

Stop and Flip: A Simple and Safe Phacoemulsification Technique

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Abstract: We introduce a simple, easy to learn, fast and safe technique to facilitate nucleus management in patients with zonular weakening in uncomplicated cases. The surgery begins with a temporal 3.2 mm clear corneal incision under topical anesthesia. Two side-port incisions are made on the inferior and superior sides. Anterior continuous curvilinear 5–6 mm diameter capsulorhexis and hydrodissection are performed to loosen capsule cortical attachments. The nucleus is not rotated, and an appropriated groove (80–90% depth) is sculpted using phaco machine. The groove is cracked into two hemispheres; lateral pressure and a side port manipulator. Then, 15–30 degree phaco tip is introduced and embedded into one hemisphere of nucleus beside the capsulorhexis edge at temporal or nasal part. After complete removal of the first hemisphere, the second is flipped again from bag into iris plane and phacoemulsified in the same manner.

Keywords: phacoemulsification, pseudoexfoliation syndrome

Introduction

Pseudoexfoliation (PEX) syndrome is a warning for cataract surgeons because of the increased weakness of zonular apparatus, reduced pupillary dilatation and increased incidence of bullous keratopathy.^{1,2} Several adjunctive devices have been designed to support the weak zonules and, therefore, to lessen the rate of surgical complications in PEX patients.³ Capsular tensions rings (CTRs) might help the surgeon more evenly distribute forces exerted on the zonules,⁴ however, they are best used when the nucleus is removed.⁵ It is clear that to accomplish uneventful phacoemulsification in a patient with PEX syndrome, exerting minimal stress to zonular complex is mandatory. In fact, nuclear manipulations are hazardous and carry a major risk for stressing the lens zonules when manipulating the nucleus in these patients.⁶ Some phacoemulsification techniques have been described to achieve minimal zonule stress in patients with the weak zonular complex including endocapsular deep-wedge-removal phacofracture, in situ nuclear disassembly and cross chop.^{7–9} However, they all need an experienced hand surgeon who is familiar with advance techniques. Hereby, we introduce a simple and fast technique that facilitates nucleus management in patients with zonular weakening, especially for residents and young surgeons.

Description of the Technique

As shown in [video 1](#), surgery begins with a temporal 3.2 mm clear corneal incision under topical anesthesia. Two side-port incisions are made on the inferior and superior sides. Anterior continuous curvilinear 5–6 mm diameter capsulorhexis is

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performed with a needle or capsulotomy forceps after filling of the anterior chamber with a viscoelastic substance. In case of poor pupillary dilatation, iris hooks are used, or the pupil is stretched mechanically before capsulorhexis. Hydrodissection was performed to loosen capsule cortical attachments using a flat-tip cannula by injecting a fluid wave from under the cortex to the opposite side of the capsule until a complete wave was created. The nucleus is not rotated, and an appropriated groove (80–90% depth) is sculpted using the phaco machine. We do this maneuver with the ultrasound energy of 50–60%, the vacuum of 40 mm Hg, and aspiration flow rate of 20 to 25 cc/min.

The groove is cracked into two hemispheres as usual (applying equal but opposite force against the grooved walls); lateral pressure is exerted by the phacoemulsification tip on the base of the right-hand wall and a side port manipulator on the base of the left side. Then, without any need to rotate the nucleus, the 15–30 degree phaco tip is introduced and embedded into one hemisphere of nucleus beside the capsulorhexis edge at temporal or nasal part. For easier flipping the heminucleus, the phaco machine is set at a power of 20–30% ultrasound with a flow rate of 25 mL/min and a vacuum of 250 mm Hg. While maintaining the aspiration level to keep the probe tip occluded, the hemisphere is dislocated anteriorly with the phaco headpiece tip and flipped from the capsular bag into the iris plane. Phacoemulsification is started and the flipped hemisphere is chopped multiply with a horizontal chopper to facilitate the procedure. After complete removal of the first hemisphere, the second is flipped again from bag into iris plane and phacoemulsified in the same manner. This is followed by cortical clean up using bimanual I/A handpieces and capsular bag expanded with cohesive OVD followed by posterior chamber intraocular lens insertion.

The stop and flip technique was performed as a novel cataract surgery method in 45 eyes of 32 patients with PEX syndrome at Farabi Eye Hospital from 2011 to now ([Video 1](#)). In all cases, phacoemulsification was safely done with the Stop and Flip technique and the IOL was implanted in all cases. Three eyes developed zonular dehiscence that was partial and only one needed capsular tension ring (CTR). There was no case with posterior capsule rupture.

Discussion

Cataract surgery is more complicated in patients with PEX syndrome due to the risks associated with poor zonular integrity, low pupillary dilatation and early diffuse corneal

endothelial decompensation resulting from decreased endothelial cell counts.^{10,11} These factors are responsible for increasing the rate of intraoperative zonular detachment, vitreous loss, corneal edema. Many approaches are currently used by cataract surgeons for these patients; all of them have the same goal: inducing minimal stress to zonula. In this paper, we described a new safe and simple method for phacoemulsification in these patients, especially for residents and young surgeons.

Traditional techniques like divide and conquer and chopping methods need rotational and anterior-posterior manipulations to nucleus that stretch the loose zonules and may lead to zonular detachment. Woodlief et al described a technique that was used in 95 patients with no reported posterior capsule tear or zonular disturbance. Their technique consists of debulking of two-thirds of the nucleus by removal of a deep, central, equilateral triangular wedge of nucleus with no manipulation or rotation, followed by cracking the remaining peripheral nuclear rim into 3 equal segments.⁷ In another technique described by Koplín et al, a Kelman-style curved tip and Kuglen hook are used to sculpting and cracking the nucleus. Kim et al introduced a modified form of horizontal chop technique (Cross chop) which does not require the rotation of nucleus in the capsular bag.⁹ Bayraktar et al have described a method that implanted the CTR just after the hydrodissection and before phacoemulsification which might create difficulties for the surgeon during cortex aspiration.¹² All of the above-mentioned techniques need an experienced hand surgeon or specific type of equipment. With Stop and Flip technique, while it is not necessary to rotate the nucleus and, therefore, the stress exerted to zonules would be minimal, there is no need to use the chopper near anterior or posterior capsule; a privilege which can decrease most of the complications especially for junior residents. In addition to that, using this technique, the need for special instruments would be eliminated. In this technique, the risk of post-operative bullous keratopathy would be minimal because it releases less energy and also the stress exerted to zonules would be minimal in comparison with other methods.

We believe that the learning curve for Stop and Flip technique would not be higher compared to traditional techniques, including phaco chop. Also, we have observed no posterior capsule rupture in our cases, which is comparable to previously mentioned similar techniques. Of the 3 cases who needed CTR during surgery, one case had severe phacodonesis, and 2 cases had mature cataracts in the preoperative slit-lamp examination.

One of the safe techniques which is commonly used for patients with zonular instability is vertical chopping, particularly when working within the confines of a small pupil. However, this technique needs much more experience to do for young ophthalmologists.¹³

One of the limitations of this method is that for better flipping the nucleus, at least a 5–6 mm diameter anterior continuous curvilinear capsulorhexis is needed, knowing that having a large capsulorhexis is difficult to achieve in these patients due to poor pupil dilation.

In conclusion, Stop and Flip technique offers a simple and safe phacoemulsification method in cases which zonular weakness is a concern. It minimized zonular stress by avoiding manipulation or rotation of the nucleus and is especially helpful for young ophthalmologists and residents.

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Disclosure

The authors report no conflicts of interest in this work.

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