

# A new application of capsulorhexis forceps in phacoemulsification: capsulorhexis forceps-assisted prechop technique

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Received: 2016-11-25 Accepted: 2018-01-14

**DOI:10.18240/ijo.2018.02.26**

**Citation:** Tang JC, Cui HP, Chu H, Xu J, Liu BS. A new application of capsulorhexis forceps in phacoemulsification: capsulorhexis forceps-assisted prechop technique. *Int J Ophthalmol* 2018;11(2):337-339

## Dear Editor,

I am Dr. Jian-Cen Tang, from the Department of Ophthalmology, Shanghai East Hospital, Tongji University School of Medicine, Shanghai. I write to present a new application of capsulorhexis forceps in phacoemulsification, which is called capsulorhexis forceps-assisted prechop technique. The nucleus was splitted by means of capsulorhexis forceps in collaboration with chopper before the beginning of phacoemulsification in this technique. This prechop approach shorten the phaco time and reduce the phaco power in the process of phacoemulsification. Compared with other prechop techniques, this technique has the advantage of not requiring special surgical instruments and using the same capsulorhexis forceps to complete the capsulorhexis and prechop which make the surgical procedure smoothly.

Prechop techniques have become more popular in recent years because they can facilitate the nucleus fracture and decrease the ultrasound power. Many prechop techniques have been developed, such as the Akahoshi prechop<sup>[1]</sup>, the Bhatti prechop<sup>[2]</sup>, the middle prechop<sup>[3]</sup>, the cross chop<sup>[4]</sup>, etc. All of these techniques allow surgeons to skip the procedure of sculpting and chopping to break up the nucleus, though they require more incisions and special instruments.

In 2015, the cystotome-assisted prechop technique was introduced by Dr. Bao-Song Liu<sup>[5]</sup>. When the capsulorhexis is completed by cystotome, surgeons can use the same cystotome and Nagahara chopper to complete the prechop. However, many surgeons are accustomed to using capsulorhexis forceps rather than cystotome to create the continuous curvilinear capsulorhexis (CCC). They must relearn the procedure to perform CCC with cystotome or replace the instruments utilized under the prechop, which complicates the surgical procedure and can cause potential damage to the corneal endothelium. So, we prefer to use the capsulorhexis forceps instead of cystotome to assist the prechop, as this technique broadens the application fields for capsulorhexis forceps.

The capsulorhexis forceps and phaco chopper are commonly used instruments in this technique. The capsulorhexis forceps have angled shafts with very delicate grasping tips, measuring 12 mm from tips to bend, and a tip length of 0.5 mm when closed (Figure 1). Two types of phaco choppers can be applied in this surgery. One chopper which has an O-shape end with a 0.5 mm wide platform on a 0.5 mm diameter straight shaft tip (Figure 2). The other chopper is a Nagahara chopper which has one end with a 0.5×1-mm<sup>2</sup> sheet tip, with a round knurled handle (Figure 3).

After temporal clear corneal incision and paracentesis have been completed, dispersive viscoelastic material is injected into the anterior chamber. Then, the closing capsulorhexis forceps is inserted into the anterior chamber *via* the main incision and punctures the center of the lens capsule to create the start of the capsulotomy. The torn edge of the flap is grasped by the capsulorhexis forceps. CCC is created by forceps through counterclockwise or clockwise tearing. The capsulorhexis forceps in the right hand is held with the tips together and introduced into the anterior pole of the lens. Meanwhile, the phaco chopper in the left hand and is inserted into the anterior chamber through paracentesis.

The following prechop procedures usually require four maneuvers: first, without releasing the capsulorhexis forceps in the right hand, it is pulled toward the main incision slightly. At the same time, the phaco chopper in the left hand is slid under the cortex and capsule. It is positioned at 5 o'clock beneath the anterior capsule (Figure 4A).



**Figure 1** The capsulorhexis forceps applied for capsulorhexis and prechop.



**Figure 2** The O-shape chopper applied for prechop and phacoemulsification.

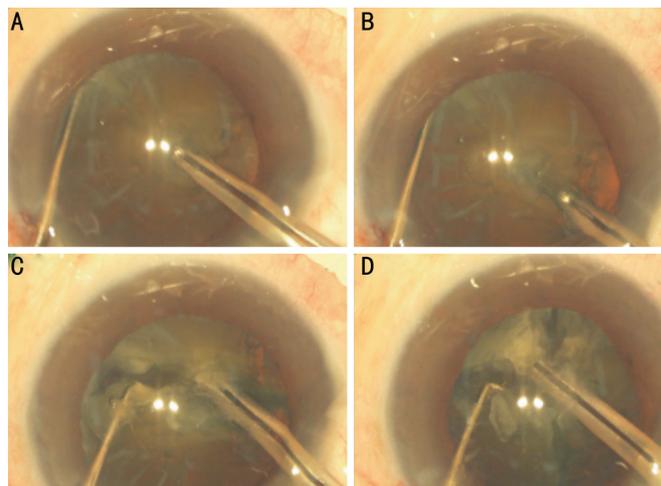


**Figure 3** The Nagahara chopper applied for prechop and phacoemulsification.

Second, the tip of the capsulorhexis forceps is repositioned and inserted into the endonucleus inside the capsular rim at 11 o'clock (Figure 4B). The capsulorhexis forceps is pushed towards the center of lens, while the chopper is pulled down along the same radial meridian to give a counterforce.

