

My EXPERIENCES of “PHACO”-A Journey from 1995 to 2011 (Beginners guide)

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Dear Colleagues,

Over the last few years this note has metamorphosed in to a handout. This also includes my experiences of teaching phacoemulsification all of which I would love to share with you. I have to date a bank of experience of around 60,000 phaco surgeries & over these years is the procedure of choice for me in almost 100% cases. **These 20 pages sounds long but it would hardly take 40 mins and save a lot of years in missing these valuable tips to learn from an experienced surgeon!** This note is for learner as well as for other surgeon who wants to modify their technique. I know you are not going to read this handout, as you do not have time, & we always feel that we know everything, but if you want to gain something then read once, I am sure you will definitely going to get lot of knowledge in depth for phacoemulsification. Remember if you don't spend time you want get mangoes next day.

Over the past few years I have taught many students. In teaching I have learnt the various difficulties students go through. **Learning from their mistakes has also helped me teach better.** It also helped me understand the technology of the machines better & its fallacies. It gave me good understanding of the **emotions a student goes through** in acquiring a machine & learning which are many times dissociated because of the financial constraints in India. Also came to know that certain wrong concept they have learned & continue to feel that same is right till somebody has shown that what is right! I understand that the other 3rd world countries would have the similar problem. So I presume the mindset of the ophthalmologists & government organizations there may be the same. **Even the so called developed nations had gone through these stages since early 90s when phaco became a standard surgery there, but only that they never put money in the way of learning skills and hence wisely never compromised on infrastructure by getting the latest equipments, etc.**

This handout has been distributed at various conferences where I have been involved or conducted workshops. Though, it is a little unfortunate that I have not received the feedback, which I have expected,

Your opinions & feedbacks are valuable in making this handout better in future.

I have used almost all machines both Peristaltic & Venturi for innumerable number of cases. In my opinion the Venturi system seems to be far superior & so in available Venturi system machines there was no need to change anything since inception of the machines in the world. However a machine is not as important as the skill with which you drive it. When you see your friend or colleague drive new car you feel to have the same. You start learning which takes some time & after few thousands kilometer you are driving the same with speed of your choice. Same is for Phacoemulsification. So grab the opportunity & spend some time money & energy to learn. It is not possible for majority of us to replace our machine once in few years. Subsequent to our purchase, if things do not work as per our thinking, it burdens our already taxed mind.

What you need to do cataract surgery?

Cutting of it & aspiration of the same, nothing more is required!
So find out the machine which cuts the best & aspirates the best with good control.

I have observed all over world that many a times machines are purchased in haste & then lying idle in clinic because of wrong selection or lack of confidence. **Recently I had seen ophthalmologists were blaming machines & compressors for non aspiration & forgot that all the machines obey your orders only. So do not blame machines etc but find out your faulty techniques.** I still learn everyday & still feel I am a student. Remember a doctor remains a student till he dies & knowledge should not die with you. (A PHYSICIAN IS LIVING TILL HE IS STUDYING). These form part of one's Continuous Medical Education or Continuous Professional development (One must have an insight to identify one's weaknesses and then determination to overcome one's weakness and convert them to strength).

I always say, **SEEING IS BELIEVING**, any of you are interested in learning & seeing me operate are welcome to India. You can contact me directly on my address or through Bausch & Lomb India.

I believe that **a good teacher** is the one who brings out the best from his student. I would like to say **“THAT A GOOD TEACHER IS ONE WHO COMES TO THE LEVEL OF STUDENTS & BRINGS HIM/HER UP.”** I am ever thankful to all my students for helping me in learning & bring out this handout with modifications every time. I advise all the students who wants to learn from experienced surgeon or colleague should first show his/her knowledge of the subject so that surgeon will understand where you are lacking in the subject & he will be able to guide you better.

Soon, I will be converting this handout to book form with some addition & deletion. I will appreciate your feedback & comments to include in the book.

“WHAT BEST YOU HAVE, GIVE IT TO THE WORLD, THE BEST WILL COME BACK TO YOU”

Affectionately Yours,

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CHANGE OVER FROM ECCE TO PHACOEMULSIFICATION

When ECCE with IOL gives good results then why Phaco?

Advantages are well recognised.

Didn't we change from ICCE to ECCE & again to ECCE & IOL implantation?

Then why not go for Phaco? Is it difficult? Is it expensive?

You want to drive old Bullock Cart or Fiat car or you want to change to new Car like Honda or Mercedes.

Nobody learns surgery in a day. It needs hard work, knowledge and experience. Commitment to Ophthalmology plays big role. If you are not ready to spend time money & energy to learn then you will never learn Phaco or it will take long time to learn.

How to start? You must have PATIENCE and ***your own Phaco Machine with a good microscope.*** Prepare your mind by reading journals extensively, exchange views with experienced Phaco surgeons, study in detail, attend courses and observe surgeons who do Phaco.

Never abandon phaco. You may fail many times or may drop the nucleus, either because of faulty technique or fear.

You should be **judicious in selecting a case** for phaco as a learner. I advise everybody to use both the hands i.e. be ambidextrous, because phaco is easier when both hands are complementing each other.

