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10-13 JUNE 2017 | BARCELONA, SPAIN

C07

Advanced Phaco Course

10 June 2017

16:15-17:45hrs

Room 112

HAND-OUT

Narrow Pupils and Synechiae

Narrow pupil surgical strategies

There are several options to manage a small pupil case. Surgeons skills and preferences will determine the level of surgeons comfort and success of patient outcomes.

1) 'Key hole surgery' ; surgeons is comfortable with smaller pupil surgery and is very dependent on skills, not discussed here.
2) Multiple iridotomies ; several small pupillotomies can be made with small scissors. Some bleeding usually occurs. This technique is not very widely used when more sophisticated devices are available to the surgeon.
3) Pupil stretching ; either with a specially dedicated stretching device or just with two separate instruments, the pupil can be stretched in one direction. The instruments should be held in the periphery in opposite positions and held stable for a few seconds. The resulting oval pupil shape can be reformed to a round shape by simply injecting viscoelastic in the middle of the pupil. This eliminates multiple stretching maneuvers and limits trauma to the iris. This is a very cheap and still widely used technique and very often sufficient in the hands of reasonably experienced surgeons. Not suitable for floppy iris cases.
4) Iris hooks ; More expensive solution, but very dependable and widely used. 4 small incisions are created to introduce the iris hooks. The position incisions should be rather peripheral to obtain a flat angle of approach to the iris to facilitate capturing of the iris by the hooks (Fg. 43). The orientation of the incisions near the main phaco incision is sometimes warranted in a way to obtain a diamond shape pupil, with one iris hook close to the main incision retracting the pupil away from the site where the phacotip enters the anterior chamber (Fig. 44).

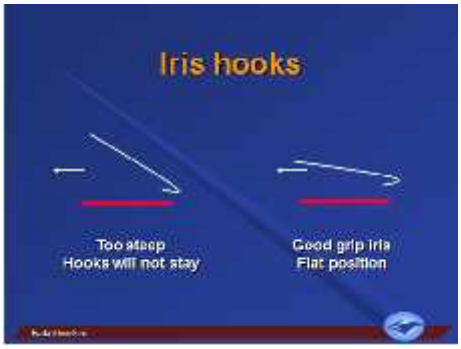

Fig. 43

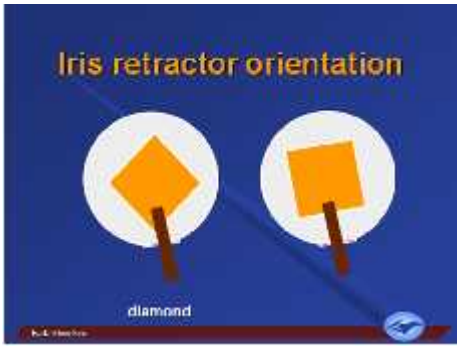

Fig. 44

5) Pupil stabilizing rings ; The Malyugin ring is the most widely known and used, but there are other devices on the market. I have no personal experience other than with the Malyugin ring. This ring is an excellent pupil stabilizing device, with a short learning curve (Fig. 45). It requires to learn a few small tips and tricks, which can be easily acquired through observing a few videos available on the internet (e.g. eyetube). Once installed in the eye, the Malyugin ring transforms extremely difficult and challenging small pupil cases in perfectly manageable cases. (Fig. 46)

Fig. 45

Fig. 46

If posterior synechiae are present, I personally prefer to dissect them by injecting a viscoelastic. This is the least traumatic technique to resolve synechiae. Sometimes mechanical manipulation is still required. Fibrotic membranes can sometimes be peeled from the pupillary edge with capsulorhexis forceps.

In a very shallow anterior chamber case with possible anterior synechiae, injection with a dispersive or visco adaptive viscoelastic is mandatory to create space. It is important to work through very small incisions during capsulorhexis formation to prevent viscoelastic egressing from the anterior chamber, thereby reducing working space. A needle technique or microcapsulorhexis forceps for CCC are both suitable for this situation.

Mature cataracts

Mature cataracts share the lack of sufficient red reflex for creating a capsulorhexis easily. Staining of the anterior capsule with trypan blue transitions this hazardous situation into a very manageable one (Fig. 48). Trypan blue can be injected into the anterior chamber directly, but I prefer to inject under air for better staining of the capsule (Fig. 47). It is even possible to ‘paintbrush’ the capsule when the anterior chamber is already filled with viscoelastic (Fig.49).

