Simplifying Posterior Polar Cataracts
Femtodelineation: Posterior Polar Simplified

Posterior Polar Catarracts are a nightmare for every surgeon, owing to the potential of intraoperative posterior capsule rupture/dehiscence. One of the most important strategies to protect the posterior capsule remains avoiding buildup of hydraulic pressure within the capsular bag, and protecting the area of potential weakness until the end by creating a cushion of epinucleus.

We explore a unique application of the Femtosecond Laser in enhancing safety and predictability during posterior polar surgery. The Femtosecond Laser is equipped with different options for lens fragmentation. We find the cylindrical pattern of lens division particularly useful for posterior polar cataracts.

The Laser is programmed to create 3 cylinders within the lens. As the laser fires, it creates distinct layers of demarcation, from centre to periphery, shielded by a peripheral epinucleus zone.

Thus, it creates a laser-delineation within the lens substance. (Figure 1)

What’s even more important, the surgeon gets to choose the number, the diameter and depth of each cylinder, guided by the live Anterior-Segment OCT view.

So how does Femtodelineation actually help the surgeon?

After removing the capsulorhexis flap, we directly proceed to do-bulking the nucleus. Starting from the innermost central zone, each zone of the nucleus is removed from inside out in a piece-meal manner. Each section of the nucleus is then emulsified step-wise within the cushion of the other. An adequate layer of cushion is left behind even at the very end. The multiple nuclear stacks act as shock absorbers.

They effectively prevent transmission of mechanical maneuvers as well as fluid turbulence to the weakest part of the capsule. Therefore, the potential area of weakness in the nuclear capsule is safeguarded until the very end.

- Guaranteed protection till the very end of surgery
- Moreover, this is done without injecting any fluid and risking buildup of hydraulic pressure.

To summarize, Femtodelineation ensures enhanced protection and better outcomes for posterior polar cataracts in a predictable manner.

Further reading:

Tackling the Malpositioned IOL

Dealing with a ‘malpositioned’ IOL is a challenge for the surgeon. The issues are manifold: the cause of subluxation/dislocation of the IOL, the extent of dislocation, the type of IOL, the presence or absence of vitreous in the anterior chamber and co-existing ocular morbidities. All these factors will influence the surgical strategy and more importantly, the outcome for the patient.

Here, we will present different cases that will show varying presentations of IOL malpositioning, and their remedial options.

Case 1: Asymmetric placement of Single-Piece Acrylic IOL

A 66 year-old lady, with a history of previous laser PI done, was planned for cataract surgery with multifocal IOL implantation. Following an uneventful surgery, a single-piece hydrophobic acrylic, multifocal IOL implantation was planned. However, during IOL implantation, the pupil started constricting, and once the IOL was placed, it was difficult to determine whether it had gone in the bag completely or not. The surgeon did not attempt to manipulate any further and closed the eye.

She presented to us 1 month after the original surgery, with an IOP of 26 mm Hg and best-corrected vision of 6/12. Dilated exam revealed that the one haptic of the IOL was in the bag and the other was in the sulcus. In 180 degrees, the anterior and posterior capsule had fused (Figure 2).

What is the next step for this patient?

The important point to note here is that the single piece design has thick haptics. These tend to rub in the ciliary body region, and produce recurrent low-grade uveitis, pigment dispersion and worsening of glaucoma. We have shown this very effectively by UBM analysis of eyes with single piece acrylic IOL in the sulcus/Vasavada AR, Raj SM, Karve S. Retrospective ultrasound biomicroscopic analysis of single-piece sulcus fixated intraocular lenses. J Cataract Refract Surg 2010; May; 771-7). Therefore, it should not be left in the sulcus.

After proper counselling patient was taken up for IOL repositioning. The plan was to try and reopen the capsular bag, and reposition the IOL in the bag. In case, at any stage, the capsular bag would be compromised, the plan was to explant the single piece IOL and place a 3-piece IOL in the ciliary sulcus. Using high viscosity cohesive ophthalmic viscosurgical device (OVD) and a spatula, the capsular bag was gently viscodissected opened up. Subsequently the IOL was dialed in the bag, Postoperatively, the vision improved to 6/6p and IOP came down to 15 mm Hg. (Figure 3)

Take Home Message: SINGLE PIECE ACRYLIC IOL SHOULD NOT BE PLACED IN THE CILIARY SULCUS. If detected in the early postoperative period, the capsular bag can be opened up to reposition the IOL in the bag. If this is not possible, still explant the IOL and place a 3-piece IOL in the ciliary sulcus.

