



**REACHING
NEW PEAKS in
*Ophthalmic Surgery***

Highlights of select presentations on new techniques and controversies in cataract and refractive surgery from Park City.

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Postgraduate Institute for Medicine

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TARGET AUDIENCE: This activity has been designed to meet the educational needs of ophthalmologists involved in the management of patients undergoing ophthalmic surgery.

STATEMENT OF NEED: The comprehensive ophthalmologist deals with a variety of anterior segment diseases and conditions on a daily basis. From cataract to glaucoma, ocular surface disease to refractive errors, the diagnostic and therapeutic tools available are numerous. As technology continues to advance, the continual emergence of novel therapies—from new drugs to innovative surgical approaches—presents ophthalmologists with an ever-changing array of options for the evaluation and management of patients with anterior segment issues.

Ophthalmology is probably unique among the medical specialties in the rate of change in technology, techniques, and clinical practice. The perpetual expansion of tools and techniques necessitates ongoing education to aid physicians in incorporating these new modalities into routine clinical care. This educational activity will provide the latest information about advanced phacoemulsification technology and techniques, IOLs, and refractive, corneal, and glaucoma surgery.

EDUCATIONAL OBJECTIVES: After completing this activity, the participant should be better able to:

1. Implement the newest techniques in cataract, refractive, and glaucoma surgery.
2. Evaluate a cataract surgery patient for premium IOLs and be able to present the best option.
3. Identify risk factors for failure with premium IOLs.
4. Outline the newest changes in the field of femtosecond cataract surgery, the newly approved platforms, and their relative merits and disadvantages.
5. Utilize the best surgical approach in challenging cataract cases.
6. Discuss the newest glaucoma surgical tools and their proper use.
7. Explain the many options in corneal surgery and the differences among the many lamellar interventions.
8. Employ strategies to fine tune modern LASIK surgery and patient selection.
9. Discuss management of the “unhappy” LASIK patient and the potential causes.
10. Put into practice the new options in the management of glaucoma.

FACULTY: Garry P. Condon, MD, is chairman of the Department of Ophthalmology and Director of the Division of Glaucoma Services, Allegheny General Hospital, as well as associate professor of Ophthalmology at Drexel University College of Medicine. Alan S. Crandall, MD, is president of the American Society of Cataract and Refractive Surgery, director of Glaucoma and Cataracts, as well as clinical professor of Ophthalmology and Visual Sciences at the University of Utah School of Medicine. David Crandall, MD, is a staff ophthalmologist with Henry Ford Eye

Care Services Department of Ophthalmology. Richard S. Davidson, MD, is an associate professor and vice chair for Quality and Clinical Affairs at the University of Colorado Eye Center. Robert C. Kersten, MD, is professor of Clinical Ophthalmology and Ophthalmic Plastic and Reconstructive Surgery at the University of California, San Francisco. Douglas D. Koch, MD, is The Allen, Mosbacher and Law Chair of Ophthalmology, as well as professor of Ophthalmology at Baylor College of Medicine. Stephen S. Lane, MD, is an adjunct professor of ophthalmology at the University of Minnesota and a visiting faculty member of ORBIS International. Samuel Masket, MD, is clinical professor of Ophthalmology at the David Geffen School of Medicine, Jules Stein Eye Institute, University of California, Los Angeles, a past president of the American Society of Cataract and Refractive Surgery. Irving M. Raber, MD, is an associate surgeon at Wills Eye Hospital, an associate at Lankenau Hospital, a clinical assistant professor of surgery at Thomas Jefferson University Hospital, an attending surgeon at Graduate Hospital and a clinical assistant professor of Ophthalmology at Allegheny University of the Health Sciences. Mitchell P. Weikert, MD, is assistant professor of Ophthalmology at Baylor College of Medicine.

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GREAT MINDS DON'T ALWAYS PRACTICE ALIKE

THINGS CANNOT CHANGE AND IMPROVE if they stay the same. That is why it is sometimes necessary to break away from the mainstream and try a different approach. If an alternate approach doesn't turn out, then hopefully a lesson of some sort can be learned. Whether an off-label use or an alternate approach or simply trying out something brand new, it doesn't do anyone any good if the details aren't shared.

Now in its 25th year, the 2014 Reaching New Peaks in Ophthalmic Surgery meeting (formerly the Park City Symposium) continually strives to provide an environment in which cataract and refractive surgeons can share their experiences and knowledge as well as openly discuss new techniques, controversies and more. Course director Alan S. Crandall, MD, and co-directors Douglas D. Koch, MD, and Stephen Lane, MD, were actively involved as session moderators and presenters. The following pages contain the highlights of presentations from the meeting that these respected physicians found particularly interesting. It is hoped that you find valuable information within this content and that you are able to apply it to your own procedures.

Coexistent Glaucoma and Cataract

According to Garry P. Condon, MD, the current glaucoma buzzword is microinvasive glaucoma surgery (MIGS), which is cataract plus when combined with phacoemulsification/intraocular lens (IOL). Small-incision phacoemulsification and traditional trabeculectomy are two time-proven surgeries, but combining them invites the potential for undesirable complications, he explained.

Ideally, performing a MIGS glaucoma procedure with cataract extraction will only minimally increase the risk of complications, require minimal additional manipulation, and use the same incision. We continue to strive to increase the effectiveness of MIGS procedures and reduce the surgical learning curve.

Below is a rundown of the MIGS devices that Dr. Condon discussed.