Third, when the capsulorhexis forceps and the chopper meet at the center of nucleus, the two instruments are separated laterally to create the first cleavage plane and form two halves (Figure 4C). If the crack through the center of the nucleus isn't completed, then rotate the nucleus 180 degree and repeat the above-mentioned procedures in order to create two segments.

Fourth, after the nucleus has been cracked in half, each hemi-nucleus can then be subdivided. The capsulorhexis forceps and



**Figure 4** The process of prechop by means of the phaco chopper in collaboration with the capsulorhexis forceps.

phaco chopper are used together to rotate the nucleus halves. The capsulorhexis forceps is positioned at the center of lens, the phaco chopper is slid under the capsule again and pulled towards the center. The two instruments are brought together to create the second cleavage plane (Figure 4D). This process is repeated for the other half. Throughout the procedure, the greatest care is taken to avoid opening the capsulorhexis forceps.

In our experience, skipping the hydrodissection contributes to keeping the endonucleus relatively steady before the first bisection of the nucleus. Endonucleus can be controlled better without hydrodissection which makes the bimanual forces along on the same radial meridian to create the first cleavage. Then, the capsulorhexis forceps and chopper are used together to bimanually rotate the nucleus with moderate force simultaneously. For beginners, hydrodissection is an option to facilitate the rotation in the situation of hard-to-rotate the lens followed by the rest of the prechop procedures.

Since 2016, more than 1000 cases were performed by using the capsulorhexis forceps-assisted prechop technique at the Shanghai East Hospital. The majority of cases in moderate-density nucleus had successfully completed the prechop. The above-mentioned two choppers worked very well with the capsulorhexis forceps for breaking up the nucleus.

The success rate by using this technique in cases with moderate-density nucleus is high. This technique also can be applied to hard nucleus. However, we don't recommend this technique on soft nucleus, or white or brunescant cataract. Soft nucleus is too soft to grip with forceps tips and it is difficult to create the split with the common mechanical force caused by bimanual manipulation. For white cataract, the emulsified cortex generally ooze to anterior chamber, which interferes with the surgical visual field. Furthermore, posterior plate of white cataract is often leathery or fibrous, making it difficult to split<sup>[5]</sup>. For brunescant cataract, inadequate mechanical force

caused by the interaction of capsulorhexis forceps and phaco chopper cannot break up the nucleus.

There are several significant benefits of this technique:

1) phaco energy isn't utilized, so no heat is generated in the process of prechop. According to the Wong *et al's* [6] investigation, ultrasound energy during nuclear emulsification is associated with endothelial cell loss. There is no significant impact on corneal endothelium by using the capsulorhexis forceps-assisted prechop technique; 2) the convenience of having a capsulorhexis forceps as opposed to specialized or tailor-made instruments such as surgeon-bent cystotome or Akahoshi combo prechopper could lower the risk by avoiding movement in-and-out of the anterior chamber and shorten the duration of surgery; 3) this variation of instrument has a short learning curve. We have found that this technique is helpful to beginners. It is difficult for a phaco beginner to hold the lens with phaco tip, which requires precise pedal control in chopping process. With our technique, beginners need only to learn bimanual maneuver instead of collaboration between manual and foot manipulation. Meanwhile, phaco-chop surgeons will have an easier transition since the capsulorhexis forceps-assisted prechop technique and phaco-chop technique require similar bimanual maneuver; 4) there is no extra instrument cost. The capsulorhexis forceps and phaco chopper are the two conventional instruments in cataract surgery, while the other prechop techniques require expensive instruments such as femtosecond laser *etc.*

Based on our experience, certain precautions must be taken with this technique. During surgery, the main mechanical force is directed toward the center of lens, not toward the zonule and posterior capsule. In early practice, we encountered a few complications of zonular dialysis and broken posterior capsule which is caused by wrong direction of bimanual mechanical force and excessive pressure to the zonule. Torquing the lens within the capsular bag is necessary, which adds the risk to zonular dehiscence for weak zonule cases. During the process of prechop, proper location of the capsulorhexis forceps and phaco chopper, as well as suitable maneuvering of the nucleus should be taken into consideration. While placing the chopper

to the nucleus edge, surgeons cannot press down too far posteriorly. Otherwise, the peripheral posterior capsule could run into the risk of being torn. The capsulorhexis forceps-assisted prechop procedure is a nucleus-separation process, which is similar with the phaco-chop procedure performed in the natural cleavage planes of the lens. If surgeons fail to split the nucleus, they should promptly turn to the classic phaco-chop process. To reduce the central nucleus mass, repeated and excessive manipulation should be avoided. At this time, some surgeons may choose to perform additional hydrodissection which facilitate the rotation of the nucleus to complete the phaco-chop.

In conclusion, the capsulorhexis forceps-assisted prechop technique is a safe, highly efficient and cost-effective alternative to crack the nucleus. The primary purpose of the design of the capsulorhexis forceps is to improve the grasp and reach of the forceps tip in order to enable easier grasping of capsular flaps [7]. The application of capsulorhexis forceps is extended to prechop. We believe this technique can significantly simplify the procedures during cataract extraction surgery

#### ACKNOWLEDGEMENTS

**Conflicts of Interest:** Tang JC, None; Cui HP, None; Chu H, None; Xu J, None; Liu BS, None.

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