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Inside the Cataracts Studio: Advanced Fluidics, Ergonomics, and Techniques for Complex Cases - Introducing Robotic SLACS

Dr. Scott:
Welcome. This is Wendell Scott and I'm really excited to introduce a new term for you called Robotic SLACS. Robotic SLACS—SLACS stands for sterile laser-assisted cataract surgery. This really represents the next generation of robotic laser cataract surgery, which is really advancing beyond what we've done with FLACS.

So what it is, actually, is the laser in the operating room with the seamless digital connectivity between the clinic, the preoperative testing, and the live surgery site itself. This really integrates robotic precision with the femtosecond laser technology to really automate key surgical steps. And in doing so, we're providing accuracy and customized outcomes for astigmatism and for multifocal, extended depth of focus lenses, toric lenses.

To really get into this, we want to talk about the indications for SLACS. And I want to present some videos for you of some of these things that we do in the operating room that really expand our capabilities.

Dr. Scott:
So this is a case of a dense cataract where we're doing arcuate incisions. You can see, when we first put the interface there, there were some bubbles. So you basically just go down and come back up to capture. You can see there's a little bubble on the edge, which in this case, and usually does not interfere with iris registration. And so this case with iris registration is initiating the OCT, and the iris registration occurs simultaneously.

Of course, we have the imaging from the anterior to the posterior, and you can see on the upper left that things are pretty stable. We have iris registration strong match at -12 degrees. And so our capsulotomy in this case is 4.9. Sometimes it can be a little larger for these dense cataracts. This is a scanned capsule centration for the arcs. And in this case, too, we'll need to adjust the main incision in the paracentesis.

I like to have just a little bit of darkness showed through from the iris. This is a very fast capsulotomy, and you can see in this case, too, that there are 8 segments, and I do that in these dense cataracts, and a grade 4 scale, being a grade 4 brunescent cataract. And I treat all of it that I possibly can.

So you can see by this like the time of the fragmentation is quite long. I've done this where I varied the settings and maximized how much energy can be delivered to the lens. And the limitation is really the gas coming forward. Because if the gas comes forward, it basically blocks the femto energy. And that's really the limitation of how much energy you can put into fragmenting the lens.

There you see now at 10, 8 seconds, there's a few little bubbles coming forward. So we know we've really maximized what we can do with the fragmentation. Our arcuates fill nicely with intrastromal gas, and you see the bubbles initiated at the beginning of the primary and at the end of the primary incision, knowing that we have a good penetration, both anteriorly and posteriorly. And the same thing there with the paracentesis.

All right, and so here's our entry into the paracentesis with a 25-gauge needle with the phenylephrine-lidocaine combination. I use my

second instrument, the chop instrument, to open the main incision. And this initially is just Healon that's placed. This is a really dense cataract, so you can't do so much the central dimple-down. In this case, you have to attempt the dimple-down, but if that doesn't work, you go to the periphery and you basically step along the periphery and make sure that that capsulotomy is complete. So you can see actually the capsule was free and actually just pushed out with some additional Healon in the anterior chamber.

So at this point, this cataract, it's not possible to do like an endolenticular viscodissection, so I'll do a compression chop. So I use my chop instrument nasally, and then a Bechert fork to go into the central segment line, bring it to the center of the lens, and then pull it apart, splitting the lens in two.

As you can see, some of the gas did come forward. So if that disrupts your view, I mean, you can always take that out before you proceed, but I usually try to get another section. So as you remember, this was 8 segments, so I basically have split one of those small segments off so that we can get that initial piece out and continue on with the removal of the nucleus.

I use EndoCoat in these cases. I don't always use it routinely, but I do when it's a denser cataract, and I know the amount of BSS infusion and/or phaco energy will be a higher amount. So this is high vacuum, low phaco energy. So vacuum is at 600 and the phaco power is at 1%. On some of these cases, we sometimes do have to go up to a higher amount, and that amount may be as high as 20.

So of course, getting that first segment out is key, and we will, in a hard lens like this, remove it really segment by segment. And it's really a good way, I think, to do it, just even as a standard procedure.

So here we're down to the last segment. Of course, this is where we want to be careful. And the second instrument is resting on the posterior capsule. And the angle formed between the tip and the capsule are critical in keeping it central and protected from the posterior capsule. So that's our last segment, and then we go with the INA and basically find the truncated edge near the capsule rim, capsulotomy rim, and just proceed along the edge of that.

Okay, so we've removed the cortex. We use the dilute Betadine and routinely intraoperatively, and then put the lens implant in. So the beauty of the iris registration is the fact that the arcs are exactly where they need to be, and it's one of the things that we will take a look at here at the end. So we'll hydrate the incision.

And so we do also have CALLISTO. So although you can't see it on this particular video, on the CALLISTO monitor at the end, we'll take pictures of the placement of the intrastromal relaxing incisions.

So this is an example of a dense cataract, and I hope some of the pointers of using the CATALYS for the purpose of doing these cases in a safe way is helpful to y'all. Thank you.

I mean, we all know hypermature cataracts are some of the most difficult, and certainly a lot of us have experienced that Argentinian flag sign. So I think looking at use of the femtosecond laser for this is important.

Here we have a femtosecond case of a hypermature cataract, and the liquid interface is in position. We verify the fluid, and there's no air bubbles that allows us to proceed with the OCT. And we can see the patient is doing great with very little movement on the Z and X and Y. When you see the OCT, you can see the liquefaction of the lens, and this is a really pathognomonic sign of hypermature lenses.

So here's our capsulotomy with a 5.2 diameter with the maximal pattern for the fragmentation. And in this case, we're taking out those because the iris registration had not located it properly. So as you see that capsulotomy, there's quite a explosion as the interlenticular pressure is released. So our fragmentation is complete, and we'll be taking a look at this under the microscope.

So we rotate the patient to the microscope and place our incision and paracentesis. And next will come the VisionBlue. And always a good idea to highlight the capsule and carefully inspect it, because of the nature of that pressure release. And it is definitely one of the advantages of using the femtosecond laser in hypermature cases, the fact that it can be done in a more safe way. But that doesn't mean that you can't have an issue. So staining the capsule and carefully inspecting it is really the next step.

So I usually put in Healon and then use the VisionBlue over the capsulotomy, using it basically to cleave the plane between the viscoelastic and the anterior capsule. Instilling additional Healon will help push the stained Healon out of the anterior chamber and leave the stained capsule in place.

Putting a little bit more Healon in now we're going to check and dimple-down on the capsule and look for any adhesions or any disruption of it peripherally. And I don't routinely use this, but I do on cases like this, because I really want to look at each part, and I see there's a little adhesion there. So it's like a little capsule sliver, and we can explain why that occurs sometimes. But in this case, it's an incidental finding, but one that we want to make sure is not going to contribute to problems later.

Now we'll use my chop instrument and a Bechert to perform the compression chop. And in this case, we compress the lens between the

2 instruments and then pulling them apart, separate the lens into 2 hemi sections. We can then use the same 2 instruments and to quarter the lens and facilitate removal. We're going to place some additional EndoCoat to protect the endothelium, stabilize the interior chamber.

So in this case, the lens comes to the tip right away, and we see we have a hemi section. We're using low power, like 1% phaco power, and a vacuum of 600. This is on Venturi vacuum to facilitate bringing the lens to the tip and controlling the amount of vacuum in the process as we go. So because we're using such a low power, we can remove this lens at the iris plane and not really place the endothelium at danger. So depending on the density, it really is an individual thing as far as how many lens segments it needs to be fragmented into.

But as it gets closer to the end, just keep in mind that using that second instrument and preserving that angle and keeping the tip in the circle of safety are important things to do to avoid any disruption of the posterior capsule.

So this lens slowly but surely everything is coming out looking good. And we just leave it there and let the tips come to us. So just performing some of the irrigation and aspiration, I noticed that the speculum is causing a small epithelial defect, so just use my finger to basically lift a little bit of pressure off that cornea as we finish the irrigation and aspiration.

So we're going to go ahead and place the intraocular lens. And the nice thing about this capsulotomy, so it is larger than our standard capsulotomy at 5.2 mm, but it still permits us to use the anterior capsule to capture the lens in the case of complication or problem. And I think that that's always, in these cases, an important thing.