Case 2: IOL dislocated posteriorly with good anterior capsule support

A 62 year-old man was operated for a posterior polar cataract 10 years ago. Intraoperatively there was a posterior capsular rupture. However, using the rest of the posterior capsule as a support, a single-piece hydrophobic acrylic IOL was implanted in the bag. 10 years later, he presented with a diminution of vision.

Further reading:
- Avoiding buildup of hydraulic pressure within the capsular bag
- Adhering to the principles of Closed Chamber Technique
- Generating a Cushion by delineating the Nuclear

Femtodelineation is unique because it offers
- Multiple layers to cushion the posterior capsule
- Precise and predictable layers within the lens
As a first step, a 23-gauge, pars planavitrectomy was performed on the Infiniti Vision System® (Alcon, USA). The parameters used for vitrectomy were: cut rate of 2500/minute, vacuum 300 mm Hg, aspiration flow rate 25 cc/minute and irrigation bottle height 50 cm H2O. Thorough vitrectomy was performed to ensure that the IOL was free of all surrounding vitreous. Using a bimanual technique and microincision grasping forceps, the IOL was gently brought out into the anterior chamber. A dispersive ophthalmic viscosurgical device (OVD). Viscosat, was injected in the anterior chamber to coat the corneal endothelium. A temporal clear corneal incision of 2.4 mm was fashioned. The IOL was explanted using a special wire-loop passed through the Alcon ‘A’ cartridge. This special device has been innovated by Dr. Anup Bhownick from Kolkata, India. This device enables ‘reverse folding’ of the IOL, i.e. it allows the entire IOL to fold back into the cartridge and be removed a very small incision. Once the IOL was explanted, the anterior capsule support was assessed, and was judged to be adequate for a sulcus IOL fixation. A 3-piece Acrysof® IOL was implanted in the sulcus, and the optic was captured through the anterior capsulorrhexis margin. At the end, intraocular tamponade (preservative-free) was injected in the anterior chamber to detect presence of any residual vitreous.

Postoperatively, at 1 month, the patient achieved a best corrected visual acuity of 20/30 with a very stable and centred IOL. He maintained the same IOL centration and stability even at 1.5 years postoperatively (Figure 5). Take home message: Perform an adequate vitrectomy to ensure that the IOL is free of all coating vitreous. Use an appropriate IOL explantation strategy that is least traumatic to the eye. Finally, very critically assess the available capsular support and then decide the site of IOL fixation.

Case 3 (IOL Dislocated posteriorly with no capsular support)

A 68-year-old gentleman had an injury to the eye, and presented with diminution of vision. Examination revealed IOL dislocated into the anterior vitreous. However, there was no visible anterior or posterior capsule support (Figure 6). Just as in the previous case, an adequate vitrectomy was performed through the pars plana approach. The IOL was then elevated and brought into the anterior chamber, it was a single piece hydrophilic acrylic IOL. It was explanted through a small incision using the same wired loop snare device as mentioned in the case above. In absence of capsular support, we prefer to fixate the IOL to the sclera. In this case, we performed an intracapsular fixation of a foldable 3-piece IOL, using the technique described by Dr. Gabos Scharioth and then modified by Dr. Anant Agarwal (Figure 7).

Other alternatives include performing a conventional sutured scleral fixation, sutured posterior iris fixation of the IOL, or an anterior chamber IOL implantation. Take home message: In absence of adequate capsular bag support, fixate the IOL to the sclera, iris or implant it in the anterior chamber.

- Presence of vitreous strands in anterior chamber, and
- Peripheral retinal lesions.

As per extent of area of zonular dehiscence surgical strategy is decided. Pars plana lensectomy with vitrectomy is an option for gross subluxation of lens, following which scleral fixation of lens or intracapsular fixation glued IOL or iris fixated lens can be done for IOL implantation. We prefer to preserve the bag as far as possible because of the advantages:

1) It preserves and maintains natural compartments
2) It preserves the intact anterior vitreous phase
3) It is the IOL implantation the ideal site for IOL fixation

But this is technically demanding and long-term stability is still a question. There are many options for bag fixation and in-the-bag IOL implantation. The Cionni ring and Ahmed segments are designed to fixate the capsular bag to the sclera without violating the integrity of the capsular bag. However, several innovative devices are available for fixing the capsular bag to the sclera.

