Lift-and-Crack Technique Increases Safety in Dense Cataracts

Maneuver avoids additional risk in eyes with incomplete capsulorrhexis or zonular weakness.

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Cataract chopping techniques, developed for safe and fast removal of dense cataracts, allow easier mechanical nucleus separation and reduce intraocular tissue damage by using less ultrasonic power. Such procedures include the phaco-chop and the stop-and-chop techniques.1,2

Here, we present a modified nonsculpting technique for grade 3 to 4 dense cataracts. This lift-and-crack technique, which uses minimal ultrasound energy and applies minimal stress to the capsular bag and the zonules, is particularly useful in the presence of an incomplete capsulorrhexis and/or zonular weakness in less than two quadrants.

SURGICAL TECHNIQUE

Under local or topical anesthesia, a temporal self-sealing clear corneal incision is created with a 2.8-mm diamond knife, and a sideport is made with a microvitreoretinal blade 30° to 45° degrees from the main incision (preferably 30° because the chopping maneuver will be easier to manipulate). Trypan blue dye is applied under air in the anterior chamber to stain the anterior capsule. In all cases, a large anterior capsulorrhexis (6–7 mm diameter) is attempted.

High intralenticular pressure in eyes with dense cataract frequently leads to peripheral extension of the capsular tear and an incomplete capsulorrhexis. Therefore, we make use of the advantages of the soft-shell technique, initially applying a dispersive ophthalmic viscosurgical device (OVD) such as Viscoat (Alcon Laboratories, Inc., Fort Worth, Texas) to protect the endothelium. Afterward, a cohesive OVD such as Provisc (Alcon Laboratories, Inc.) is introduced into the anterior chamber to prevent collapse and to avoid an errant radial capsular tear.

The phaco tip is used to grasp the nucleus centrally with high vacuum (approximately 350 mm Hg), and the nucleus is elevated with a tilt so that it protrudes outside the capsular bag distally. Then the chopper is used to segment the nucleus centripetally, with a maneuver that starts from the lens equator (or just behind) and uses the vector forces efficiently to cleave the nucleus without applying additional stress to the capsular bag or the zonules (Figures 1 and 2).

Figure 1. (A) The nucleus is lifted centrally and tilted up distally. (B) The chopper is initially placed at the lens equator, and (C) the horizontal chopping maneuver proceeds centripetally.
The nucleus is then cleaved and segmented into smaller triangular sectoral pieces, which are emulsified with the following parameters: 250 to 400 mm Hg vacuum, 30 mL/min aspiration flow rate, and 120 mm infusion bottle height. Phacoemulsification power is titrated according to the density of the nucleus, generally ranging from 25% to 60%. The I/A tip is used to clean any residual cortical material, and the IOL is implanted in the bag or in the sulcus, with proper positioning of the haptics perpendicular to the axis of the capsular defect or tear.

**DISCUSSION**

Chopping techniques achieve fast and safe cracking of the nucleus. Several unique characteristics of our lift-and-crack technique are favorable in grade 3 to 4 dense cataracts, particularly in the presence of an incomplete capsulorrhexis and/or zonular weakness. Lifting the distal nucleus is beneficial because it brings the nucleus through the anterior capsular opening and partially out of the capsular bag, so that chopping and phacoemulsification are performed at the pupillary plane. High vacuum is applied to the central nucleus, preventing transmission of stress to the zonules in the presence of a large anterior capsulorrhexis. In techniques in which the whole lens is prolapsed into the anterior chamber, excessive tilt of the nucleus may lead it to skim over the corneal endothelium in eyes with a shallow anterior chamber. But with manipulations performed in the pupillary plane, as in our technique, the capsular bag and zonules are protected from excessive stress, and the corneal endothelium is spared the deleterious effects of phacoemulsification power.

In conventional phacoemulsification techniques such as divide-and-conquer and phaco-chop, significant ultrasound energy is required for segmentation and complete removal of dense nuclei. After a central groove is created, in situ forceful outward separation of the large, hard nucleus may transmit excessive stress to the capsular bag and zonules. This stress increases with further maneuvers to divide the nucleus into smaller pieces due to inadequate space in the bag. Additionally, such maneuvers frequently remain inefficient for cracking. Proceeding to phacoemulsification after incomplete separation of nuclear pieces may lead to greater risk of decreased capsular and zonular integrity. Increased stress on the capsule may eventually lead to posterior capsular rupture or zonular dehiscence, particularly in eyes with an incomplete capsulorrhexis due to peripheral extension of the tear or zonular weakness.

In the lift-and-crack technique, the positioning of and distance between the chopper and the phaco tip maximizes the efficiency of the vector forces when the chopper is moved centrally to cleave the nucleus into two segments. Therefore, unsuccessful cracking attempts are unlikely. This horizontal chopping technique also removes the need for

**TAKE-HOME MESSAGE**

- The lift-and-crack technique uses minimal ultrasound and applies minimal stress to the capsular bag.
- This technique is favorable in grade 3 to 4 cataracts, especially in the presence of an incomplete capsulorrhexis or zonular weakness.
- Chopping and phaco are performed at the pupillary plane.
grooving the central nucleus and decreases use of phacoemulsification power considerably. Additionally, the chopper does not pass beneath the nucleus, unlike in peripheral chopping techniques where the chopper may slide over the nuclear surface with any tilt of the nucleus, risking posterior capsular integrity. In our technique, the surgeon can continuously observe the tip of the chopper, increasing the safety of the capsular bag.

The tilt-and-chop technique uses a similar method of chopping. The distal edge of the nucleus is tilted from the capsular bag by digging the phaco tip into the nucleus, proximal to its center, and pushing posteriorly. The chopper is then placed around the lens equator or behind the nucleus, and a horizontal chop is performed. In our opinion, the maneuver of depressing one edge of the nucleus to elevate the other may further stress the capsule and the zonules. However, when the nucleus is grasped centrally and lifted up with high vacuum, the only force applied during chopping will be toward the center of the phaco tip.

CONCLUSION

The lift-and-crack technique we present is a modification based on recent trends in chopping. It seems to be particularly useful in eyes with dense cataracts, especially in the presence of an incomplete capsulorrhexis or zonular weakness. The technique has allowed us to perform phacoemulsification in such usually risky cataract cases with minimal risk to the capsular bag, the zonules, and the endothelium. We have enjoyed successful outcomes in challenging cases that other cataract surgeons were hesitant to undertake.

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