Half-Moon Supracapsular Nucleofractis Phaco

We also recommend using this technique with biaxial microincision cataract surgery in hard and soft cataracts.

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Half-moon supracapsular phacoemulsification (HMSP) is a recent cataract surgery technique. First, the nucleus is split supracapsularly; second, quadrant removal is accomplished endocapsularly.[1] This technique is a derivative of two other phaco methods: Nagahara's horizontal chopping[2] and Maloney's supracapsular phaco.[3] It also closely parallels Pandit and Oetting's pop and chop technique.[4] The aim of HMSP is to maintain the advantages of the techniques and avoid their disadvantages.

The first part of HMSP is based on hydroprocedure and hydrodelineation. Because fluid is captured between the posterior capsule and nucleus, the anterior-pushing effect makes the distal part of the nucleus prolapse out of the capsulorrhexis rim during hydrodissection. At this stage, its appearance resembles a half moon. Afterward, horizontal chopping is performed under direct visualization of the anterior chamber, starting from the area of the prolapse. Once split, the heminuclei are replaced in the bag, and emulsification is continued within the capsular bag.[1] Details of the technique are shown in Table 1 and Figure 1.

CHOPPING TECHNIQUES

Nucleotomy and phacoemulsification techniques have gradually improved, thus reducing energy; shortening operation time; and making the operation more effective, safe, and functional.[5,6]

Stop and chop. Currently, one of the most popular phacoemulsification techniques is Koch's stop and chop,[7] which uses only manual energy generated by the chopper after the first sculpting phase. As a result, ultrasound energy diminishes. Koch's technique has higher efficacy versus previous methods, such as chip and flip and divide and conquer.

Horizontal chopping. In Nagahara's horizontal chopping technique,[2] the nucleus is divided in half within the capsular bag. Because no groove is sculpted with ultrasound power, horizontal chopping not only reduces energy but also lowers zonular stress by avoiding use of centripetal forces. Nagahara's technique has, therefore, more advantages than stop and chop in terms of safety and efficacy.[8] However, horizontal chopping has two main disadvantages. Use of the chopper behind the iris may damage the zonules and posterior capsule because the surgeon cannot see peripherally. This technique also has a long learning curve.

TAKE-HOME MESSAGE

- Like other supracapsular phaco techniques, nuclear splitting and quadrant removal is performed in the anterior chamber during half-moon spuracapsular phaco.
- HMSC phaco has a short learning curve and increases efficacy and safety.
- Distal pieces of the heminuclei remain outside the capsule, and rotation facilitates phaco.

Vertical chop and prechop. Pfiefer[2] and Fukasaku,[9] with their vertical chop technique, and Akahoski,[10] with his prechop technique, tried to solve the problems associated with other phacoemulsification techniques. Both are performed without entering the periphery; however, these methods face some challenges when performed in soft nuclei. Additionally, there is risk of posterior capsule rupture.

Supracapsular. Another group of phaco strategies, presumably developed to simplify phacoemulsification, is supracapsular techniques, including Brown's phaco flip,[5] Maloney's supracapsular,[3] Davis and Lindstrom's tilt and tumble,[11] and Pandit and Oetting's pop and chop.[4] The common feature of these techniques is that splitting and quadrant removal are mostly performed in the anterior chamber. The only disadvantage of these effective and facilitative phaco techniques is more corneal endothelial cell sacrifice, possibly due to working in close proximity to the endothelium.

HALF-MOON TECHNIQUE

When studying the HMSC technique, we considered the pros and cons of supracapsular phaco. This half-moon technique has a short learning curve, with partial prolapse