Select the right eye if you are right handed & left eye if you are left handed and a 1st and 2nd grade hard nucleus and a well dilated pupil. At any stage be prepared for planned conversion to ECCE. **NEVER FEEL SHY TO CONVERT.**

Select **large normal eye** where orbit size is relatively ok compared to eye size so that size of palpebral fissure is normal to fit speculum without any pressure on eye.

Never choose small eye with small cornea & shallow AC & hypermetropic eyes. Invariably small eye gives lot of trouble to beginners. **For more understanding please read my GLAUCOMA paper.**

RAM (Relative Anterior Microphthalmos) OR GRAM (Glaucoma in Relative Anterior Microphthalmos) is to be diagnosed beforehand to avoid any complication during surgery. (In Glaucoma paper it has been mentioned)

Very **high myopic eye**, large deep AC will create problem due to visibility. If you try to focus nucleus cornea looks hazy & so on. You can dislocate endonucleus in AC & do Phaco

Avoid very soft nucleus (i.e. young patients), deep seated eyes, small Palpabral fissure, pseudoexfoliation; Glaucoma operated cases/shallow AC and lastly the small pupil.

Many of my students told me that Sir we went for fellowship & there we have to strictly follow protocol & so we had many problems to proceed comfortably to finish surgery. We on many occasions don't know which case will come for learning.

I feel some liberty is to be given to fellows for some modifications so that student gets confident & can develop own method convenient to them & at the end eye is not damaged. Also student should be given chance to select cases so wrong selection for beginners are avoided. Always **try to scrutinize your case** why complication took place till you get answer so you never repeat your mistake either in selection of case or faulty technique. I have observed that nobody is bothered to find out why complication took place. During learning almost everybody concentrates on **phaco time** factor but not the technique. I always record the surgery done by beginners & at the end of day we find the faults of students & solve the problems.

I strongly suggest to fellows that if you feel that eye he/she got is not correct for beginners then he/she should refuse to operate on that eye & let senior to do surgery. We have no rights to damage poor patient's eye. Always feel that you are operating on your near & dear, so that you will do the best for that patient. After learning once you are in your own practice & poor patient comes for management, please do not refuse for money! By managing the case he will be paying you much more than any other patients in the form of experience which will make you richer in knowledge.

Recently I met a vitreo-retinal fellow who had worked in a reputed institute in south India and I was shocked to learn that he wasn't exposed to anterior segment surgery in almost 3 years so his knowledge about anterior segment surgery was very poor. **I request all the institutes to allow**

surgeons to get oriented in all the departments at least once or twice in 2-3 wks so that the surgeon is more aware of the cause of the complications, new modalities of management.

Never start surgery if anesthesia is not complete, THE EYE SHOULD BE IN YOUR CONTROL AND NOT YOU IN CONTROL OF EYE. The most important point is surgeons comfort, if not comfortable on table and chair then make you comfortable with everything & then start surgery. Remember if you do not have good microscope then it may give you trouble in doing Phaco in learning stage. I recommend learning the microscope focusing & developing reflexes for both the legs & hands plays big role. Phaco is the only surgery where whole body of the surgeon is involved, both the legs for Phaco & microscope control, both hands for doing phaco, both the eyes to see what you are seeing, mind to take decisions during surgery. After mastering your surgery you can go for TOPICAL ANESTHESIA.

You can **learn phaco either after capsulorhexis or can opener capsulotomy.** About phaco in can opener capsulotomy is written elsewhere.

Capsulorhexis: It can be done by 30G needle cystitome or forceps. It can be done thro' side port or main incision as per situation. Even if you have to push viscoelastic 3to 4 times or more then do it but never try to do it in shallow AC. Try to go on increasing your speed which will help you in almost 100% success in doing good capsulorhexis. There are many opinions about the size. Optimum size is sufficient & depends on case you have to do. **In hard nucleus it should be largest possible. Keep on pushing viscoelastics off & on & grasp regrasp the flap of capsule with forcep to do rhexis easily. Try to increase the speed of doing it so before it goes periphery you are finished with rhexis. If it goes to periphery then pull towards the center of the lens & it will come back.**

In case you are stuck subincisional then thro' side port you can try to push the flap towards center of lens & bring in view. You can attach viscoelastic syringe to cystitome & go on pushing the same whenever there is shallowing of AC. Or now a days 23G capsulorhexis micro forceps are available, & used thro' side port to complete the rhexis.

Even if you have mastered the technique convenient to you, there are chances that you may go periphery. Do not continue from there or pull, go opposite side & cut the capsule & complete the rhexis. Once you have mastered the phaco you can do the phacoemulsification in such cases.

Mature/Hyper mature Cataract: do not start surgery if eye ball is tight ie make sure that you make eye ball very soft by any means you like & start

surgery. Nowadays it is easy to visualize capsule in such cases due to availability of dye **Trypan Blue**. Make a small nick in the center of capsule after staining & very slowly push **irrigating fluid** with cannula in the bag so that all white fluid comes out. After that fill up the bag & then AC with **visco**, followed by rhexis with forceps. Try to make **small rhexis** so it will not go periphery. After phaco completion & implantation of IOL one can extend rhexis. At present 23G capsulorhexis forceps are available for your use & it will make your work of rhexis easy through 0.8mm side port. I always make 0.6mm side port with diamond knife. One Swiss machine has RF capsulotomy mode which is very good for those who are not able to do capsulorhexis or Fugo blade can be used to do the same. In case of mature cataract rhexis goes to periphery on one side then you can do phaco comfortably by giving small 2 more cuts in rhexis to reduce strain on bag & use maximum power & low vacuum & no pushing nucleus this is possible only in soft eyes, never allow posterior capsule to bulge anteriorly otherwise tear in anterior capsule will go to posterior capsule & will complicate the case.

Select your **choice of incision either tunnel or clear corneal and valvular** so as to prevent leakage of fluid. It must be done by very SHARP & THIN blades as this prevents collapse of chamber, clear corneal incision should be always by Diamond blades. Remember good DIAMOND blade is CHEAPER in long run. Remember **clear corneal incision is best in learning stage** as you are very near to nucleus & so maneuvering for phaco is very easy & safe. People are of the opinion that clear corneal incision is dangerous & can give rise to endophthalmitis. In my opinion it is not so. First of all surgeons' uses blunt blades to do clear corneal incision which keeps on leaking both ways thro' micro channels in it & they never push air at the end of surgery. This will make **NEGATIVE** pressure in eye post operative & so external contaminated fluid from conjunctival area will get sucked in & produce infection & reaction. Also to keep watch on sterilization of equipments, this will prevent infections. I perform exclusively clear corneal incision up to 6mm size without sutures in eye camps & also in my private practice, & that without any post operative complications. Here once again I have to repeat, **SEEING IS BELIEVING**. See that you take clear corneal incision in steep axis so that reduction of astigmatism takes place if it is there. If you feel that your incisions is not proper in any sense then please abandon the same & take another good one. Now **OcuSeal** is available to seal the wound from BD Company which is good in case there is leakage in wound

Do very **good hydrodissection**, with any convenient cannula in your hand **through main wound** only. **Never do it thro' side port. See that while injecting fluid for hydro dissection you should never come out from periphery to center of capsulorhexis. If you do not reach periphery then fluid will come back in center as there is minimum resistance area in center.**

There is no fix criteria about [how much fluid to inject](#) or which syringe to use. Remember once you see fluid wave coming & covering all lens area or forward movement of lens confirms hydro dissection completed. Once you see a wave of fluid behind the nucleus stop pushing more fluid as it may rupture posterior capsule. This is because Capsulorhexis opening is blocked by forward movement of nucleus by the fluid wave, this happens especially when your Capsulorhexis is not enough size. Now do hydrodelineation to separate the endonucleus from epinucleus. Gently confirm by rotating nucleus in capsulorhexis area only. Never try to rotate by pushing chopper in epinucleus area. I use always 20cc syringes for all these procedures with 27G cannula.

[Now you can start phaco by keeping in mind certain parameters for sculpting.](#)

You need more power to sculpt and less aspiration. So keep power about 55% Linear and lowest possible vacuum. **REMEMBER TWO POINTS:** MAXIMUM POWER [DURING SCULPTING](#) WITH LOWEST POSSIBLE ASPIRATION & LOWEST POSSIBLE POWER WITH HIGHEST POSSIBLE VACUUM [AFTER CRACKING](#). **THIS IS BECAUSE DURING SCULPTING VERY SMALL AREA OF TIP TOUCHES THE NUCLEUS & MAXIMUM ENERGY IS WASTED; WHERE AS AFTER CRACKING WHOLE TIP IS TOUCHING NUCLEUS & SO FULL ENERGY IS UTILISED FOR EMULSIFICATION. SO DURING SCULPTING IF YOU ARE USING 80% POWER THEN ONLY EFFECTIVE POWER WILL BE ABOUT 25% OR LESS.** During surgery you don't have the time to look at phaco dynamics at that moment your foot control will help you in doing best phaco surgery. After getting smooth rhythm for sculpting and control over phaco you can proceed for complete removal of cataract. When you are sculpting see that you remain in capsulorhexis area only ie only endonucleus. **NEVER CROSS ENDONUCLEUS AREA AT PERIPHERY.** At periphery posterior capsule is very near due to anatomical shape of human natural lens. **Keep sculpting in center only & go deep as much as possible** by making your hand piece more & more straight. [When you reach near end in center go on reducing power & slowly shave the endonucleus.](#)

Start making tract of one and half size of phaco tip just opposite to the side of entry in the eye. Go deep enough in centre of endonucleus without to much periphery and then rotate nucleus 90 degrees and make one more tract. Similarly you [make 4 tracts deep enough](#) to see a faint glow through the tract. Now crack the nucleus into 4 parts with the help of nucleus rotator and phaco tip or [lens cracker by opposing movements](#). THIS 4 QUADRANTS TECHNIQUE IS FOR BEGINNERS ONCE YOU MASTER THE TECHNIQUE YOU CAN DO STOP & CHOP TECHNIQUE. You must observe that all 4 parts are completely separated otherwise it will be difficult to remove them with great ease. While rotating irrigation should be ON, [while cracking, irrigation is OFF for a while](#). You can do only two tracts in one & proceed for cracking. **Remember** you have to go

for minimum 95 to 98 % of depth of endonucleus & never cross your casulorhexis area or **endonucleus** during sculpting as posterior capsule is more forwards at periphery. Always do sculpting in visible area only **ie only in endonucleus only**, also specifically in small pupil.

Now you need to remove the 4 quadrants of nucleus one by one. At this stage you need more vacuum and aspiration to attract each part of the nucleus. So increase the vacuum to 70 to 80 mm Hg OR MORE AS PER YOUR CHOICE & CONTROL, depending upon the type of phaco tip or machine used. If needed increase the height of the BSS bottle to prevent collapse of chamber. Lift the central part of one quadrant by pressing it at periphery by spatula or rotator and bring the phaco tip to touch the same, by depressing the foot pedal start increasing vacuum to hold nucleus quadrant bring it in centre and emulsify. All quadrants are removed in similar fashion. Remove a quadrant which comes easily. If one does not come easily, do not try to remove that one.

If your hydro delineation is correct then only endonucleus will come like this or you will face difficulty.

Remember that the vacuum is not the only culprit for shallowing of the anterior chamber. It is the nature of wound i.e. entry in eye you have done and height of bottle of BSS that determine the AC depth. If the wound is not valvular then there is more leakage of fluid causing collapse of AC hence increase the height of BSS bottle, this will reduce the chances of AC collapse. Faulty handling of Phaco hand piece in the wound & direction of the same can keep the AC shallow. I have observed that all beginners brings phaco tip in wound & so irrigating fluid do not enter the eye but flows out with same aspiration rate collapsing the chamber & then blames machine or pump. You can keep anterior chamber maintainer in early stages of learning to maintain AC. But this will increase fluid inflow & outflow & so loss of more endothelial cells.

SECRET OF SUCCESSFUL PHACOEMULSIFICATION:

Use wound as fulcrum & never press posterior lip of the wound. Always try to pull eye ball **UP/FORWARD** so that upper lip only gets little stretched. This will never collapse AC & you will be comfortable in doing phaco procedure. Good complete Hydrodissection & hydrodelineation will complete your phaco surgery quickly & easily so master these procedure first. **See that you learn rotational movements in first three fingers of both hands so that wounds are used as fulcrums & no collapse of AC. Learn rotating phaco hand piece & chopper in fingers & you will learn phaco very fast.**

Here, I would like to stress one point. I do not find any problem with the venturi system. People have developed a wrong impression that the Venturi system is very dangerous & fast. Same car driven by two different surgeons with two different speeds. Actually it is your skill, learn how to use it and take maximum advantage of Venturi system. Once you learn phaco then you will ask for faster machine and here venturi system helps in doing quick surgeries. Faster technology has the best control as you go on changing techniques from the 4 quadrants to crack, flip, and chip chopping. This is the venturi technology which shall give you a tremendous advantage over peristaltic. Manufacturers of peristaltic pumps in phaco machines have tried to modify the same to give effect of venturi system by increasing rollers, etc. for aspiration in fact many companies has come out with venturi system but not disclosing the same. **Remember whatever machine it may be there is always man behind the machine!** In last few years almost every company has changed software in their phaco machines except venturi system machines; this is for your information. **Remember when you use ultrasound power to cut nucleus it tends to go away by force so you need vaccum to keep nucleus fragments attracted towards phaco tip. This is achieved well by Venturi system as you are working with high vaccum in AC where as in peristaltic pump machines vaccum develops only after occlusion as you are working with ZERO vaccum in AC. This is the most important cause of use of more power as it is wasted in empty space in eye.**

Since last few years I am hearing & seeing workshop of micro incision phaco procedures. This has brought many changes in technology. Most important is type & size of phaco tip, irrigation sleeves, & vacuum advantage with stability of anterior chamber & micro lens for implantation. I strongly feel that at this stage of phaco we should not experiment what we see but slowly change over after mastering the technique. Do it in cases where AC is deep with large/normal size eye & at last if you are master in doing normal phaco procedure & lastly with good machine & microscope. **It always takes more time to finish the whole surgery so more fluid is used & more endothelial cells are lost. This is because of thinner phaco tip reduces total aspiration rate. B&L has come out with new Phaco tip which has same aspiration rate as micro flow tip of same company giving advantage of same aspiration rate for quick surgery.**

Once you remove all four quadrants of the endonucleus, the epinucleus is aspirated with phaco tip carefully. You can decrease phaco power to lowest possible (5%). Slowly aspirate from 6 O Clock position and then from 12 O clock position. Lens matter is removed with I/A mode with 550 to 600 Vacuum. Always remember that maximum rupture of posterior capsule takes place in I/A procedure only. See that opening of I/A probe is towards you only and not towards posterior capsule. 12' O clock lens matter can be removed with two

hand technique or curved I/A probe or bimanual. If you want to do good I/A with your machine then use 0.2mm aspiration port in your I/A hand piece. This will give you best control for aspiration & chances of rupture of posterior capsule will come down. All epinucleus comes easily if hydro dissection is correctly done. I usually remove epinucleus with phaco tip with **ZERO** power or just 5% power with 150-200 Vacuums. Inject some viscoelastics in between capsule & lens epinucleus to separate the same to facilitate removal. ALSO REMOVAL OF LAST PIECE OF ENDONUCLEUS IS TRICKY. MAINLY IN ABSENCE OF EPINUCLEUS OR MATURE CATARACT. REDUCE THE POWER & INJECT VISCOELASTIC IN BAG BEHIND THE PIECE WILL KEEP PC AWAY & WILL NOT TOUCH PHACO TIP EASILY. SAFELY REMOVE THE PIECE WITH CONTROLLED POWER & ASPIRATION.

With above all observations let me tell you few words about variety of machines now available. In last 10 years lot of changes took place only in peristaltic machines only. Machines are coming out with new names like cold phaco, white phaco high vacuum phaco etc. That means previous models of same companies were wrong? Defective in output? Burning corneal wound regular features? Surge common? Or companies strategies to sell more machines to surgeons. We all humans want some name & fame & so we buy the new machines & on that pretext charges also goes up for our poor patients.

I would like to stress one point, now a days we are doing more & more softer cataracts even with almost 6/6 vision. Here we need minimum possible power but best way of aspiration. So basic simpler machine is ok for the same with good aspiration. Please see conquering soft cataract elsewhere in this paper.

Let me tell you the causes of wound burn:

High frequency of phaco hand piece (40-60 KHz) gets hot very fast & also 4 crystal hand piece. In my experience I have found that 4 or 6 crystals hand piece produces more heat compared to 2 crystal hand piece. I have compared in a small beaker the rise in temperature in BSS after using same time & power for varieties of hand pieces. So **B & L** has come out with the CCS software with wave form delivery of power for better efficiency in the Millenium & Stellaris machine to reduce the temperature rise in hyper pulse mode. Millenium & Stellaris machines are the best in the world at present but unfortunately are expensive in this third world developing countries.

In peristaltic pump you are always working with **ZERO** vacuum in AC till you occlude the tip, then sudden surge comes & AC collapses. So you tend to keep low vacuum during surgery. So large piece of cataract occludes either tip or

tubing & before you realize the block in tube you burn the corneal wound by continuous power & no aspirations.

Type of tips also plays some role. [Thin walled tip gets hot faster, also](#) if your [wound is tight](#) with tip also burns the wound.

Remember, in phaco procedures you have to use ultrasound power to emulsify cataract lens more so in hard type looking at Indian scenario. Try to use maximum power in bag during sculpting away from cornea.

I use maximum possible power (OPTIMUM FOR THAT CATARACT'S HARDNESS) without wound burn & damaging the corneal endothelium & blood aqueous barrier. Due to this I am able to finish surgery very quickly & safely. I have done studies by measuring endothelial cell count; tension check ups postoperatively, corneal thickness etc & found no significant changes in any of eye structures. Once again I will repeat, **SEEING IS BELIEVING**.

[Learn as early as possible to use optimum power for type of cataract surgeries.](#)

I am using Venturi system by B&L since more than 18 years which has 28 KHz probes so less heat production. I also use micro flow micro (NEW) tips by B&L which can work on many machines. It has serrated shaft, so there is inflow & out flow of fluid in spite of tight wound & can be used comfortably for micro incision phaco. Now one more tip has been developed by B & L which can be used for 1.8mm of incision with MIL lens implantation.

Remember more numbers of entry & exit in wound during surgery will damage wound & more loss of endothelial cells surrounding it. So try to finish the surgery with minimum numbers of entry & exits during phaco.

Few Tips:

Most important of all, **foot-pedal should never come to O stage** i.e. irrigation should never be stopped unless & until hand piece comes out of the eye. **Always remove it last i.e. after side port instruments.**

No machine in the world collapses anterior chamber, only surgeon does it due to lack of control on foot-pedal.

Sometimes in a hurry irrigation sleeve's opening comes in wound & so irrigating fluid cannot enter the eye & collapses the AC. This happens mainly in long tunnel incision.

Train left hand & Left leg for microscope control. You have to change the focus constantly as you go deep & deep in sculpting. I'm repeating, **never rotate**

nucleus by engaging the epinucleus, always engage endonucleus & keep irrigation on. Similarly, if you are left handed then train your right hand.

Phaco tips occlusion depends on (1) Nuclear Density, (2) Intention of surgeon & (3) Bevel of Phaco Tip. Use 45* tip for cutting, 30* for optimum use, 15* for good occlusion.(4) TOTAL OUTER DIAMETER OF TIP

Whenever you convert to ECCE always put relaxing cuts in the anterior capsule for delivery of a large nucleus.

Once you master the technique of Phaco, you can modify it in your own way. Like chopping of nucleus, aspirating soft cataracts etc. Always remember that you learn from somebody, but have to develop your own technique which is convenient to you in your set up.

To judge the height of BSS bottle – Adjust the height of Phaco hand piece 4 inches above patient's eye, adjusting the bottle height in such a way that test chamber just collapses. When bottle gets half empty, infusion reduces, increase the height of bottle.

Remember: when you are using venturi system there is same vacuum in A C & chamber of phacomachine cassette. So while learning you develops reflexes to work with correct vacuum & aspiration without collapsing chamber. Also you don't have to go behind lens fragments to remove it. It comes to phaco tip with aspiration force & direction of fluid.

Reasons for Chamber collapse: Too much wound leakage due to defective wound construction. If large take one stitch and proceed. Use good sharp instruments for entry in eye, good equipment, control of foot pedal and continuous irrigation mode. **REMEMBER IRRIGATION FLUID RATE SHOULD BE ALWAYS HIGHER THAN ASPIRATION RATE TO MAINTAIN ANTERIOR CHAMBER IN ANY MACHINE IN WORLD.**

Height of BSS bottle if low adjust it (approximately 16-24 inches) above the patient's eye level. Too much vacuum applied without increasing the height of BSS bottle.

Rupture of Posterior capsule and so vitreous pushes cataract up. Time to convert to ECCE.

Cannot crack the nucleus: b'cos, Sculpting is not deep or very soft cataract. Do a little more deeper sculpting and it will crack easily. Keep instrument deep

enough while cracking and stop infusion for fractions of second or use nucleus cracker. Very soft nucleus is very difficult to crack. In soft nucleus emulsify central endonucleus & then push some viscoelastic/irrigating fluid between epinucleus & capsule, it will mould out in center & will come out easily.

Aspiration is affected: This usually occurs when you try to use less power & so large piece of lens occludes the aspiration pipe & so aspiration line gets choked. Remove all connections and flush it with BSS.

Phaco tip is not cutting: check the tip for sharpness, make tight with wrench and reprime it. Or you are using less power & lens is hard, or doing sculpting without touching lens i.e. wasting of phaco power.

It is very difficult to do Phaco in myopic cases for the following reasons:-

1. Anterior chamber becomes deep as soon as Phaco hand piece enters anterior chamber with irrigation on, this is due to large eye ball.
2. If you try to focus on anterior curvature of lens the cornea becomes hazy and visibility reduces. You should use good microscope for good visibility. Remember illumination plays big role in visibility.
3. To overcome above problems, extra side port should be made, height of irrigation solution should be reduced and vacuum should be increased to reduce fluid in anterior chamber. This prevents the lens from going down and Phaco can then be done easily.

If the above mentioned is not working then use the 4th method.

4. In myopic cases when eye ball is large and it is difficult to focus the nucleus in such cases it is better to do very good hydro dissection and dislocating the nucleus in the anterior chamber. It is kept sandwiched in between viscoelastics, anteriorly and posteriorly, and then Phaco is done easily. This is possible when your Capsulorhexis is large.

Conquering soft Cataract: Optimum size of capsulorhexis is done followed by good hydro dissection. Hydro delineation is done properly. Here you can have ZERO OR 15 DEGREE PHACO TIP for soft cataract which will facilitate aspiration of it without more power. Now with **lowest possible power** (may be even 5-10% or ZERO power) which can just cut the nucleus is used to sculpt.

Make large bowel shaped excavation in nucleus deep in center about 90%. **never use the power at periphery in soft cataracts.** Now to get peripheral areas of cataract increase the vacuum & reduce the power further. Use thin cannula to inject viscoelastic in between capsular rim & lens matter. As the cataract is soft it will mould in the central area & can be aspirated very easily. If your hydro dissection is proper then it will come very easily. When viscoelastic is injected, more separation can be done by spatula moving between bag & lens matter. **Here venturi system scores above peristaltic** machines for aspiration. If your machine does not go to Zero power then you can remove the same in I/A mode by keeping vacuum about 150 to 200. **For peristaltic pump machine user best parameters are as follows:** Power **0 to 5 % Power** according to machine used, **Vacuum-** 120 to 250 mm of Hg, **Aspiration Rate** – 25 to 35 cc/min, depending on machine used & phaco tip used. Again all sophisticated tips will be of no use in future. **Ultimately best control on machine will win the race.**

How to manage small tear in posterior capsule?

1. Never remove instrument suddenly, cool down, have patience, every body breaks the posterior capsule.
2. Maintain closed chamber.
3. If the tear is small, then push viscoelastic substance like sodium hyaluronate behind the posterior capsule to push the vitreous back. Please give dose of acetazolamide to such patients where you are keeping some sodium hyaluronate to avoid spike of IOP. Remember good visco-elastic is the eye saving key & must be used as much as possible. This is my experience in difficult situations & PC rupture.
4. Always push viscoelastic first in 3 mm wound to remove vitreous and then fill anterior chamber and bag so that vitreous will go back in the posterior chamber.
5. Try to preserve as much capsule as possible.
- 6) If lens matter can be removed after implanting IOL, then it is better. Otherwise dry aspiration of lens matter can be done but then lot of viscoelastic is required.

As the incision is 3 mm it is easier to maneuver all procedure.