The Hydrus Microstent (Ivantis) is an intracanalicular scaffold for the treatment of primary open-angle glaucoma (POAG) that can be performed during cataract surgery using the same microsurgical incisions. In the United States, it is only available for clinical investigational use right now. The Hydrus Microstent dilates Schlemm's canal for roughly three clock hours in the nasal quadrant, is open on the back side and fenestrated windows on the meshwork side. It is a true blue canal device—you can't put it

in the wrong location; if it's not in the canal, then it's sitting on the iris or on the floor because there's no place else in the eye for this to go. The inserter is 8-mm long, has a spade-like tip and a snorkel at the tail end, which sits in the anterior chamber and allows fluid direct access into the scaffold-opened area.

In a six-month prospective European Trial¹ of Hydrus surgery alone (n=40) and Hydrus combined with cataract surgery (n=29), there was a 21.8 percent reduction in IOP for device only, compared to 26.1 percent reduction in IOP for Hydrus surgery plus cataract IOL.

“With infusion, the ophthalmic viscosurgical device can come out pretty rapidly, so I hang the bottle high. That way, no matter what, I still have a nice clear view of the landmarks.”

—Garry P. Condon, MD

The CyPass Micro-Stent (Transcend Medical) is an investigational micro suprachoroidal stent. It's a polyamide and has microperforations or fenestrations all along the tube of the device. The tip opens up the gap between the sclera and the iris and the retention ring keeps it locked at the point where the ciliary

body fuses to the sclera or scleral spur. The CyPass uses an ab interno approach through a small incision and spares the conjunctiva, sclera and trabecular meshwork. According to Dr. Condon, it really represents a controlled cyclodialysis.

In a multicenter study of 81 patients by Transcend Medical, there was a mean decrease of 29 percent in IOP and two intraoperative hyphemas, so it is really a nontraumatic event.² There's currently a Phase III FDA trial underway (COMPASS). A total of 505 cataract patients with mild to moderate glaucoma have been enrolled and will be followed for two years.

The Trabectome (NeoMedix Inc.) is a minimally invasive surgical device that can be used for ab interno trabeculectomy. It's done under infusion, which is nice because if there is any blood, it washes away. Of all of these devices, only the Trabectome is FDA approved for more advanced glaucoma and without limitations.

“With infusion, the ophthalmic viscosurgical device can come out pretty rapidly, so I hang the bottle high,” Dr. Condon explains. “That way, no matter what, I still have a nice clear view of the landmarks.”

The iStent Trabecular Micro-Bypass Stent (Glaukos Corp.) is an FDA-approved trabecular micro-bypass technology that improves the eye's natural fluid outflow to safely lower eye pressure by creating a permanent opening in the trabecular meshwork. It is



implanted through a clear corneal incision using a disposable inserter. A study by Samuelson, et al, compared reduction in IOP following iStent implantation and cataract extraction (n=100) versus cataract extraction alone (n=106).³ Change in IOP from washout baseline to one year: mean (SD) was -8.4 mmHg (3.6) for iStent + cataract and -8.5 mmHg (4.3) for cataract extraction only. Another study compared the same for two years and found the change in IOP from washout baseline to two years: mean (SD) was -8.3 mmHg (2.9) for iStent + cataract (n=98) and -7.4 mmHg (3.3) for cataract extraction only (n=101).⁴

GENERAL ADVICE

Dr. Condon shared that for any of this, gonioscopy is key, and being able to identify your landmarks is important. However, the view of the angle can be significantly different than at the slit lamp when you're in the operating room, particularly if you've just done cataract surgery on the eye and the cornea is less than clear. Guttata have an incredible effect on the ability to identify and really see clear detail in the angle structures. Blood reflux in the Schlemm's canal can also be helpful, but is not always present.

Dr. Condon also noted that the fulcrum of the implantation process with any of these devices is really at the corneal incision, and not in the pupil or central zone;

therefore, the angle of attack increases the further away you go from that straight-ahead view, and so the tendency to sort of "dig" things into the angle is unavoidable.

1. Tetz M, et al. Presented at: ESCRS Annual Meeting; Sept. 2011; Paris.
2. Ianchulev T, et al. Presented at AAO; 2010; Chicago.
3. Samuelson TW, Katz IJ, Wells JM, et al; US iStent Study Group. Randomized evaluation of the trabecular micro-bypass stent with phacoemulsification in patients with glaucoma and cataract. *Ophthalmology*. 2011;118(3):459-467.
4. Craven ER, Katz IJ, Wells JM, et al.; iStent Study Group. Cataract surgery with trabecular micro-bypass stent implantation in patients with mild-to-moderate open-angle glaucoma and cataract: two-year follow-up. *J Cataract Refract Surg*. 2012;38(8):1339-45.

iPhone Slit Lamp Photography and Surgical Videography

Baylor College of Medicine assistant professor Mitchell P. Weikert, MD, in collaboration with Christian Hester, MD, covered the topic of ophthalmic photography and videography. He pointed out that it is increasing in importance and utility with the adoption of electronic medical records (EMRs), so the more physicians can do with photography, the better off they'll be. Of course, your typical photographic equipment is a bit expensive and cumbersome and requires dedicated space and trained personnel. Fortunately, smartphones offer a cheaper and

more flexible alternative, and Dr. Weikert explained how. He recommends a minimum of 5 megapixels, but adds that "really, the more the better." He also pointed out that a telephone contract isn't necessary to use a phone's camera as long as you have wi-fi connectivity.

ADAPTORS & APPS

Dr. Weikert uses a slit lamp adaptor from EyePhotoDoc (Haag-Streit BQ and Advanced I-Illuminator), which goes directly over the slit lamp ocular. It has a little post so you can put it on the left ocular and it stabilizes it so it sits nice and horizontal (or vertical, but you get a little bit more real estate for your efforts in landscape mode). He shared that, with a light, it costs about \$500, which, in the grand scheme of ophthalmic photography, is not that expensive. The adaptor without the light costs about \$350 and is available for iPhones as well as the iPad and iPad mini.

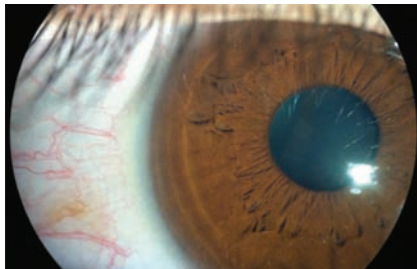
He pointed out that Zarf Enterprises and OculoCAM also have adaptors for iPhones and Android devices and noted that if you're more of a do-it-yourselfer, you can create your own adaptor with the cap from a Gillette shaving foam travel pack container, the rubber disc from an empty CD stack box and rubber-based adhesive.

According to Dr. Weikert, ProCamera has a versatile, but inexpensive photography app. "The advantage of the ProCamera app," he says, "is that it allows you to separate your exposure and focus and

SURGICAL VIDEO PROGRAM BUILDS CONFIDENCE WITH UNFAMILIAR PROCEDURES

David A. Crandall, MD, of Henry Ford OptimEyes Super Vision Center in Troy, Mich., spoke to attendees about a program he is putting together with colleagues. The program is a website and an app that contains short (three minutes or less), educational videos that summarize key points and pearls in surgery. "The idea is for surgeons to review a video—either online or on their mobile phone—of an unfamiliar procedure before or during surgery to gain some confidence performing it themselves," he explained.

Right now, Dr. Crandall says the program is mainly an educational tool for residents, but in time, they'll add increasingly complex topics. The basic categories will cover every step of cataract surgery, including subcategories such as different ways of implanting three-piece lenses or putting in anterior chamber lenses with forceps and without. He clarified that the program won't show full cases or perfect cases, as the point is to expose surgeons to simple procedures they will realistically run into. Additionally, all videos will be reviewed before being added to the site and the ultimate goal is to have it hosted on the American Society of Cataract and Refractive Surgery's website.



Difference in photo quality between five-megapixel iPhone 4 (left) versus the eight-megapixel iPhone 4s (right).

move them independently.” He also made a point about illumination, noting that, “if you just use a slit lamp and you put the broad beam on, you can’t light the whole area of the eye. It’s about 8mm maximum.” But, he explained that if you put a diffuser on and flip it up, you can get broader illumination. He added that a transilluminator works really well, explaining that you can hang it on the dial for the slit lamp or have a scribe or tech hold it for you. Or, you can use a clip-on light source. His transilluminator is from EyePhotoDoc, and he says it has a blue light and a white light, allowing him to also do some fluorescein photographs. Additionally, the instrument also has a little rheostat, so he can vary the illumination.

THE VALUE OF VIDEO

Before ending his talk, Dr. Weikert commented that taking a slit lamp video is helpful—especially in the operating room (OR). “We all know that just seeing a static image is not always as valuable as seeing motion and being able to maneuver the light,” he said. The ProCamera app is capable of shooting video as well as taking still photographs, and you can do that

with the app in the iPhone as well. The Magnifi iPhone photoadapter case is useful in the OR, and he says it fits well on a Zeiss scope with f125 oculars. Orion also has an adapter (Orion SteadyPix Telescope Photo Adapter) that clips onto the ocular and works well with a Leica M840 scope.

TAKE-HOME POINTS

iPhone slit lamp photography and videography is a nice, inexpensive, portable and efficient alternative for ophthalmic photography, Dr. Weikert concluded. He added that physicians can bill for it just like any ophthalmic photography, and said it can be used to review surgical videos, etc. “It may be applicable in telemedicine, as you could FaceTime with it,” he postulated. “And it might be useful for screening clinics that are manned by nonMDs.” Keep HIPAA in mind, Dr. Weikert cautioned, and don’t record any images with identifying information (e.g., facial picture, date of birth). You can use the medical record number to reference images. His final advice: don’t underestimate using the zoom feature on your iPhone when it’s on the eyepiece. “Just remember, you’re doing a digital zoom—

not an optical zoom, so you may lose a few pixels,” he said.

IOL Calculations: Why We Can’t Get Any Better

“These days, patients expect painless, complication-free surgery at minimal cost and with instant excellent uncorrected visual acuity and minimal downtime,” Mitchell P. Weikert, MD, began his second presentation. Thus, he submitted, good, accurate intraocular lens (IOL) calculations are absolutely necessary for meeting patients’ expectations.

Dr. Weikert said that when many ophthalmologists consider IOL calculations, the formula is sort of a big black box. “We take measurements and enter them into the calculator, which spits out the lens power that we’re supposed to implant in our patient,” he stated. He believes it’s valuable to look into this black box because it contains other black boxes that have limitations and make assumptions that can effect our results. But first, Dr. Weikert discussed IOL power calculation formulas.

IOL POWER CALCULATION FORMULAS

“Most of the current IOL calculation formulas that we use today are still based on geometric optics and principles derived in the 1960s and 1970s,” he admitted. “We have the refractive index outside the eye and a single refractive index inside the eye,” he continued. “And we have our target refraction, the corneal power and the power of the IOL with our image targeted on the retina.” Several distances must also be considered: the vertex distance from the target refraction to the eye, the anterior chamber depth (ACD) from the anterior corneal surface to the lens plane, and then the axial length from the interior corneal surface to the retina. So this formula models the eyes as three refractive surfaces represented by the target refraction, the cornea, and the IOL power.

As Dr. Weikert noted, basically, you have light coming into the first surface, which creates an image that becomes the object for the second surface, which creates an image that becomes the object for the third surface,



Transilluminator (left) and clip-on light source (right).



which hopefully is on the retina. “That gives us the vergence formula,” he added, “which is the basis for the most common IOL calculation formulas used today.”

He noted that the effective lens position (ELP), true corneal power, index of refraction, and the axial length are all other black boxes, which he went on to discuss.

THE “OTHER” BLACK BOXES

ELP. This is the estimate of the position where the IOL will sit in the eye. It’s not a physical distance; it’s the effective refractive plane of the lens. Dr. Weikert noted that ELP changes with axial length, so this black box has a lot of potential for improvement. The following formulas rely on ELP.

Dr. Weikert explained that the Holladay 1 formula is based on corneal height and increases the base of the cornea proportionally with axial lengths, according to average axial lengths and average angle-to-angle distances. He added that it also includes the surgeon factor (an optimization constant), which is the difference between the corneal height and the effective IOL plane. He explained that the Holladay 1 has a very shallow linear relationship, as ELP increases with axial length. He then pointed out that one source of error lies in the fact that although ACD will increase as the eye gets bigger and the axial length increases, the surgeon factor is a constant number and thus stays the same.

The SRK/T formula uses the same model, Dr. Weikert noted. “It changes how it increases the base of the cornea depending on the axial length,” he explained. “The SRK/T formula has something called an offset, which is basically the same as the surgeon factor. The SRK/T offset can be calculated from the IOL’s A constant, so you can directly convert an A constant into a surgeon factor for ELP.”

He finished the roundup of formulas with the Hoffer Q, an empiric derivation dependent on axial length and corneal power to create a personalized A constant as its optimization factor, and the Haigis, another empiric derivation, that is a linear model that depends on axial length and preoperative ACD rather than on corneal power.

“All of these ELP formulas are different,”

Dr. Weikert pointed out. “But they all get put back into that same Binkhorst equation. And because they all have different shapes, so you would expect them to produce very different results when put into that same equation.”

Corneal Power. He reminded attendees that most commonly, corneal power is measured indirectly via an image reflected off the tear film. “The radius of curvature is then calculated from this image,” he added.

“Most models assume that the cornea is a spherocylinder,” he continued. “We also have to take into account the fact that the size of the zone that we measure varies from device to device, and those zones will vary with the curvature.” Dr. Weikert explained further that a flatter cornea is going to measure a larger area, and a steeper cornea is going to measure a smaller area. “And we implant those results back into the same formulas,” he noted. “Most devices that we typically use still measure the anterior surface only and reduce the index of refraction to account for the negative value of the posterior surface. And they assume a fixed front-to-back curvature ratio for the cornea. Corneal power also varies with pupil size,” he reminded his colleagues.

Index of refraction. The cornea is a prolate surface, steeper in the center, flatter in the periphery. “When you have incident light coming in, overall the effect is to have positive spherical aberration of the cornea with peripheral rays are refracted more strongly than paraxial rays, so you end up with a little overall myopic shift as you sample larger areas of the cornea,” Dr. Weikert explained.

In the United States, ophthalmologists use 1.3375 for our keratometers, which simply models the cornea as the sum of two refractive surfaces with a curvature ratio equal to the Gullstrand ratio. In Europe, they use 1.3315 because their model factors in the corneal thickness. Newer devices can measure the front and back cornea, but they rely on measuring elevation, which is more difficult to do because you need much higher resolution to extract curvature information.

Axial length. This is one of the most

critical steps in calculating IOL power, according to Dr. Weikert. “Small errors can have large effects on our postoperative results and errors about 0.1 mm can have 0.27D+ of error in the spectacle plane,” he stated. “Optical biometry has really improved this over the last few years. It’s non-contact; we have high resolutions. But compared to ultrasound, we’re measuring different distances.” He explained that with optical biometry, we are measuring to the retinal pigment epithelium, whereas with ultrasound, we’re only measuring to the internal limiting membrane. Fortunately, the machines take that into account and compensate for it.

Dr. Weikert advised the doctors in the audience to remember that these optical biometers are calibrated to ultrasound, which is calibrated to an average population of patients, and pointed this out as another source of error. He explained, “You’re taking a direct measurement and changing it to agree with a bunch of other patients who are going to have variation in and of themselves.”

IOL Design. This is the final black box Dr. Weikert spoke about. The refractive effect of an IOL depends on the shape of the front and back surfaces, asphericity etc., where the lens lies in the eye, the index of refraction, refractive power, the thickness of the lens, the spherical aberration, and the manufacturing tolerance. He noted that the International Standards Organization permits up to 0.3 up to 1.0D of error in a lens, though he added that he believes manufacturers have a much tighter tolerance than this.

WHAT NEEDS TO HAPPEN?

In conclusion, Dr. Weikert admitted that unfortunately, there will always be error in our measurements. He added that, “the biggest hurdle is predicting the postop position of the IOL. We need better formulas that more closely model the human eye, and we need to go beyond the paraxial approximation. We also need to account for aberrations and implant an accurate corneal power. I think the ultimate answer may lie in postop adjustment of the cornea or the IOL power.”

New Approaches and Insights for Toric IOLs

Douglas D. Koch, MD, was the moderator of the session on intraocular lenses (IOLs). He also gave a presentation specifically on toric IOLs with suggestions regarding what surgeons could do before, during and surgery.

BEFORE SURGERY

“We have many ways to measure,” he began, explaining that we have four points of measurement with the keratometer, six points with the IOLMaster (Carl Zeiss), 32 points with the Lenstar LS900 (Haag-Streit), and hundreds of points with topography. “Unfortunately, the more you measure, it seems the less you know!” he admitted. “In some eyes, there’s a lot of variability in these measurements.”

Dr. Koch said that if you look at the IOLMaster’s K readings and you see empty boxes, then you know it measured all six points, but any Xs represent points that the machine did not measure and does not trust.

With the Lenstar, he explained that you can look at the six measurements and identify any outliers. “If you eliminate any big deviations, all of sudden it cleans it up and is quite consistent,” he noted. “You might have some hesitation about eliminating a data point, but if the others are consistent, then getting rid of that outlier is reasonable.” We can somewhat reproducibly measure the anterior corneal surface, and we can measure the posterior corneal surface, though not very accurately, Dr. Koch acknowledged. “And if there is with-the-rule (WTR) astigmatism on the front, then the steeper the surface is on the front and you can get up to 9.9D of astigmatism on the back surface of the cornea, which is a lot. Conversely, with against-the-rule (ATR) astigmatism on the front, if it’s steep horizontally, then there isn’t much change (up to 0.50D) on the back surface of the cornea.”

To take into account the fact that our eyes shift ATR, Dr. Koch recommended that we have a target of just slightly creating WTR astigmatism up to 0.4D. That’s because IOLs

come in half-diopter increments, and some of them will be up to that much. For most eyes, he noted that the anticipated amount is lower. “To take into account posterior corneal astigmatism, in a clinical study we found that it creates about a half diopter on average in WTR of corneas, but more on the steeper ones, and 0.3 in the ATR corneas.

Effective toricity of the IOL. According to Dr. Koch, this is another important factor, and it varies depending on the lens’s power and where it sits in the eye. “So if you have a low power IOL deep in the eye,” he continued, “then the effective toricity can be lowered by as much as 0.3D or more.” He said that the Holladay II or AMO’s toric calculator can be used for this. Alcon’s toric calculator will soon have it as well.

Surgically induced astigmatism. This also needs to be factored in to your measurements, Dr. Koch stressed. He developed a nomogram where everything is basically shifted up by 0.7D, so he doesn’t use a toric lens unless the patient has up to 1.7D of WTR astigmatism. “Otherwise, I’ll use a relaxing incision, and if they only have 0.9D, then I don’t do anything at all,” he explained.

For ATR patients, it’s the opposite, he said. “I’m much more aggressive in using toric lenses, and if the patient has 0.8D of ATR astigmatism, then I’m going to use the AcrySof IQ T4 (Alcon) or the AMO ZCT225. And I may even put a toric lens in if the patient has 0.4D of ATR astigmatism.” He also pointed out that if it’s in the glasses, the measurements are consistent, especially if the glasses have more ATR astigmatism.

DURING SURGERY

While in the midst of surgery, physicians are now able to align things better, Dr. Koch revealed. He then listed the five systems available for alignment:

1) **The iTrace Ray Tracing Wavefront Aberrometer and Corneal Topography** (Tracey Technologies). He pointed out that this instrument is somewhat manual. “You have to have a notebook computer, but you can find vessels, get it aligned, and it will tell you exactly where to put the implant,” he adds.

2) **The Callisto eye** (Carl Zeiss Meditec), which is automated. Dr. Koch noted that it is

based on the IOLMaster, which, he reminded the audience, has only six points.

3) **TrueGuide** (TrueVision) powered by TrueVision Smart 3D creates an IOL calculator with incision guidance and lens positioning on the eye during live surgery. Data are provided to the TrueVision device by the Cassini (i-Optics). This is a topographer that has red, yellow and green LEDs, so it has some potential advantages in doing measurements, according to Dr. Koch. He explained that the LEDs are reflected off of the cornea, which creates a topographic map. At the same time, the machine takes an image of peripheral vessels, so when you get into the operating room, you align the circle with the limbus at the start of surgery and it locks right in and tells you where the steep axis is so you can mark it. “The software continues to evolve, and it’s pretty intriguing and very quick and easy,” he noted.

4) **The Verion Image Guided System** (Alcon), which appears to be a very sophisticated approach that helps with patient imaging, procedure planning and surgical guidance.

5) **Intraoperative aberrometry.** Devices such as the ORA System (WaveTec Vision) are used by many surgeons for intraoperative toric IOL measurement and alignment. Dr. Koch also mentioned that the Holos IntraOp (Clarity) wavefront aberrometer may also be something to consider in the future.

AFTER SURGERY

Dr. Koch listed options available to surgeons postop, such as relaxing incisions, photorefractive keratectomy, IOL rotation, IOL exchange, or the light-adjustable lens developed by Calhoun Vision, among other interesting technologies coming along. He uses an app on his phone called Eye Vectors that calculates error. He also pointed out that most surgeons are aware of the Berdahl & Hardten toric IOL calculator, which is a website where you can enter the current refraction where the IOL is aligned and it tells you just what to do and what to expect.

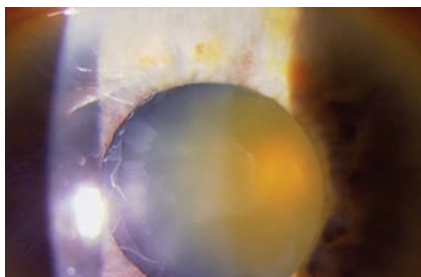


Stress-Free Phaco in Pseudoexfoliation

Garry P. Condon, MD, was slated to give several presentations at the meeting, and he was certainly ready to share. In this particular lecture, he informed the audience that he was going to talk about five lessons he learned the hard way while taking care of pseudoexfoliation patients.

But first, he provided some background. Pseudoexfoliation syndrome (PXS) was described by Lindberg in 1917.¹ It is a systemic condition and is always bilateral. “For the anterior segment surgeon,” he said, “PXS encompasses all (e.g., glaucoma, cataract, endothelial loss, complex intraocular lens [IOL] surgery, etc.), and for the posterior segment surgeon, it means a retained lens and/or late IOL issues.” Dr. Condon pointed out that pseudoexfoliation glaucoma (PXG) is different than primary open-angle glaucoma for several reasons: damage progresses more rapidly in PXG; there’s typically more severe disc damage at the time of diagnosis in PXG; and PXG typically requires surgery more frequently.²⁻⁴

He says that the past 25 years have been a love-hate, yet practice-shaping relationship. Below are the important lessons about PXS that he has learned over these years and feels compelled to share.



Clinical image of pseudoexfoliation syndrome.

Lesson #1: Pseudoexfoliation Produces the Meanest Form of OAG

Dr. Condon explained that PXS is more likely to cause damage than primary open-angle glaucoma (POAG) for any given intraocular pressure (IOP). And

with PXG, there’s higher peak IOP and worse IOP fluctuation than POAG; hence poorer outflow and more susceptible disc.⁵ “These patients need lower pressures, much closer monitoring, and they need surgery more often than patients with POAG,” he adds.

He continues, noting that a two-year prospective study by Damji, et al. indicates that cataract surgery in patients who have pseudoexfoliation—and particularly those with PXG—have the biggest IOP-favorable response.⁶ It looked at IOP following phacoemulsification in patients with and without pseudoexfoliation. The results: overall, IOP reduction was greater in PXS than non-syndrome (-1.85 mm vs. -0.62 mm $p < 0.004$) and even greater in PXG than POAG (-3.15mm vs. -1.54mm $p < 0.03$).⁶ “So doing cataract surgery earlier in these cases I think is something we all advocate for now,” Dr. Condon noted.

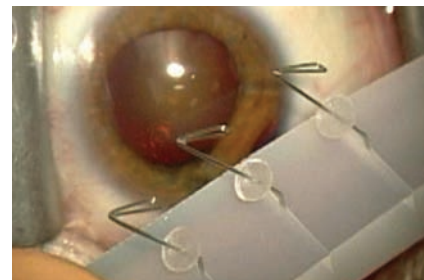
When dealing with pseudoexfoliation, you need zonule support, he continued, which leads to the next lesson.

Lesson #2: Take the Stress Off You and the Zonule

According to Dr. Condon, iris hooks, MacKool capsule supports, MST capsule retractors and capsular tension segments can be safely placed prior to phacoemulsification. He points out that while the use of simple iris hooks can assist with stabilizing the bag, they easily dislodge and the posterior capsular bag remains lax/redundant. And as far as capsular tension segments, he recommends that standard or modified (Cionni) capsular tension rings (CTR) be avoided.

The basic lesson here he said, is: use better available capsule support. He explained that while “Dual Ahmed segments are good, it’s an expensive proposition to open up two Ahmed segments to get the ultimate capsule support”. He says he typically uses Micro Surgical Technologies (MST) capsule retractors, which have a longer “loop” design and a duckbill appearance.

“They tension the posterior capsule



Dr. Condon relies on three MST capsule retractors to improve capsule support.

because they extend to the equator, and you can put them in at any time,” Dr. Condon offered. He admitted that when dealing with a loose zonule and tremendous laxity in the capsular bag, the challenge is getting a big enough rhexis done so that you can complete the dense cataract case without the anterior rhexis edge becoming a problem. He has found that by using three MST capsule retractors, he gets nice tensioning of the posterior capsule and remarkable bag stability for the case. “I think the three-prong approach might produce a more evenly tensioned capsule than adding a fourth one,” he explained, so he doesn’t think it’s necessary to use four. “The idea here is to get adequate tension of the posterior capsule while also taking stress off the zonule and obviously yourself while you’re doing this,” he added.

Next, he asked about cortical clean-up.

What About Cortical Clean-Up?

Radial or tangential: is there an optimal approach? “With pseudoexfoliation and these really delicate zonules, is there any way to reduce this potential problem,” Dr. Condon asked. “What about a CTR? It’s not routine for me and it won’t prevent dislocation, but it may help re-fix and I’ll put one in if the bag is very redundant,” he answered, continuing that, “There are no hard-and-fast rules about CTRs, but they can certainly have downsides, and one of the problems is you’re dealing with a bag that’s super large in size.” He went on to explain that the bag has to be blown up firmly; otherwise, as the ring goes in, it will catch the ridge of



the bag, completely tearing the equatorial part of the bag apart.

Lesson number three has to do with pseudoexfoliation and CTRs.

Lesson #3: A Ring is Not Always a Wonderful Thing

Dr. Condon kept this pearl short and sweet: in pseudoexfoliation, CTRs aren't always so great, although you can undo them from the start. "And in my experience," he said, "a male in with pseudoexfoliation in the operating room is more likely to have problems than a female with pseudoexfoliation, even though females tend to get late IOL dislocation."

The last two lessons are a bit similar, but they are good points.

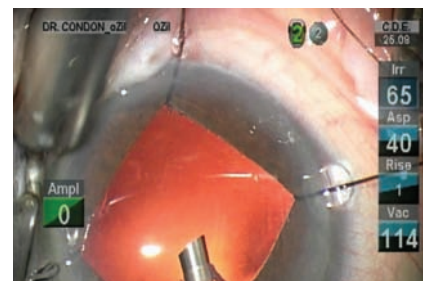
Lesson #4: Know When You've Met Your Match

Obviously you want to do everything you possible in the best interest of your patients, and phacoemulsification is a wonderful operation for pseudoexfoliation, said Dr. Condon. However, sometimes your best intentions just aren't meant to be. He added, "Don't miss out on the opportunity to do a really good job in the 99% of patients who will have a good end result."

So, what about the cases that don't end the way you had hoped? That's lesson number five.

Lesson #5: Losing the Game

Sometimes, there's just no winning. You may see complete zonule loss in a PXS case. "Don't beat yourself up when you don't get the result you want because it happens," Dr. Condon advised. "We definitely have techniques. As far as those loops sweeping in a nonvitrectomized anterior, when you blow the viscoelastic agent back there, you're making a lot of space between the posterior iris and the vitreous face, and you don't want to blow the iris back," he continued. He also noted that surgeons should keep that planer when doing this sort of technique. "Don't fill the anterior chamber up and have



Less-than-ideal results (e.g., complete zonule loss, above) are sometimes unavoidable.

the iris turn into this concave structure," he said, adding that, "when you release the lens, you don't have to have the lens all the way down at the pupil level. You can release the lens and just see that the haptics are going to go out through the pupil."

Dr. Condon wrapped up this presentation by assuring the audience that of course, you can finish these patients and do a really great job, but explained that keeping these points in mind can make your pseudoexfoliation cases much more free of stress.

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2. Konstas AG, Tsatsos I, Kardasopoulos A, et al. Preoperative features of patients with exfoliation glaucoma and primary open-angle glaucoma. The AHEPA study. *Acta Ophthalmol Scand*. 1998;76(2):208-12.
3. Konstas AG, Mylopoulos N, Karabatsas CH, et al. Diurnal intraocular pressure reduction with latanoprost 0.005% compared to timolol maleate 0.5% as monotherapy in subjects with exfoliation glaucoma. *Eye (Lond)*. 2004;18(9):893-9.
4. Ritch R, Schlötzer-Schrehardt U, Konstas AG. Why is glaucoma associated with exfoliation syndrome? *Prog Ret Eye Res*. 2003;22(3):253-75.
5. Konstas AG, Hollo G, Astakhov YS, et al. Factors associated with long-term progression or stability in exfoliation glaucoma. *Arch Ophthalmol*. 2004;122(1):29-33.
6. Damji KF, Konstas AG, Liebmann JM, et al. Intraocular pressure following phacoemulsification in patients with and without exfoliation syndrome: a 2 year prospective study. *Br J Ophthalmol*. 2006;90(8):1014-8.

When to Address the Corneal Surface with Cataract Surgery

"We've talked a lot about intraocular (IOL) calculations," began Colorado surgeon Richard S. Davidson, MD, "and obviously anything that affects the corneal surface will affect these calculations. For example," he continued, "lesions such as pterygia and Salzmann's nodules can induce significant irregular astigmatism, which can't be corrected with spectacles or a toric IOL." Dr. Davidson explained that this can result in a sub-optimal visual outcome for the patient postoperatively, so surgeons need to look at the surface and determine whether any lesions need to be removed prior to surgery. He added that removing lesions following cataract surgery may cause the patient to experience a significant change in refraction.

Going into further detail on *pterygium* and Salzmann's nodules, he reviewed the fact that pterygium is a type of degeneration of the conjunctiva and will induce with-the-rule astigmatism, typically when they're >1mm under the cornea. Excision will steepen the cornea and reduce corneal astigmatism. He advises surgeons to inspect the cornea carefully, and examine the tear film, looking for areas of dryness or staining around the lesions. Manual keratometry can be very helpful here, Dr. Davidson noted. "With it, you can look at the mires and determine whether the cornea looks regular or irregular. Placido-disc topography can also be helpful for examining the rings. A refraction can also assist in determining the patient's best-corrected acuity."



In Dr. Davidson's opinion, *Salzmann's nodules* tend to be more challenging for surgeons as far as whether to remove them. "These blue-grey elevated nodules located in the superficial stroma are thought to be caused by chronic inflammation over time, dry eye, phlyctenules, trachoma, and contact lens wear," he said. "Furthermore, they are more common after the age of 50 and tend to be bilateral, but they can often be very asymmetric. Histopathologically, they look like a very thin area of epithelium that's overlying a thickened basement membrane."

The first thing to do is inspect the cornea, Dr. Davidson remarked. Every patient who comes in to his office for cataract evaluations gets topography before the technician does anything else. "If it looks like they have lesions," he said, "the tech will also perform manual keratometry and examine the mires." He again noted that Placido-disc topography will show you how regular or irregular the cornea is.

