Commentary: Managing rock hard cataracts

Successful removal of a hard cataract is accomplished by careful history taking, complete physical examination, the surgical technique chosen, incision creation, good capsulorhexis, hydrodissection, pupil management, nucleus dismantling, and power modulation. Several surgical techniques can be considered for the removal of a hard cataract, including intracapsular cataract surgery, extracapsular cataract surgery, small incision cataract surgery, phacoemulsification, femtosecond laser-assisted cataract surgery (FLACS), and the recently introduced miLOOP.

Although considered as the gold standard, phacoemulsification in a hard nucleus is tough despite developments in technology and the availability of a variety of viscoelastics. Even the most experienced surgeons worldwide encounter capsular-zonular problems, corneal edema, wound burn, and postoperative inflammations. The first and foremost reason is that the lens fibers are totally adherent, making chopping very difficult. Second, there is very little cushion or no cortical cushion between the lens and the capsule. Most important is the technique, or the right and effective strategy to deal with these types of cataracts, which can result in gratifying results.

The earliest technique to tackle these rock-hard cataracts was classically described as the crater-and-chop technique by Vanathi *et al*.[1] in 2001. This involved making a large 6-mm crater by sculpting up to 90% of the nuclear thickness and leaving the outer rim intact. This was followed by the formation of multiple small wedges under high vacuum and emulsifying these in the crater, which is within the bag. Modification of this original crater technique was described a decade later by Aslan *et al*.[2] In this technique, following the creation of a small 3-mm crater, a nucleus splitter is inserted along with the phaco tip in the crater. The splitter is moved from the periphery toward the tip horizontally to split the nucleus. Compared with the original technique, the creation of a small crater allows a deeper and efficient hold, which may result in a successful split.

Another technique for nuclear disassembly of a hard cataract is the drill-and-crack technique.[3] In this, a deep hole is drilled in the central nucleus with a phaco tip and a prechopper is used to divide or crack the nucleus. This is similar to dynamite being placed in a hole. It requires a special instrument known as the Akahoshi prechopper, which opens like a tong and helps to separate the nucleus. According to the authors, this technique does not have a steep learning curve, can be done in a small pupil, and can even be used if the phaco-cop technique fails in a hard nucleus because the phaco-tip drilled hole can be reused in the drill-and-crack technique. Vasavada *et al*.[4] described a technique of multilevel chop in dense leathery cataracts, where after the phaco tip is inserted in the nucleus, a vertical element of the chopper is depressed posteriorly in the lens fibers, keeping it near the tip. This initiates a partial crack. Phaco tip is inserted again, and the process is repeated at a deeper plane. Thus, this involves occluding and positioning the chopper at two or more levels to achieve complete division of black cataracts.

Tilt and crack is another reported surgical technique where the lens is impaled with the phaco-tip and the distal pole is tilted up out of the capsular bag.[5] This gives space to access the posterior leathery plate so that it can be easily chopped. The capsulorhexis size can be varied (made larger: 6 or 7 mm) to decrease the zonular stress.

Although different techniques have been described, yet there are only few comparative studies reporting the efficacy of one technique over the other. In a comparative study (prospective randomized trial) comparing outcomes of cataract surgery performed with phaco-chop, divide-and-conquer, and stop-and-chop techniques,[6] it was found that for eyes with hard cataract, the phaco-chop technique can be more effective for lens removal and causes the least endothelial damage than the other two techniques. In the study by…,[7] the clinical outcomes of endonucleation chop versus conventional Crater techniques in hard cataracts were compared. This modification of the conventional crater technique involves the disengagement of the central core of the nucleus from the epinuclear shell by giving multiple peripheral chops. It was observed that the new technique significantly reduces effective phaco time, the amount of balanced salt solution used, and endothelial cell loss.

