping for softer cataracts and vertical chopping for harder cataracts.

Newer techniques, such as Maloney's supracapsular flip[4] and Joo and Kim's bevel down technique[5] were developed in the late 1990s to better handle the brunescent cataract. None of the techniques illustrate how to specifically handle the posterior plate.

This paper describes a technique that attacks the posterior plate by combining crater formation with nuclear flipping, creating a donut and making subsequent chopping less difficult.

SURGICAL TECHNIQUE

The procedure was performed by 2 surgeons (MCDR and LGV) at a tertiary center on 7 eyes of 6 patients who had age-related cataracts with moderate to dense (2+ to 4+) nuclear sclerosis. Patients were 54 to 76 years old (average of 67); five were female and one was male. None of the patients had ocular problems other than the cataract, except one who had chorioretinal scars off the macula. The study conformed to the tenets of the Declaration of Helsinki. All participants signed an informed consent.

Table 1. **Settings for surgeon 1.**

Surgeon 1	Vacuum (mm Hg)	Power (%)	Pulses/sec
Sculpt	30	40	0
Segment Removal	270	25	20
Dual Linear Segment Removal	150	45	0

Table 2. **Settings for surgeon 2.**

Surgeon 2	Vacuum (mm Hg)	Power (%)	Pulses/sec
Sculpt	300	40	0
Segment Removal	300	50	10
Dual Linear Segment Removal	300	40	10

Patients were placed under general anesthesia (5 eyes) or local anesthesia (2 eyes). Two sideports were created, one either at 6 or 12 o'clock, and the other 120 degrees counterclockwise from the first sideport. When necessary, 0.1 ml tryphan blue (Blue Rhexis, Contact Care, Butsarat, India) was used to stain the anterior capsule. Sodium hyaluronate 3.0% chondroitin sulfate 4.0% (Viscoat, Alcon Laboratories, Fort Worth, TX, USA) was injected into the anterior chamber. A temporal clear corneal incision was made. A 5-6 mm continuous curvilinear capsulorhexis was created to make room for the nuclear flip (Figure 1). Hydrodissection and hydrodelineation were done with Balanced Salt Solution (BSS, Alcon Laboratories, Fort Worth, TX, USA).

The Storz Millennium (Bausch & Lomb, New York, NY, USA) was the phacoemulsification machine used. Settings are detailed in Tables 1 and 2. A well half the diameter of the capsulorhexis was made in the center, which was at least 1/2 to 3/4 the thickness of the center of the nucleus (Figure 2).

A Steinert chopper was inserted through the second sideport to hook the nucleus, inverting and landing it on the capsular bag or the supracapsular space (Figure 3). A spatula in the other side port aided in the flipping when necessary. Central sculpting was performed on the posterior plate (Figure 4) creating another well that eventually connected with the anterior well to form a central hole, causing the nucleus to assume a donut or ring shape (Figure 5). Vertical chopping was done either with the Steinert chopper and the phaco tip or with a Nagahara and a Steinert chopper. The nuclear fragments were emulsified at the iris plane.

Hydroxypropyl methyl cellulose 2% (Viscolon, Contact Care, Butsarat, India) was injected to inflate the capsular bag. The incision was extended to 5.1mm in 6 patients and a polymethylmetacrylate (PMMA) intraocular lens (IOL) with 5.25mm optic (Texel, Eagle Optics, Mumbai, India) was inserted. The clear corneal incision was not extended in 1 patient and a foldable hydrogel IOL (Hydroview 1.5, Bausch & Lomb, New York, NY, USA) with 6.0 mm optic and PMMA haptics was inserted. A final irrigation/aspiration was done, followed by reformation of the anterior chamber and a check for leaks. Postoperatively, patients were given topical antibiotic and steroid eye drops.

Data collected included preoperative visual acuity, nuclear sclerosis grading, phacoemulsification time, incidence of complications (zonulysis, posterior capsular tear, corneal edema), and one-week-postoperative visual acuity.

RESULTS

Average effective phaco time was 2:31 minutes. Five out of the seven eyes had visual acuity of 6/15 (20/30) or

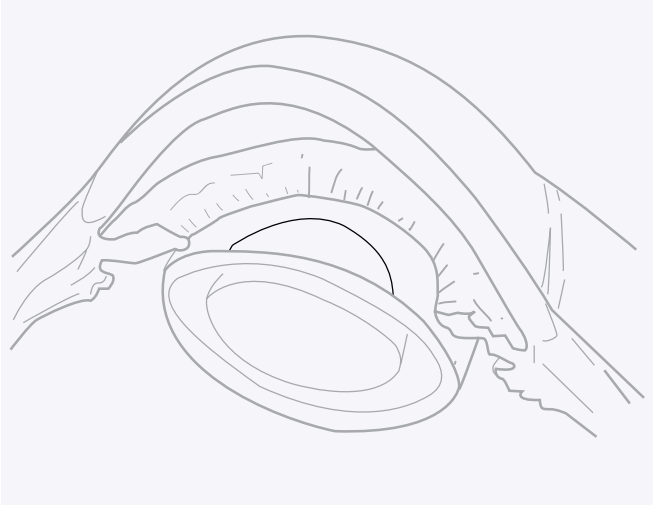

Figure 1. Creation of a 5-6 mm capsulorhexis.

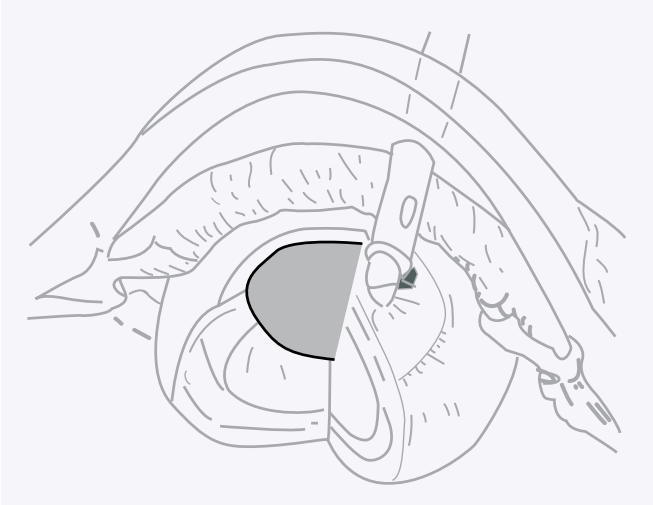

Figure 2. Central nuclear sculpting forming a crater 1/2 to 3/4 depth.

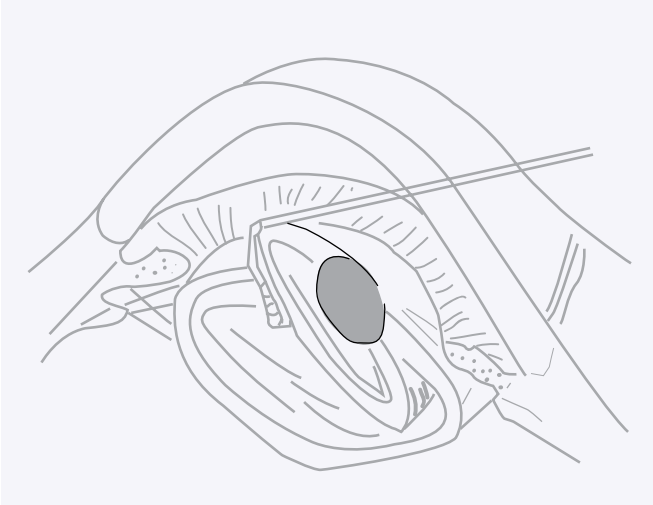

Figure 3. Nuclear flipping with a Steinert chopper.

better one week postoperatively. Two eyes of one patient had 1/4 to 1/2 quadrant zonulysis after the nuclear flip, and the IOL was inserted in the ciliary sulcus. Four eyes had transient corneal edema, which resolved within a week. None of the patients had posterior capsular tear or iris damage. One patient developed postoperative vitritis. Individual patient characteristics and results are detailed in Table 3.

DISCUSSION

The chopping technique combines crater formation with a nuclear flip, allowing the surgeon to sculpt the posterior plate. This makes vertical chopping less difficult by debulking the central nucleus.

Zonulysis and transient corneal edema were the two most common complications found with this technique. Two of the patients developed zonulysis during the flip,

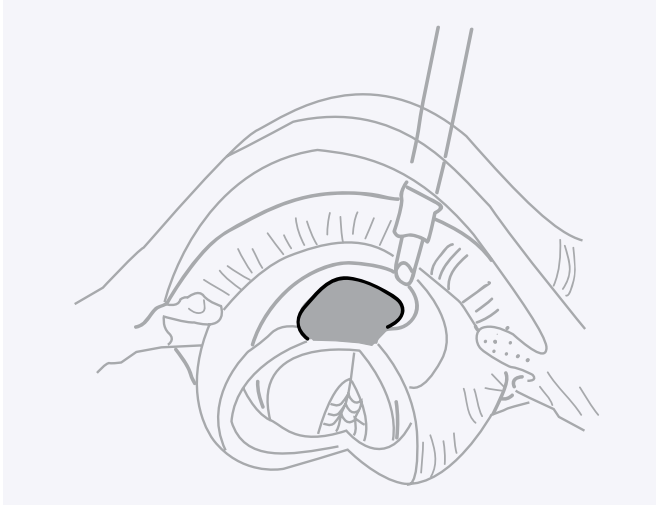

Figure 4. Sculpting of the posterior nucleus after flipping.

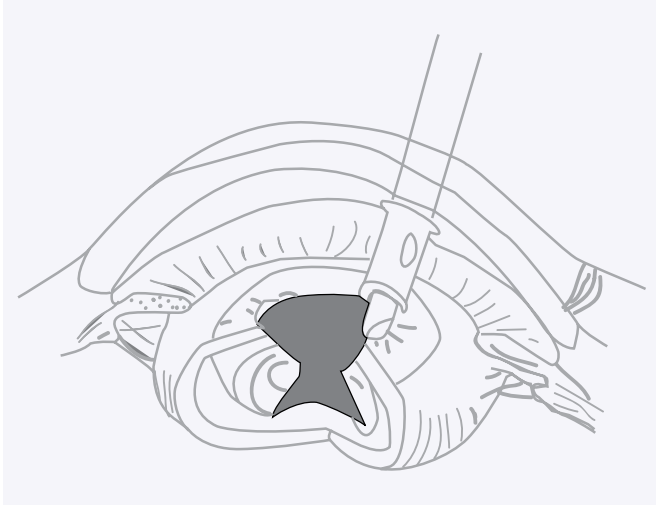

Figure 5. Formation of a donut.

Table 3. **Patient characteristics and results.**

Eye #	Age	Sex	Nuclear Sclerosis	Preop VA	Postop VA	Phaco Time	PC Rupture	Zonulysis	Corneal Edema	Others	Surgeon
1	76	F	2+	20/100	20/30	1:03	No	No	Yes		LGV
2	75	F	3+	20/50	20/50	0:48	No	No	No	Vitritis	LGV
3	62	M	4+	HM	20/30	6:10	No	Yes	Yes		MCDR
4	62	M	3+	HM	20/25	3:35	No	Yes	Yes		MCDR
5	54	F	2+	5/200	20/25	1:40	No	No	No		MCDR
6	73	F	3+	HM	20/70	2:09	No	No	Yes		MCDR
7	60	F	3+	HM	20/25	2:14	No	No	No		MCDR

which was attributed to the small capsulorhexis (5 mm) and the landing of the nucleus on the capsular bag after the flip instead of on the supracapsular space. Chopping in the supracapsular space places less stress on the ciliary zonules. Zonulysis occurred in the two eyes of one patient who may have had inherent zonular weakness. He also had the hardest cataract of all the eyes in this study.

There were 4 cases of transient corneal edema, which has been reported in previous studies as a more common complication of the supracapsular flip in the early part of the learning curve.[4] In all cases, the corneal edema resolved within one week.

The vitritis in one of the patients was a result of retained viscoelastic material during the procedure and not of the chopping technique itself. Vitritis has not been reported with the supracapsular flip or with the crater-and-chop technique.

Phacoemulsification time was rather long because of the sculpting required to form the central hole. Thus, we do not recommend this technique for softer cataracts.

We did not experience other complications of the nuclear flip like iris damage in suboptimally dilated pupils and IOL decentration because of the large capsulorhexis reported in other studies.[4, 6]

This technique is suited for cataracts with 3+ and 4+ nuclear sclerosis, where a posterior plate would cause a problem for the surgeon. We do not recommend it for less than 3+ nuclear sclerosis because of the added phacoemulsification time required for sculpting the plate. The technique should be done with a large capsulorhexis and in the supracapsular space to avoid zonulysis.

Subsequent studies to evaluate the technique should include the measurement of endothelial cell loss, which is said to be higher in a supracapsular nuclear flip than with other chopping techniques. This technique may also be compared with the crater-and-chop or quick-chop technique for harder cataracts with regard to complication rates, particularly posterior capsular tear and zonulysis, in a randomized trial.

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