You see that little capsule sliver down there, that's not something to be concerned about and, of course, more likely to occur when the settings are adjusted in these cases. So we pretty much have eliminated those for like routine cases, but it has to do really with the vertical spacing and the fact that when the white cataract is present, that is going to decrease the effectiveness of the femtosecond pulses of the capsulotomy posterior to the capsule. So we have to make that vertical distance less to make sure we get a nice cut. So we have a well-centered lens in a case of hypermature cases, and things are looking good. Thank you so much.

Dr. Scott:
Okay, so this is a 38-year-old that had a serious trauma from a fireworks injury. He had a total hyphema and a giant retinal tear, vitreal retinopathy. He had had previous retinal surgery and had this really complex anterior problem with a partially absorbed lens, silicone in the anterior chamber, and residual lens material. So there were synechiae of the iris that I freed up to better visualize the remaining capsule and lens. And so the idea here is to see if we can get a intraocular lens fixated in proper position.

So one of the advantages of doing sterile laser cataract surgery, or SLACS, is being able to do the capsulotomy even in the worst of circumstances, and do it accurately in a way that you can then use it to fixate the intraocular lens.

So we freed up all the synechiae. There's some silicone oil there, and that silicone oil needs to be removed prior to the laser, because it will block the laser pathway and the femto energy cannot get through that. So we've got that silicone out of the way now and have gotten things in a good position now to be able to see if it's possible to do a capsulotomy on this particular patient.

So we've already placed the main corneal incision and paracenteses, and have placed the interface in a way to avoid removing or placing pressure on those incisions and keeping the anterior chamber formed.

So now the OCT visualization starts coming through for us and we can see that there looks like there's a collapsed lens, if you will. And so we're going to have to be a little constructive here in deciding where the pupil should be and thus where we think our capsulotomy should be. And in this frame we're adjusting the pupil size and centration. So you can see the anterior capsule and there is no posterior capsule. So we either have to put that posterior capsule or, in this case, the software assumes where the posterior capsule would be or could be.

We've programmed in the capsulotomy, and we're going to look at that in more detail, as far as what kind of considerations you have to take into account for that, that are different than your standard capsulotomy.

So we have a pupil-maximized of 4.6-mm capsulotomy. We can see the position of where the incision depth is on the right-hand side. And we can see that we might also want to make some adjustments. So you can pretty much adjust everything on this laser, and you can see that we're moving the right-hand side up in order to place the capsulotomy incision depth where we want. And you can see then that it's going through the anterior capsule.

Now, that posterior, it's been ruptured at the periphery of the lens, or the posterior. We don't know the exact status there, and we really don't mind if we cut all the way through it, as long as we have a capsular complex that we can fix a ciliary haptic lens with the optic captured. So we're custom-centering the capsulotomy now. Okay, that's something else that you have the ability to do. You can base it

on pupil, limbus, scan capsule, or in this case, you can customize and place it wherever you want it.

So once placed, you can then again see the incision depth. And I placed it where we'll go through the anterior, and anterior only. You see the time of this capsulotomy is extraordinarily long, and the reason for that is that we've maximized the power, if you will, of the capsulotomy. Because in these fibrous cases, you really have to do that to attempt to cut through the tissue.

So to be more specific about the capsulotomy settings, let's just go through those. So for someone who has some kind of interference with the path of the laser, then our settings for like incision depth at 600, horizontal spacing at 4, vertical at 10, power at 8, those are standard for like if there's a corneal scar or there's some other pathology interfering with the capsulotomy. So in this case, and I've really taken it to the extreme and gone with the closest horizontal spacing, the closest vertical, and the highest power. So we're giving it all we can here to try to cut through this. And this understanding of how the vertical spacing and that kind of thing works, it is important in really deciding on all your capsulotomy settings, and it will greatly affect also the capsulotomy speed. And that's why this capsulotomy took so long, was because of these adjustments. So our normal capsulotomy with an incision at the 400 is 0.9 seconds, so under 1 second. So you can see such a huge difference based on those settings.