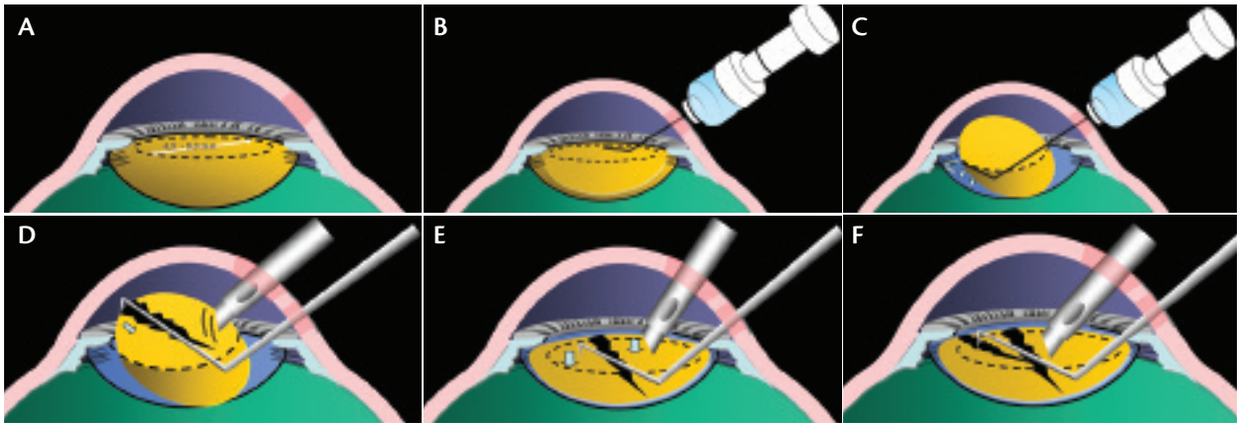

Figure 1. (A) The capsulorrhexis is ideally 4.5 to 5 mm. (B) Hydrodelineation. (C) Prolapse of the distal endonucleus pole through the capsulorrhexis opening, resembling a half moon. (D) Horizontal chopping of the partially prolapsed endonucleus.

occurring during the nucleus stage. Chopping is performed under direct visualization, without any risk of capsular and zonular damage. Therefore, the procedure may be proposed to surgeons without any chopping experience. As in Nagahara's technique, centripetal forces decrease the amount of stress to the zonules. Additionally, because the nucleus is partially kept outside of the capsule, no pressure occurs on the capsule itself.

The HMSC technique increases efficacy and safety of phacoemulsification, especially in patients with a high risk of zonular or capsular failure, such as those with high myopia, pseudoexfoliation, glaucoma or previous glaucoma surgery, and traumatic cataract. After dividing the nucleus, replacement of the heminuclei in the capsular bag transforms the procedure to standard endocapsular phacoemulsification, allowing the surgeon to safely work far enough from the corneal endothelium.

Similar endocapsular chopping techniques that split the nucleus within the bag, such as Nagahara's horizontal chopping, may cause some of the chopped nucleus to interlock—much like a jigsaw puzzle—within the capsule. This makes the operation difficult. With HMSC, after partial pro-

TABLE 1. STAGES OF THE TECHNIQUE

Anesthesia	**Topical**
The main incision	1.4 mm (biaxial), 2.2 mm (microcoaxial), and 2.3 mm or more (standard coaxial)
Side incision	20-gauge (1.4 mm) for all approaches
Capsulorrhexis	Ideally 4.5 to 5 mm. If it is wider, the prolapse of the nucleus will be harder. If it is smaller, capsular block may occur.
Hydroprocedure	It is performed with a 27-gauge needle with a flat cannula. Removing viscoelastic from the incision would reduce the risk of capsular blockage and iris prolapse.
Hydrodelineation	It facilitates the prolapse but it is not an absolute necessity.
Hydrodissection	A continuous fluid wave is injected until the distal part of the nucleus is prolapsed through the capsulorrhexis rim anteriorly. Only the distal part of the nucleus is let to prolapse, leaving the other parts in the bag. The image in that stage resembles a half-moon.
Chopping	After burying the phaco tip in the nucleus, the nucleus is chopped under direct visualization, beginning from the prolapsed pole with a chopper inserted from the sideport. A small wedge can be removed afterward, which will ease the latter phacoemulsification procedure.
Replacing the heminuclei into the capsular bag	The heminuclei are placed back in the bag easily with the help of the chopper, phaco tip, or flow of infusion.
Endocapsular phacoemulsification	Phacoemulsification is performed by standard chopping technique in the bag (safe and away from corneal endothelium).

lapse and division of the nucleus, distal parts of the heminuclei remain outside the capsule. Therefore, removing a small wedge to create more space will allow further movement inside the capsular bag. In this stage, rotating the heminuclei will facilitate completion of phacoemulsification.

COMPARISON

We recently compared the HMSC and stop and chop techniques[1] and concluded that HMSC was more effective (ie, shorter and more effective phaco time) and similar to stop and chop in functionality and safety. The only disadvantage of HMSC compared with techniques that use manual energy to crack the nucleus in the bag is that the nucleus partially prolapses into the anterior chamber. Thus, chopping begins in the anterior chamber. Although HMSC caused an increased central corneal thickness on the first postoperative day, it was statistically insignificant.

The HMSC technique, with the advantages mentioned in this article, may be performed easily in both hard and soft cataracts. We also recommend this technique for biaxial microincision cataract surgery. ■

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