Another new technique is "terminal chop,"[8] which utilizes a specially designed chopper called the "terminator" to exert a mechanical force to form a crack at the weakest and the thinnest equator. This traverses through the center and to the equator on the other side. Compared with the conventional crater chop technique, the endonucleation chop technique for phacoemulsification of hard nuclear cataracts conserves phacoemulsification energy and minimizes exposure to an intraocular irrigating solution, provides a significant reduction in corneal endothelial damage, and leads to faster visual rehabilitation.

Various advancements and ongoing surgical techniques are evolving that are easy to learn and which cause minimal damage to the endothelium as well as protect the posterior capsule at the same time. One of them is femtosecond laser-assisted cataract surgery. The major advantage is the potential to decrease intraocular phaco energy times, save the endothelium, decrease the zonular stress, and tackle astigmatism with accurate incisions.[9] The only limitation is the optical penetration of the laser through very hard leathery cataracts.

Another device to deal with the rocky hard nucleus is the miLOOP. It is a manual micro-interventional endocapsular disassembly technique that uses a disposable microfilament made of nickel and titanium (Nitinol) ring that can open to a 10.5-mm radius and then can be contracted to a 1.5-mm radius. A prospective interventional controlled trial of 101 subjects with grade 3-4 cataracts was randomized to torsional phaco alone or torsional phaco with miLOOP.[10] Micro-interventional endocapsular fragmentation with the manual, disposable miLOOP achieved consistent, ultrasound-free, full-thickness nucleus disassembly and significantly improved the overall phaco efficiency in such advanced cataracts. Although there exists little literature to date, miLOOP is a promising technology for people living in the developing world who have limited access to healthcare resources.

In conclusion, phacoemulsification in hard cataracts is challenging, and the best technique for a phaco-surgeon is

the right balance of the ease of performing surgery as well as the repeatability of the procedure. A comparative trial with a long follow-up is necessary to establish the superiority of the surgical technique.

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References

1. Vanathi M, Vajpayee RB, Tandon R, Tityal JS, Gupta V. Crater-and-chop technique for phacoemulsification of hard cataracts. J Cataract Refract Surg 2001;27:659-61.
2. Aslan BS, Muftuoglu O, Gayretli D. Crater-and-split technique for phacoemulsification: Modification of the crater-and-chop technique. J Cataract Refract Surg 2012;38:1526-30.
3. Hwang HS, Kim EC, Kim MS. Drill-and-crack technique for nuclear disassembly of hard nucleus. J Cataract Refract Surg 2010;36:1627-30.
4. Vasavada AR, Raj SM. Multilevel chop technique. J Cataract Refract Surg 2011;37:2092-4.
5. Cakir H, Utine CA. Lift and crack technique for risky cataract cases. J Catract Refract Surg 2010;36:539-41.
6. Park J, Yum H, Kim MS, Harrison AR, Kim EC. Comparison of phaco-chop, divide and conquer, and stop and chop techniques in microincision coaxial cataract surgery. J Cataract Refract Surg 2013;39:1463-9.
7. Upadhyay S, Sharma P, Chouhan JK, Goyal R. Comparative evaluation of modified crater (endonucleation) chop and conventional crater chop techniques during phacoemulsification of hard nuclear cataracts: A randomized study. Indian J Ophthalmol 2022;70:794-8.
8. Prasad R, Badhani A, Dogra GB. Terminal chop: New technique for full thickness nuclear segmentation in mature hard cataract. Indian J Ophthalmol 2017;65:1414-8.
9. Chen X, Yu Y, Zhu Y, Wang W, Yao K. Clinical outcomes of femtosecond laser-assisted cataract surgery versus conventional phacoemulsification surgery for hard nuclear cataracts. J Cataract Refract Surg 2017;43:486-91.
10. Ianchulev T, Chang DF, Koo E, Mac Donald S, Calvo E, Tyson FT, *et al*. Microinterventional endocapsular nucleus disassembly: Novel technique and results of first-in-human randomised controlled study. Br J Ophthalmol 2019;103:176-80.

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