Surgical Steps:

My preferred surgical strategy consists of the following steps:

- Creation of a Scleral Pocket

Initially, a scleral pocket is created in the area of maximum zonular dehiscence. I prefer the technique described by Dr Hoffman, which involves creation of a partial thickness limbal groove, which is then dissected backwards into the sclera, without dismutting the conjunctiva. (Figure 8)

- Corneal Incision

I fashion two clear corneal paracentesis incisions of about 1.00 mm. I also make a temporal clear corneal paracentesis of 1.00 mm to start off. Using the “soft shell technique” of Dr. Aichino, first dispersive OVD, Viscosat, is injected into the anterior chamber, specifically over the area of zonular dehiscence. This creates a tamponade on the exposed anterior vitreous face. This is followed by injection of cohesive OVD (preservative-free) was injected in the anterior chamber to detect presence of any residual vitreous. (Figure 10): is carried out under maximum mydriasis for detecting:-.
- Extent of zonular weakness,
- Grade of cataract, if any

- Cortical Cleaving Hydrodissection

Gentle but thorough multidirectional hydrodissection is performed to reduce the stress on zonules during cortex removal.

- Lens Removal

In cases of children or young individuals, bimanual I/A is performed for lens removal. This allows maintenance of a closed chamber. By using a low aspiration flow rate and low bottle height minimal turbulence is maintained within the anterior chamber. At every stage, Viscoat is injected into the eye before retracting an instrument out of the eye to prevent collapse of the anterior chamber and forward bulge of the vitreous face.

- Capsular Bag Fixation

The capsular bag is inflated using high viscosity cohesive viscoselastic. I prefer to use a Cionni modified capsular tension ring for stabilization and centration of the bag. A cortical paracentesis incision is made opposite to the area of maximum zonular dialysis. The Cionni element of the ring is threaded with 90 prolene monofilament nonabsorbable suture, double armed with 2 straight needles (Ethicon) outside the eye. The ring is then is passed through a 2.8 mm corneal incision into the capsular bag. It is diaded until the Cionni’s element is subjacent to scleral flap. Bent 26 G needle is passed transconjunctivally through scleral pocket to fetch the curved needle which is introduced through the opposite corneal stab incision. Similarly the second needle is passed in the same track. Both the needles are cut, and the ends of the sutures are pulled out through the scleral pocket, and tied. This allows the knot to be buried inside the dissected scleral pocket. (Figure 10) Once the capsular bag is stabilized the IOL is implanted in the bag. My IOL of choice is a hydrophobic acrylic IOL (AcrySof, Alcon Laboratories, USA). Thereafter, a thorough removal of the OVD is performed, again taking care to avoid very high aspiration. Finally, before retracting the I/A cannula from the eye, stromal hydration of incisions is performed. The paracentesis incisions and the main incision are sutured. (Figure 11)
The Ahmed capsule tension segment is a modification of the Cionni ring, that provides segmental support, and can be used for small areas of zonular dehiscence or as an additional support in presence of a cionni ring.

Several other devices, like the Assia Anchor device and others have also been designed to provide stable capsular bag fixation.

Alternatives to Capsular Bag Fixation

In cases where the capsular bag cannot be preserved, I fixate the IOL to the sclera using conventional scleral fixation technique. However, the intrascleral IOL fixation (the glued IOL) is also a very elegant method of stable IOL fixation. Other options are iris sutured IOL fixation of anterior chamber IOL implantation.

To recapitulate, the pearls for surgical management of ectopia lentis are:

(i) Adhere to the principles of the closed chamber technique
(ii) Use modest irrigation and aspiration parameters to prevent turbulence
(iii) Choose the IOL fixation site according to the available capsular bag support
(iv) Capsular bag fixation with IOL implantation in-the-bag preferred

Legends for the figures:

Fig-8: Hoffman`s Scleral Pocket.
Fig-2: Capsular bag stabilization with Iris retractors.
Fig-3: Capsular Bag Fixation with cionni ring
Fig-4: Cionni ring and in the bag IOL implantation.

Suggested reading:
