Instructions for the Femtosecond Laser in Posterior Polar and White Cataracts

The Femto LDV Z8 can handle them all.

BY SOON PHAIK CHEE, MD

Figure 1. Professor Chee performs laser cataract surgery with the Femto LDV Z8.

Laser cataract surgery is a well-established procedure, with a growing number of surgeons worldwide who perform it. For more than 5 years now, I have used the femtosecond laser in cases ranging from routine to challenging. In my hands, I find that the Femto LDV Z8 (Ziemer) helps me to achieve safe, successful cataract surgery regardless of the cataract type or grade (Figure 1). That said, I have found that the femtosecond laser technology has some additional benefits in complex cases, such as posterior polar cataracts and white cataracts. I discuss them here, and further in the videos available at www.ziemergroup.com/videos.

POSTERIOR POLAR CATARACTS

The way that I treat soft posterior polar cataracts varies slightly from how I treat dense posterior polar cataracts. Because the risks associated with each type are different, the technique used should be different.

Soft/moderate posterior polar cataract. For soft cases, I first attempt to use hydrodelineation, directing the fluid within the nucleus and not under the capsule. Having a well-centered laser capsulotomy that is sized smaller than the optical diameter of the IOL is beneficial because, in the event of a posterior capsular rupture, I know that there is enough anterior capsule to support the lens and a perfectly sized and centered capsulotomy for optic capture—even if there's no posterior capsule. My ideal capsulotomy size is 5 mm.

I use the Femto LDV Z8 to fragment the nucleus into six pieces. Without rotating the outer shell of the epinucleus, I aspirate the segments out of the capsular bag. I use phacoemulsification to remove them, taking care to not break the posterior polar opacity.

I use a 600-µm posterior offset so that there is no breakthrough of gas into the polar opacity. If a gas breakthrough does occur, it could cause the posterior capsule to tear. The reason why the Femto LDV Z8 is so safe is because little gas is produced by this low-energy laser. Once I have done the laser portion of the procedure, I feel safe because even if the posterior capsule opens, which can happen during cortex aspiration, I have never dropped the nucleus. This is because it had already been safely removed over the cushion of epinucleus.

Alternatively to hydrodelineation, I also use viscodissection. I inject OVD especially in the subincisional areas (main and sideport incisions) just under the capsule. I find that injecting the OVD until it just reaches the equator helps to free the epinucleus, facilitating its removal. Using OVD is safer than injecting fluid, as it provides better control and allows one to perform a limited cortical cleaving dissection. If this crucial step is missed, surgeons are often left struggling with a thick sticky epinucleus as a result of hydrodelaminating too deeply into the nucleus.

After viscodissection, I proceed with my routine cataract surgery technique using the standard phaco machine settings for stop-and-chop phaco. In these cases, I always sculpt the center of the nucleus, cracking the ends of the trough and avoiding the center over the polar opacity. I next place the phaco needle at the depths of this trough and move my chopper across the phaco needle, slipping it just under the anterior capsule up to the equator. I then bring my chopper in the bag against the phaco needle, which provides a counterforce. This maneuver chops through the equatorial uncut nucleus and frees the nuclear fragments of the heminucleus away from the sideport incision.

Having OVD under the capsule helps me to more easily release the nuclear segments. After removing the first quadrant, I can remove the subsequent freed quadrant by using my chopper to roll it forward and toward the phaco tip. When I impale the heminucleus next to the sideport with the bevel of the phaco needle facing sideways and tumble it forward, it will already be loose from the prior viscodissection. This makes it easy to remove without having to rotate the nucleus and break the adhesion with the polar opacity. The epinucleus is then removed by aspiration. This technique has decreased my rate of posterior capsular rupture to around 3%. For the moderate posterior polar cataract, I prefer to use viscodissecction rather than hydrodelineation.

Dense posterior polar cataract. Many of the surgical steps with a moderate posterior polar cataract are similar to the steps I would use with a dense one. The major difference is that I use the Femto LDV Z8 to fragment the nucleus into eight segments. I only perform cortical cleaving viscodissection under the subincisional areas

TIPS FOR POSTERIOR POLAR CATARACTS

- Use a 600-µm posterior offset so that fragmentation does not interfere with the opacity
- Hydrodelaminate rather than hydrodissect soft posterior polar cataracts
- Inject OVD in the subincisional areas just under the capsule for denser posterior polars
- Sculpt in the center to create space and facilitate cross-chop
- Tumble out and phaco the prefragmented nuclear pieces
- Aspirate the epinucleus and cortex, leaving the polar opacity last
- Do not rotate the nucleus nor break into the opacity
- Fill the anterior chamber with OVD each time the instruments are removed to prevent posterior capsular rupture

up to the equator. All of the other steps are the same: sculpting a little trough in the center, cross-chopping the nucleus with the counterforce being provided by the phaco needle, removing the nucleus bit by bit, and completely removing it without breaking the adhesion to the posterior polar opacity. The epinucleus is removed by aspiration, peeling cortical material from the fornices of the capsular bag and leaving the polar opacity for last. It is important to fill the anterior chamber with OVD each time the instruments are removed from the eye to prevent posterior capsular rupture.