6. If capsule tear is larger then anterior vitrectomy is employed. Good vitrectomy with complete removal of vitreous from AC is must before implantation of IOL. Please keep Vitrectomy probe ready every time you do Phaco & **Backup AC IOL or PC large IOL. At present 25G Vitrectomy works wonderfully to manage PC tear cases.**
7. Remember that a low vacuum and high rate of cuts per minute is used with separate irrigation bimanually. This helps in control of irrigating fluid entering the eye and so more vitreous is not disturbed. **NOW A DAYS 25G OR 23G VITRECTOMY CUTTER WITH HIGH SPEED UP TO 1500 CUTS OR MORE IS BEST IN DOING ANTERIOR VITRECTOMY ALSO.**
8. Flow of irrigating fluid should be directed towards iris only.
- 9) After vitrectomy, viscoelastic is used and lens is implanted with the help of Lens glide in the bag or in sulcus as per condition. You can use either AC multiflex IOL of smaller size either 5mm or 5.25mm or 5.5mm optic size only but never 6mm optic size, or Iris Claw IOL in Posterior Chamber having easier & quick procedure than sulcus fixated IOL procedures. Subincisional lens matter etc can be removed by making port at 6 o'clock position & do 25G vitrectomy from there.
- 10) If you have converted the case then, try to close the chamber as early as possible by starting suturing from periphery always and never from the centre.
- 11) Avoid high infusion .Bring down bottle as low as possible. Manual inflow is preferred.

12) Always do small sphincterectomy at 6 O'clock position to prevent up drawn pupil & most important reduction of postoperative tenderness & pain as there is minimum pull on ciliary body by sphincter of iris. Also move spatula from one side over the iris below wound to remove any vitreous from wound & AC, also try to make small one PBI.

I RECOMMEND THAT ALL ANTERIOR SEGMENT SURGEONS MUST LEARN ANTERIOR VITRECTOMY TO PREVENT PULL ON PERIPHERAL WEAK RETINA & ULTIMATELY RD. THE AIM OF VITRECTOMY IS TO CLEAR THE ANTERIOR CHAMBER OF VITREOUS WITH NO TAGS IN THE WOUND. From side port pass the spatula below the wound & check the strands of vitreous & if it is there then remove it with Vitrectomy cutter or any other method, 25G or 23G Vitrectomy cutters are very useful in this procedures.

Can we do Phaco in Can-opener Capsulotomy?

Yes, in learning phase of Phaco you can easily do this.

1. Perform Can-opener Capsulotomy of about 5.5 to 6.00 mm size OR MORE PREFERABLY.
2. No hydro dissection should be done.
3. Learn sculpting in the area of Capsulotomy or endonucleus only **NEVER IN EPINUCLEUS**. See that you are not at all pushing whole lens down while sculpting, first press foot pedal fully & then only push phaco tip down so it will make a tract & will not push lens down. Make bowl by removing endonucleus (hardest part of lens). By this you will develop rhythm and co-ordination of right hand with legs and the left hand. Control of foot-pedal is achieved. Train left hand by writing ABCD with left hand. Left handed doctors can train their right hand by writing ABCD alphabet with right hand.
4. Now hydro dissection can be done.
5. Usually, the soft epinucleus remaining inside, will come in the centre. Remove it either by irrigation/aspiration or Phaco needle with high vacuum and lowest possible power.
6. Otherwise, slightly enlarge the incision from 3 to 5 or 6mm according to the size of optic of lens to be implanted and all lens material can be expressed out (viscoexpression).
7. After the lens matter is removed, IOL can be put in the bag/sulcus as per condition inside the eye.
8. After developing complete control of foot-pedal you can start capsulorhexis and complete Phaco in the bag.
9. Select the machine which is best in your hand. See which machine needed changes in their programmes in last 5 to 10 years.

What to do in Posterior Polar cataract?

Many surgeons mentioned that about 60-70% of posterior polar cataracts have dehiscence in posterior capsule.

With my experience I can definitely say that in Posterior polar cataract, posterior capsule is never involved. It can be weak or thin in that area but there is no hole in it. I have observed my own & other surgeons surgeries in presentations or in OT & found that surgeons are at fault. In 90s we did maximum ECCE surgeries without getting any trouble in posterior polar cataract. It is very difficult to get true posterior polar cataract.

Always START SURGERY BY MAKING EYE TOO SOFT & try to make optimum Capsulorhexis, you can do hydro dissection till you see the wave behind nucleus & proceed as usual. OR just do hydro delineation & remove endonucleus. Once endonucleus is out nothing will fall in vitreous. Slowly do hydro dissection now & remove it.

Nucleus drops only when your Capsulorhexis is small & you do more than required hydro dissection so forward movement of nucleus which blocks opening of the capsulorhexis & so fluid punctures the weak central posterior capsule giving rise to drop nucleus, this happens in brown cataracts also. Too much movement in AC during phaco will break posterior capsule.