So we can see as we place some Healon in the anterior chamber, some of the silicone oil comes forward and the cortical soft lens also comes forward. So we're trying to create some space here before we aspirate that out.

So the eye is introduced and the lens material aspirated and the silicone oil aspirated as well. Interestingly, there was some posterior capsule intact, and the defect was in the periphery of the lens where the silicone oil was coming around.

There was a 2 o'clock hour part of the capsulotomy that was not complete. It's grasped in this case, traced along the intended area of the capsulotomy to complete it.

So the intraocular lens is injected into the anterior chamber and the capsulotomy now becomes the fixation for the optic as we get it into position. Then we'll just need to also then place the haptics in the sulcus. So the temporal haptic is grasped and torqued to place it in the ciliary sulcus. The nasal haptic is also compressed and placed in the ciliary sulcus.

So with the lens in position and taking care to maintain the anterior chamber of pressure, the silicone oil that's present is aspirated and the captured haptic acts as a barrier. And so it really illustrates how the capsulotomy using the laser can create a capsulotomy that's useful as a surgical tool, and we've used this, of course, in other instances, but it's a more unique application because of the fireworks injury and trauma, extensive anterior segment problems.

So thank you, and I hope this is helpful to you in some situations that can be challenging ones.

Dr. Scott:
Okay, so this is a case of a hyperopic patient with a shallow anterior chamber. And just really to help familiarize yourself with the adjustments that sometimes need to be considered for these. So as the OCT imaging is coming into view from the anterior to the posterior, you can see right away that this is a very shallow chamber, and you can see by where the corneal placement that it's very shallow peripherally as well, which means that it measures the limbus in a different position and anterior chamber depth is 2.2 mm.

So this is actually like one of the reasons the femto is an advantage in these cases, because it can be difficult capsulorhexis is to do. Now you can see, I'm taking the incisions out, and the reason being that it will not really measure the limbus accurately because of the safety parameters that are placed so that you don't hit tissue in an unintended way, which peripheral incisions could do. So be mindful of taking those incisions out when they're not going to be useful for you.

And so I think that's really the main point of the video. And in my case, and I usually use a 25-gauge needle to create the paracentesis and filling the anterior chamber with viscoelastic or, as I commonly do, even in this case, I'm able to just go and make the primary incision. But I would say it's probably a good idea to fill it with viscoelastic prior to that main incision. But very shallow chamber and always creates a little bit more of a challenge for getting the phaco tip in and getting the case done. But this case proceeded routinely. And I really just wanted to point out a couple things on that first part, during the OCT imaging and the femto application.

Dr. Scott:
So this is a case where there are obviously some radial keratotomy scars and we are wanting to place a toric IOL. So the iris registration in this case is something we hope is going to work for us, because this is going to make it more accurate.

So you can really, like, when the OCT on these RK patients, look how flat that is centrally, it's very impressive. And the tech in this case had left the incisions in. Now, I usually do take them out and just do them manually, although it is possible to just rotate them as needed. So the iris registration didn't work and the orientation cornea marks are in good position, but the peripheral incisions are not going to work for us.

So this is also scanned-capsule centration, which should line up with what appears to be the center based on the radial keratotomy scars as well. So here's our lens fragmentation, followed by the 2 little radial corneal marks.

Dr. Scott:
All right, and so the lens is in position. We're going to make some little minor adjustments here. And this is an Eyhance Toric, so we want the centration to be in that central 1-mm zone. And so we basically carefully want to align this with the corneal marks, and looks pretty good at that point. So it's very good.

So you do gain efficiencies with SLACS. By having the laser and doing the surgery in one sterile setting, you really minimize patient transfers and you reduce the time between the laser treatment and the start of the surgery, which means really that the laser treatment itself doesn't have an effect on pupil size. So using the laser intraoperatively is like using it as a surgical tool and allows you to do things, for instance, like inserting a pupil ring.

Integrating the preoperative diagnostics, such as iris registration, takes the guesswork out of marking for the toric alignment by providing the laser marks on the corner of the capsule. So using the laser for the incisions and capsulotomy and lens fragmentation allows you to customize and personalize the treatment for the patient. With SLACS, you use less phacoemulsification energy.