The main question before starting surgery is whether the mature lens is swollen or not. A hypermature swollen lens needs to be decompressed as described below before any other manipulation. Another potential danger should be kept in mind when dealing with mature cataracts; capsules, and posterior capsules in particular are more fragile and very easy to rupture!

Fig. 47

Fig. 48

Fig. 49

Hypermature White Intumescent Cataract

A hyper mature white intumescent cataract can turn into a real nightmare for the cataract surgeon if the necessary precautions are not taken.

The hyper mature cataract is characterized by a swelling of the lens and liquefying of lens material. The swollen content of the lens bag develops a higher intralenticular pressure with stretching of the lens capsule. When an intumescent hyper mature cataract is punctured without any precaution, it can suddenly “explode” with an

instantaneous anterior capsule rupture extending into the zonules. This is very well known as the “Argentinian Flag” sign; the clear white cataract zone between Vision Blue dyed capsule mimics the Argentinian Flag.. Upon suspicion of a swollen hyper mature cataract, the cataract surgeon should take the following precautions:

- Overfill the anterior chamber with viscoelastic to flatten the bulging anterior capsule and to exert counter pressure to the swollen lens bag (Fig. 50)
- Relieve the elevated capsular bag pressure by aspirating liquefied lens material whilst puncturing the lens with a sharp 27G needle. The needle should be introduced in the anterior chamber through a very small side port incision to avoid viscoelastic leakage and to maintain the high pressure in the anterior chamber (Fig.51).
- Once the hypermature is decompressed, spontaneous explosive extension of the anterior capsulotomy will no longer occur (Fig. 52). The anterior capsule can then be safely dyed with Vision Blue by “painting “ the capsule underneath the viscoelastic substance. After successful capsulorhexis formation, phacoemulsification should be relatively normal. The posterior capsule can be weaker than normal, but if handled with care, the case can be handled properly.

Fig. 50 **Fig. 51** **Fig. 52**

Capsule rupture

Anterior capsule rupture

An anterior capsule rupture, which does not extend into the zonules, can be salvaged by simply pulling the loose end of the torn flap back to the center to create a continuous capsulorhexis.

When the tear is already in the zonules region (Fig. 68), one should practice the “pull back” technique. The capsule needs to be caught with capsulorhexis forceps very near to the end of the tear. The forceps should then be directed in a “backward” direction; not forward, not towards the center, but almost in the backwards opposite direction of the normal capsulorhexis creation (Fig. 69). Once liberated from the zonules, the capsulorhexis can be finished in a regular fashion (Fig. 70).

Fig. 68 Fig. 69 Fig. 70

Posterior capsule rupture

Whenever a posterior capsule rupture is suspected, the most important thing to remember is: do not follow your impulse to retract everything from the eye! The sudden change of volume in the anterior chamber can lead to direct extension of the posterior capsule tear and displacement of nuclear fragments to the posterior segment.
The dogma to follow is: "Hold phacotip still in the eye" ! the second instrument can be carefully withdrawn from the eye (not much change in volume) and inject any viscoelastic available in the area of the suspected rupture to stabilize lens fragments and prevent them from falling back. If this has been executed successfully, one can retract the phacotip and take a deep breath of relief. Then a very important decision has to be taken; consult a colleague or continue by yourself…. If the decision is to proceed, my recommended measures are:

1) Lower bottle height, Aspiration flow and Vacuum; Have a dedicated Low Flow program preset
2) Inject a dispersive viscoelastic through the posterior capsule rupture to install a "dispersive viscoshield barrier" (Fig. 71).
3) If vitreous is suspected to be already present in the anterior chamber, inject diluted (approx. 10x) triamcinolone in the anterior chamber to 'stain' vitreous. If vitreous is detected, this should be removed by careful bimanual low flow anterior vitrectomy to prevent traction to the retina.
4) Reinstall the viscoshield barrier as often as needed to prevent nuclear fragments falling to the posterior segment. I personally inject profuse amounts of dispersive viscoelastic to make sure that nothing can pass this barrier to the vitreous.
5) The nuclear pieces need to be elevated manually to a safe position far enough from the capsule rupture(Fig. 72).
6) Emulsification of these nuclear fragments should be performed at a very low flow setting to limit the removal of the viscoelastic barrier as much as possible (Fig. 73). The vacuum should be very moderate to reduce the occlusion break surge response; my personal settings for the Infiniti machine (which can be translated into comparable settings for other machines) 40 cm bottle, 12 ml/min flow, 200 mm Hg vacuum. Torsional Ultrasound settings can remain normal because of the lack of repulsion. With longitudinal ultrasound, power settings should be limited and dutycycle decreased to reduce the phenomenon of repulsion as much as possible.
7) After completion of nucleus removal (with repeated dispersive viscoelastic injection if necessary), bimanual anterior vitrectomy through 2 sideports can be initiated. Make sure that the sideports do not allow significant leak flow, as any flow might drag along vitreous with traction to the retina as a result. A bimanual system with separated irrigation and vitrectomy/aspiration is mandatory (Fig. 75).
8) Inject diluted triamcinolone to detect any remaining vitreous (Fig. 74). And remove by vitrectomy if applicable.
9) After removal of all vitreous, bimanual irrigation/aspiration of residual cortex through the same sideports follows. A very low aspiration flow of 5ml/min is preferred to minimize the risk of vitreous aspiration.
10) If the CCC is intact, a sulcus fixated 3 piece IOL implantation is the most convenient solution. Optic capture through the CCC is favorable for IOL stabilization and sequestration of the posterior segment (Fig. 76). The IOL can be implanted with an injector or forceps, depending on the surgeons experience and instrumentation availability. A regular non angulated single piece IOL is not designed for sulcus fixation. The sharp edges of the lens can easily come into contact with the backside of the iris, which can lead to potential pigment loss and inflammation.

Fig. 71

Fig. 72

Fig. 73

Fig. 74

Fig. 75

Fig. 76

Handout for the Advanced Phaco Course Symposium at SOE 2017

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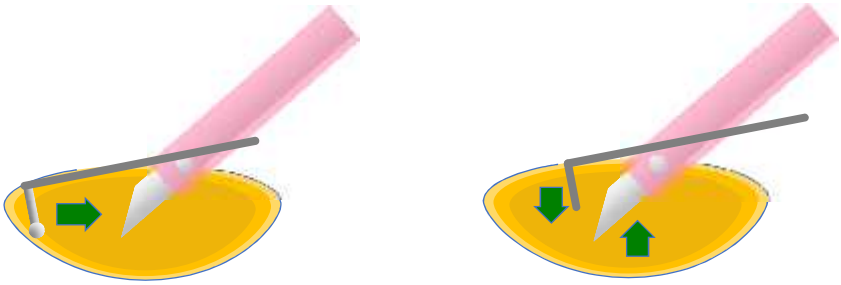
1. Hard cataracts and chopping techniques

Hard cataracts are nuclear cataracts that have hardened and therefore require more phaco energy to be emulsified than cataracts of medium density. They can be brown-green in color, brown (brunescent), red (rubra), and even black (nigra). Because of the hardness, it is more difficult to use the divide-and-conquer technique since it will require more power to sculpt the trenches. In addition, cracking the lens is more difficult due to leathery lenticular fibers at the back of the lens.

Chopping is a technique that has been developed for these types of cataract. It allows cracking of the lens in a very energy-efficient way. In chopping, the lens is fixated with the phaco tip that has been buried into the center of the nucleus. With the buried phaco tip giving counter-pressure, a second (relatively) sharp instrument is then used to split the lens into fragments.
Other advantages of chopping is that, compared to divide-and-conquer, it reduces the stress on the zonules and the capsular bag, it has a decreased reliance on the red fundus reflex, and it may be very useful in small pupils (because it is a kinesthetic technique).
Chopping can be divided into either horizontal chopping or vertical chopping. In horizontal chopping, the second instrument is pulled toward the buried phaco tip to crack the lens. In vertical chopping, the second instrument is used to push the lens down while the buried phaco tip lifts the lens; this also results in cracking the lens.



Horizontal chop | Vertical chop

Various instruments can be used for chopping the lens: a Sinskey hook, an Haefliger phaco cleaver, a Nagahara phaco chopper, a Chang horizontal Microfinger chopper, and a Chang vertical chopper.
Compared to the divide-and-conquer technique, the sleeve around the phaco tip is retracted (thereby allowing more metal to be seen) so that the tip can be buried more easily in the nucleus. After the lens has been chopped and the lens is to be emulsified with quadrant removal, it can be advantageous to return the sleeve in its normal position. In addition, some may find the tip of the chopper to be too sharp for their liking; in that case, one may use the sweep (iris spatula) to assist during quadrant removal.

In the horizontal chopping technique, one of course needs a good hydrodissection. A hydrodelineation is optional but may be easier when starting to chop. Hold the phacotip in the center of the nucleus; to achieve this, one must start drilling before the center of the

lens. Hold occlusion (by maintaining footpedal position 2) and hook the chopper behind the nucleus. Then, move the chopper in a horizontal motion toward the phacotip. Just in front of the phacotip, move the chopper sideways to complete the chop.

In the vertical chopping technique, one also needs a good hydrodissection. A hydrodelineation is of less value. Similarly to horizontal chopping, hold the phacotip in the center of the nucleus and hold occlusion by maintaining footpedal position 2. Then bury the chopper in the nucleus just in front of the phacotip and press the chopper down while moving the phacotip up.

To start learning the chopping technique, it may be good to start with the stop-and-chop technique. This is a combination of divide-and-conquer and chopping. To this end, one sculpts one central groove and cracks the lens into 2 halves. Then, one chops the 2 heminuclei separately.

2. Zonular weakness

The lens is attached in the eye by means of the zonules. Zonular weakness may be either local or generalized. Generalized zonular weakness may occur in, for example, pseudoexfoliation syndrome, Marfan syndrome, homocystinuria, and high myopia. Localized zonular weakness may be congenital, or traumatic. A traumatic localized zonular weakness may be iatrogenic due to pulling on the lens bag during cortical aspiration or due to previous external trauma.

In localized zonular weakness (or absence), vitreous may enter the anterior chamber during surgery through the defect. This may be prevented by applying a high-dispersive OVD (ophthalmic viscosurgical device) in the zonular defect. In addition, implantation of a capsular tension ring (CTR) will expand the bag at the location of the zonular weakness and reduce the risk of vitreous entering the anterior chamber. In addition, a localized zonular weakness may induce late subluxation of the pseudophakic lens and the lens bag. A CTR implanted during surgery will redistribute forces equally over the zonules thereby minimizing subluxation over time.

In generalized zonular weakness, the lens bag itself may become less stable and thereby increase the risk of a collapse of the bag during surgery. This may lead to subsequent aspiration of the bag with the risk of a posterior capsule tear. Maintaining the volume of the capsular bag can be obtained with injecting a high-dispersive OVD in the bag. Furthermore, implanting a CTR may stretch the bag as well and decrease the risk of collapse.

When there is advanced generalized zonular weakness, it may be even necessary to fixate the bag during surgery with hooks. Dedicated lens hooks are available to this end. Many surgeons, however, use iris hooks to support the bag in these occasions. Although care must be taken to not induce an anterior capsule tear with these hooks. In the case of generalized zonular weakness, implanting a CTR and a single-piece intraocular lens (IOL) in the bag may lead to postoperative pseudophaco-irido-donesis. The patient may then complain of wobbly vision. When this occurs, scleral fixation of the lens-IOL-CTR complex may sometimes be

necessary. In a case of advanced generalized zonular weakness, one might also choose for implanting a multipiece IOL in the sulcus with capture of the IOL's optic into the capsulorhexis (optic capture). In my experience, this gives a more stable situation than implantation of a CTR and intracapsular implantation of a single-piece IOL.

When the zonules do not provide any meaningful support anymore, one may choose to explant the capsular bag itself after the lens itself and, preferably, the cortex has been removed. To this end, one grabs the far side (i.e., at the 6 o'clock position) of the capsule with forceps (e.g., a McPherson forceps). A second instrument (such as an iris spatula [sweep]) is held orthogonally in the anterior chamber so that one can pull the capsular bag over the second instrument and remove the entire capsular bag from the eye. After this maneuver, an IOL can be fixated to the iris. To this end, special ARTISAN Aphakia lenses are available. Alternatively, one could suture an IOL to the iris or fixate a multi-piece IOL to the sclera.