CATARACT SURGERY IN CHALLENGING CASES

Choosing the miLOOP for safe and effective energy-free fragmentation of a brunescent lens

By Matthias Bolz, MD

CASE HISTORY

A 71-year-old female presented with bilateral cataracts. The right eye had a brunescent cataract and decimal BCVA was 0.1 (Figure 1). The fellow eye had a cataracta provecta and decimal BCVA was 0.87.

Cataract surgery was scheduled for the eye with the brunescent cataract followed 1 week later by surgery for the fellow eye. The first eye procedure was performed using the miLOOP (Carl Zeiss Meditec AG) to divide the lens into four quadrants followed by phacoemulsification of the lens and irrigation/aspiration.

Lens removal was completed without any complications. Phacoemulsification time was 7 seconds. A single-piece C-loop haptic monofocal IOL was implanted. The patient was prescribed standard postoperative medication with a topical corticosteroid, antibiotic and nonsteroidal anti-inflammatory drug along with hyperosmolar eye drops as a precaution to minimize corneal edema.

At examination on postoperative day 2, the cornea had minimal Descemets folds (Figure 1), which were attributable to the increased ultrasound energy needed for phacoemulsification of a dense brunescent lens but less than expected if a phaco chop technique was used for lens fragmentation. Refraction was +1.00 sph -1.50 cyl @ 95°, and BCVA was 0.4.

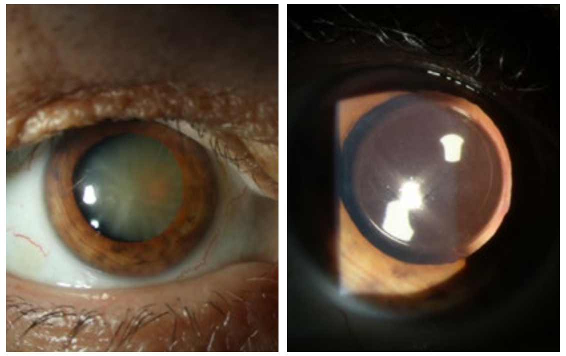

Fig. 1. Images of the right eye preoperatively with a brunescent cataract and from postoperative day 2.

When the patient returned at day 7 after surgery, Descemets folds had resolved and BCVA had improved to 0.5. Because of the fast visual recovery, the patient was able to undergo the second eye surgery as planned.

DISCUSSION

Patients with a brunescent cataract are not commonly encountered outside of underdeveloped countries. When these cases present, they can pose a challenge for even the most experienced cataract surgeons.

Greater phacoemulsification energy is needed to divide and remove the dense nucleus of a brunescent cataract, and surgery time can be prolonged. Consequently, these cases are at risk for increased corneal endothelial damage, corneal edema, wound burn, capsular tears and postoperative inflammation that together can contribute to delayed visual recovery and long-term corneal endothelial cell loss.[1,2]

For the past 12 months, I have been using the miLOOP for energy-free disassembly of the nucleus in eyes with a brunescent cataract. Consistent with results of published prospective and retrospective studies,[3,4] my experience shows that using the miLOOP minimizes ultrasound energy usage. I have observed less corneal edema after using the miLOOP in cases of brunescent cataract that is associated with faster visual recovery and allows me to shorten the interval to the fellow eye surgery.

Using the miLOOP

The miLOOP is a manually operated, penlike, single-use instrument for endocapsular lens fragmentation that can be implemented regardless of cataract density. It is introduced through a corneal incision ≥2 mm and features a thin, super elastic, pre-shaped, nitinol filament that ensnares and transects the nucleus.

The miLOOP is operated with one hand and is easy and intuitive to use (Figure 2, see video). After inserting the tip of the device into the anterior chamber, the surgeon expands the nitinol filament by pushing forward on the handpiece's actuator button and then sweeps the filament along the hydrodissection plane beneath the capsule to surround the nucleus. To bisect the nucleus, the surgeon retracts the actuator button, causing the filament to constrict to a radius of <2.5 mm.

In cases of brunescent cataracts, I use the miLOOP to fragment the nucleus into four quadrants. To make the second cut, I rotate the nucleus after expanding the filament and then repeat the constriction. The miLOOP performs consistently with the repeated maneuver thanks to the material's pre-shapingand cutting characteristics. In contrast to cases where phaco chop is used for nuclear disassembly in eyes with brunescent cataracts, I have not found it necessary when using the miLOOP to instill additional viscoelastic between serial transections of the nucleus.

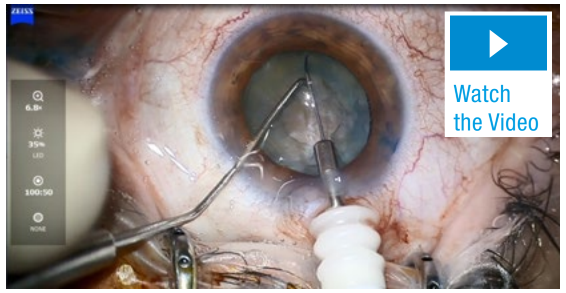

Fig. 2. Fragmentation of a brunescent lens using the miLOOP

Advantages of the miLOOP

During expansion, the miLOOP's filament glides beneath the capsular bag without exerting any outward forces because its flexible material contours to the shape of the capsular bag. When contracted, the miLOOP filament cuts completely through the fibrotic posterior nuclear plate of a brunescent lens. Because the force used to divide the lens is applied in an out-to-in direction, lens disassembly with the miLOOP minimizes stress on the capsular bag and zonules that are often weak in eyes with a brunescent cataract.

In contrast, use of a phaco chop technique to dissect a brunescent lens is associated with centrifugally directed (outward) instrument forces that can cause stress on the zonules and the capsular bag.[3] Furthermore, nuclear segments created with phaco chop may be held together at the posterior surface by tough elastic strands.[5] In this situation, it can be difficult to pull the nuclear fragments anteriorly where they can be safely emulsified and aspirated.[5]

Published reports describe benefits of using the miLOOP in eyes with dense cataracts. Authors of a prospective study randomizing 101 eyes with grade 3-4+ nuclear cataracts to phacoemulsification alone or with the miLOOP for nuclear disassembly reported statistically significant reductions in both ultrasound usage as measured by cumulative dissipated energy and irrigation fluid volume in the miLOOP group.[3]
Similarly, investigators of a recently published retrospective study reviewing outcomes of a consecutive series of 212 eyes that underwent routine cataract surgery reported that average phaco time and average irrigation/aspiration time were both significantly lower in miLOOP versus non-miLOOP cases.[4]

Some surgeons advocate using a femtosecond laser as an ultrasound-free technique to soften and divide the nucleus in eyes with a brunescent cataract.[6] However, the laser also cannot fully transect the nucleus because it must be programmed to leave a peripheral margin of untreated lens material as a safety zone to avoid capsular damage. In addition, the laser cannot be used in eyes with small pupils or certain anatomic configurations. Furthermore, it is much more expensive than the miLOOP, can decrease surgical efficiency, and depends on electrical power.

Additional considerations

My learning curve for the miLOOP was minimal. After using it initially in routine cases to gain familiarity with its operation, I felt comfortable using the miLOOP in eyes with a dense cataract.
I recommend that the miLOOP should not be used in eyes known to have a capsular tear. In addition, I would hesitate to use it in a highly hyperopic eye with a very shallow anterior chamber in which there may not be adequate space for manipulating the miLOOP.

Because the miLOOP is designed to minimize zonular stress, future research may investigate if the device could be an attractive option to use for lens fragmentation in eyes with zonulopathy from causes other than a brunescent lens. Increased ultrasound energy, aspiration time, and irrigation fluid volume are associated with increased endothelial cell loss.[7] Since these parameters are reduced with miLOOP,[3,4] it would also be interesting to investigate whether use of this device has a benefit on endothelial cell loss, particularly in eyes with compromised corneas.

CONCLUSION

As a relatively low cost, manually operated, disposable device that can effectively fragment any grade cataract, the miLOOP may be viewed as particularly attractive for use by surgeons in areas of the world where dense cataracts are common. Although I see just one or two patients a month with a brunescent cataract, I still consider the miLOOP a valuable addition to my arsenal of surgical tools because of the advantages it has provided in these challenging cases.

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References
1. Chang DF. Ten strategies for the rock-hard nucleus. EyeNet Magazine. aao.org/eyenet/article/ten-strategies-rock-hard nucleus.
2. Lundberg B, Jonsson M, Behndig A. Postoperative corneal swelling correlates strongly to corneal endothelial cell loss after phacoemulsification cataract surgery. Am J Ophthalmol. 2005;139(6):1035-1041
3. Ianchulev T, Chang DF, Koo E, et al. Microinterventional endocapsular nucleus disassembly: novel technique and results of first-in-human randomised controlled study. Br J Ophthalmol. 2019;103(2):176-180.
4. Wiley WF, Shamik Bafna, Hercules D Logothetis. Comparative study of phacoemulsification parameters with and without nitinol filament nuclear disassembly. J Cataract Refract Surg. 2021 Jan 18. doi: 10.1097/j.jcrs.0000000000000575. Epub ahead of print.
5. Steinert RF, Chu RY. Dense cataract. Cataract & Refractive Surgery Today. April 2010. 74-77
6. Hatch KM, Schultz T, Talamo JH, Dick HB. Femtosecond laser-assisted compared with standard cataract surgery for removal of advanced cataracts. J Cataract Refract Surg. 2015;41(9):1833-1838.
7. Mahdy MA, Eid MZ, Mohammed MA, Hafez A, Bhatia J. Relationship between endothelial cell loss and microcoaxial phacoemulsification parameters in noncomplicated cataract surgery. Clin Ophthalmol. 2012;6:503-510.