WHITE CATARACTS: THREE MAIN TYPES

When we talk about a white cataract, we are mainly looking at the color. But the white cataract can be categorized into three main types depending on its texture. Again, my surgical approach will differ depending on the type of white cataract.

Intumescent. This is the white cataract class that is feared the most. In an intumescent cataract, the whole lens is swollen with flocculent lens material and fluid, and it is under tension and pressure. For this reason, a pharmacologic agent (eg, intravenous mannitol) must be used about 30 to 60 minutes before surgery to reduce swelling and draw water out of the vitreous as well as the lens. Provided this prophylactic step is taken, the femtosecond laser capsulotomy will not run out.

Docking the laser is extremely important in intumescent cataracts. The laser should approach the entire capsule evenly so that it does not initially puncture one aspect. Should this occur, the lens material could decompress rapidly, causing the incompletely cut anterior capsule to tear outward and extend uncontrollably. Once the laser is properly docked, a very safe capsulotomy can be created. Even if it is not complete, I simply stain the capsule to see where it is not complete and how broad the attachment is. Minor microadhesions, or tags, can be pulled radially to complete a safe and strong capsulotomy. Broader adhesions, or bridges, should be torn like a capsulorhexis. When docking the Femto LDV Z8, the laser invariably is always mounted perpendicular to the capsule because of the flexible laser arm.

Also it is common to see subcapsular fibrosis, fibrotic tags, or even calcification in mature white cataracts. I try to note these in the patient's chart ahead of surgery, as I will be reminded to use a higher laser energy to penetrate these formations. Then, at the time of surgery, I also stain the capsule. This helps to ensure a complete capsulotomy is created. In the rare event that it is not, we can usually complete it very safely because the tendency to tear out is reduced due to the fact that the lens has been decompressed. The laser cuts the capsule but may leave persistent fibrotic tags that can be cut with intraocular scissors. I believe that using the pharmacologic agent to decompress the eye prior to the laser helps to reduce the risk of a tearout. I attempt fragmentation in many of these cases even though the laser will not cut through an opaque lens.

Dry type of white cataract. Cataract surgery in this setting is quite straightforward. Most times, the laser capsulotomy is complete and free from tags. The advantage of using the femtosecond laser here is that the capsulotomy is well-sized. Manual capsulorhexis tends to undersize the capsulotomy for fear of run out, making nucleus removal difficult. Additionally, I also try to use laser fragmentation in these cases; the laser can typically pass through to break up the nucleus if the outer white layer is not too thick.

Morgagnian. In the Morgagnian cataract, the outer cortex is already liquefied and the nucleus is mobile and may have settled inferiorly. These hypermature cataracts are typically very challenging to handle.

Compared with intumescent lenses, the liquefied Morgagnian cataract is often not under high pressure, but there can be subcapsular fibrosis and calcification, making it difficult to handle manually. The main problem with Morgagnian cataracts is that the moment the laser punctures the anterior capsule, fluid escapes rapidly and egresses into the anterior chamber, and the laser cannot fully pass through this fluid. Furthermore, the anterior capsule position suddenly drops, which also contributes to the incomplete capsulotomy. Again, staining the capsule after the laser cut can help to identify the sections that have not been cut.

Another issue with Morgagnian cataracts is that the lens often settles inferiorly. In these situations, it may be dangerous to do laser fragmentation because the fragmentation that has been planned can overlap with the new anterior capsule position. Inserting an IOL into the capsular bag beneath the small mobile nucleus helps to protect the posterior capsule during phacoemulsification.

CONCLUSION

There are many advantages to using the femtosecond laser in complex cataract surgery. After 5 years of experience with the Femto LDV Z8, I can say that the femtosecond laser makes even complex cataract cases like those described in this article feel like routine surgery. Indeed, I have found that the femtosecond laser makes surgery safe in such challenging cases. ■

TIPS FOR WHITE CATARACTS

- Use pharmacologic agent to reduce swelling in intumescent cataracts
- Proper docking of the femtosecond laser is crucial
- If capsulotomy is incomplete, stain the capsule to detect the attached areas and pull the tag radially; for bridges, use a capsulorhexis maneuver
- If subcapsular fibrosis, fibrotic tags, or calcification are present, increase the laser energy
- Well-sized capsulotomy with the femtosecond laser is helpful in every white cataract when following the important tips
- Laser fragmentation is often possible in the dry type of white cataracts

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- Financial disclosure: Consultant (AbbVie, Alcon, Allergan, Bausch + Lomb Surgical, Carl Zeiss Meditec, Hoya Medical Singapore, Johnson & Johnson Vision, Leica Microsystems, Santen Pharmaceutical Asia, Ziemer Ophthalmic Systems)