Try to finish all your procedure quickly so that there is minimal breakdown in blood aqueous barrier & minimal damages to internal structures of the eye. Always try to remove total viscous material especially Methyl Cellulose by water Jetting method, this will reduce PCO rate, red eye postoperatively, synechiae in the eye & tender eye. Also keep some air in AC to maintain the chamber whatever type of surgery you are doing ECCE or Phaco. This will not allow conjunctival fluid to enter the eye by maintaining positive pressure in AC postoperatively which is contaminated & so prevents iritis, red eye & even endophthalmitis. As fluid leaks out easily, air is more resistant to leak. I have observed this & so commenting about it. Even I have done study of Endothelial count for effect of water jetting & air in AC & found no changes in count of the same. This will definitely change your results postoperatively. **SEEING IS BELIEVING** And now in all corneal surgeries AIR is used in AC. People who were objecting the Air in AC please comment! Also now we are using routinely Antibiotic in AC after completing surgery. As we do many surgeries at a time we prepare Moxisurge eye drops (or any other Preservative free Moxifloxacin eye drops) 5ml in 13-15 ml of BSS or RL solution which we inject in the eye at the end of surgery like water jetting in bag as well as in AC.

In my practice PCO rate is hardly 1% in 1st year. I attribute this to water jetting procedure I developed in 1995 & larger rhexis with standardization of Cataract surgeries in clinic.

Please wash SILICON Lens thoroughly before implantation by any way to prevent inflammation. We were getting some reactions with silicon IOLS, but after complete wash before implantations, reduced the reactions to ZERO.

Recently I read an article where the phaco hand piece has been blamed for endophthalmitis. This has really hurt me! Phaco procedure is totally one way system, irrigation fluid from bottle goes to eye via tubing & phaco hand piece & goes out via phaco hand piece & tubing to out & through wound. This never comes back & also phaco hand piece & tip uses ultrasound which act like sterilizing agent which even burns the wound, organisms will not survive. We have to find other cause for infections. If hand piece is not cleaned properly by technician then also surgeon is responsible for not keeping watch. Ideally all instruments should be cleaned as early as possible after finishing surgery. In our set up we too are doing large numbers of cataract surgeries by phaco. We (doctors) keep a strict vigil on sensitive aspects of infection control ourselves and not leave it to technicians. With this practice I have seen a low rate of endophthalmitis lower than reported in literature. I do not have a very large study to prove it but I repeat **ONCE AGAIN SEEING IS BELIEVING**. To my young colleagues in private practice I advise, take 5-10 min out and clean your own instruments. Your instruments are your wealth. This will save you a lot of stress. If you still do not have the time, then have surprise checks. I am sure you will learn a lot..... Remember a swordsman who goes on the battlefield always sharpens his own sword

You are welcome to see how we clean the instruments, maintaining, sterilization & handling & equipments for cleaning. It will save your time & money both & no tension after surgery.

If your result changes by water jetting, keeping air in AC at the end of surgery & sphincterectomy in case where vitreous is lost then please let me know, your reply will encourage me & I will be highly obliged.

Lastly I would like to say following:

Remove your big EGO from large ECCE wound to learn removal of cataract from small wound. Why we should feel shy or EGO comes in way to learn more & more from anybody. Remember your residency days, when we got to learn from ward boys. Drop your big EGO not Nucleus. Big EGO lies in "I" which stands like a wall whereas a flat I "I--I" make bridge between two people.

ALSO WE INDIANS WANT TO ACCEPT THE FACT WHEN WESTERN PEOPLE SAY THE SAME FACTS AFTER FEW YEARS. PLEASE LISTEN CAREFULLY ALL INDIAN OPHTHALMOLOGISTS & YOU WILL GET BEST

POSSIBLE KNOWLEDGE FROM THEM DUE TO LARGE EXPERIENCE & NOT WRITTEN IN BOOKS. AS OLD BOOKS WERE WRITTEN WHEN ALL DIAGNOSTIC EQUIPMENTS WERE NOT AVAILABLE, SO IN LAST 15 YEARS ALL THE ASPECTS OF OPHTHALMOLOGY CHANGED.

For instruments:

Please ask more & more senior doctors for opinions about equipments as soon as you clear the post graduation. As for many years you have worked in one institute you may not be aware of different variety of same equipments with better efficiency & modifications. So look for the best equipments, when you are investing in high value equipments. **Customization of instruments is the best though it is little expensive in beginning...**

Try to have best available in the world it will improve your skill & clinical judgments which will improve your efficiency. To get good ripe mangoes you have to invest the time & money. This will increase your practice more & help to recover your investment faster. When you buy car, always go for best then why to compromise for ophthalmic instruments. Car will eat your money whereas instruments will help to earn money for you. Recently one of our colleague bought microscope of the company which I was telling him not to go for it. Now he feels he did mistake & saved money is not worth.

ALWAYS TAKE BANK LOANS FOR BEST EQUIPMENTS, YOU NEVER PAY THE INTEREST ON YOUR LOANS. TO LEARN THE ECONOMICS OF BANK LOAN YOU CAN CONTACT ME, PROVIDED YOU WANT TO DO GOOD WORK WITH BEST AVAILABLE EQUIPMENTS.

You are welcome for any suggestions & comments and that would be my best Gurudakshina (as one pupil kindly suggested)

THIS WAS WRITTEN IN 1995 & REVISED FIVE TIMES IN LAST 16YEARS WITH EXPERIENCE & SO MANY POINTS ARE REPEATED OR MIXED UP HERE & THERE. (2011)

Thank you for your valuable time and hope you will get started now with sleeves rolled up! Best Luck.

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