TO REMOVE OR NOT

When Dr. Davidson looks at patients with lesions and is trying to determine whether to remove them, he asks himself three questions:

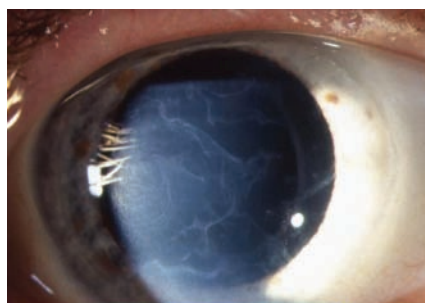
- 1) Is it growing or has it been growing?
- 2) Is it currently causing a change in the vision, or do you expect it to?
- 3) Will it be in the way of surgery (e.g., you're a temporal-operating surgeon and the lesion is temporal).

If the answer to any of these questions is "yes," then he will remove the lesion(s), usually via superficial keratectomy, which can be done in the office in a procedure room. "They're easy to remove; simply find the plane under the lesion and shave it off," he explained. "I use a 69 or 57 blade, then a diamond burr to polish it, and I put a bandage contact lens in for about five days and put them on some antibiotic and steroids, and it heals quite well," he offered. "We'll bring them back usually once a month for the first couple of months, and once the keratometry is more regular and we have consistent readings, we'll start planning for cataract surgery."

Managing Recurrent Erosion Syndrome

Irving M. Raber, MD, started his lecture talking about corneal epithelial basement membrane dystrophy (EBMD), or map-dot fingerprint dystrophy, and how it can cause irregular astigmatism that can lead to a visual disturbance. He noted that it can also be associated with recurrent erosion. "When it's a spontaneous recurrent erosion," he continued, "it's usually dystrophic, meaning if you look in their other eye, you can see signs of it, but it can also be traumatic, and the big three for this type are: fingernail, paper cut, and tree branches."

The Pennsylvania surgeon went on to explain that the irregular astigmatism should be treated in order to improve visual acuity, eliminate the visual disturbance (i.e., monocular diplopia, shadowing, starbursts, etc.), and allow for more accurate keratometry needed for IOL calculations. "Treatment of irregular astigmatism can be accomplished with a contact lens—either RGP, soft or scleral," he commented. However, most patients are not keen on contact lens wear and opt for epithelial debridement. Dr. Raber manually debrides all the corneal epithelium that comes off easily. "As I get more peripheral, if it seems to be adherent, that's where I stop." He didn't originally do diamond burr polishing, but now he does it all the time—even if it's pristine underneath—to try and stimulate some changes that will promote adhesion of the epithelium. Since he's been doing it, he hasn't had any issues with subsequent recurrent erosion.



And example of map-dot-fingerprint dystrophy, or epithelial basement membrane dystrophy.

TREATING RECURRENT EROSION

When recurrent erosion is a problem, surgeons can choose to treat it either medically or surgically, Dr. Raber stated, explaining that medical treatment consists of the following:

- **Topical lubricants/hyperosmotic agents.**
- **Topical steroids.** "These help to quiet things down. About 50% of my patients respond with good long-term benefit. I typically prescribe a steroid q.i.d., then taper it off every two weeks so that in two months, they're off it," he shared.
- **Oral doxycycline.** Dr. Raber gives patients 50mg b.i.d. for a month, then q.d. for a month, and then has the patient stop taking it.
- **Bandage contact lens.** He said that he has gotten away from using these unless a patient is really uncomfortable because of a recurrent erosion. "I will debride and remove the loose epithelium, but I usually won't do stromal puncture or polishing because if an infection is brewing, I don't want to spread it all over the cornea," he noted. "Typically, I just put in a bandage lens for about five days and patients do very well."

Dr. Raber wrapped up his lecture with a review of the surgical treatment options for recurrent erosion, which include:

- **Anterior stromal puncture** with a needle or a Yag laser.
- **Manual corneal epithelial debridement and diamond burr polishing.**
- **Excimer laser phototherapeutic keratectomy.** He said, "I tend to reserve stromal puncture for patients with nondystrophic, posttraumatic recurrent erosion who have small, localized areas that aren't in the middle of the visual axis." For those with larger areas that are dystrophic, Dr. Raber simply debrides the area and performs diamond burr polishing. "But for stromal puncture," he adds, "I start with the surrounding normal epithelium and then go more central to fill in the whole area that's involved. And I will put in fluorescein because it shows you the location of your punctures."

Update on Endothelial Keratoplasty

In his second lecture during the session on corneal matters, Irving M. Raber, MD, shared that it seems everyone is pushing for endothelial keratoplasty (EK) these days. He reviewed that it is indicated for endothelial dysfunction, corneal edema, and the absence of visually significant stromal scarring, and/or irregular astigmatism that's not amenable to superficial keratectomy.

Dr. Raber followed this brief intro of the indications for EK with a review of the cases in which EK is not recommended.

CONTRAINDICATIONS

"Contraindications include visually significant corneal stromal scarring not amenable to superficial keratectomy and visually significant irregular astigmatism noted prior to onset of corneal edema (existing penetrating keratoplasty [PK]) in a non-contact lens candidate," he cited. And for patients with stromal disease and significant irregular astigmatism—or who have a lot of problems in a graft that's failed and they never saw well because of irregular astigmatism and couldn't wear contact lenses, etc.—he noted that he tries to do a repeat PK instead of EK. "Another contraindication," he added, "(and I think it's an absolute contraindication), is silicone oil in the anterior chamber. It will interfere and prevent the adhesion of the EK."

Getting more specific, Dr. Raber explained that there are also relative contraindications for EK, and that these include monochamber globe, anterior segment disorganization not amenable to anterior segment reconstruction, anterior chamber intraocular lens (AC IOL), clear crystalline lens, and long-standing corneal edema/bullous keratopathy. "However," he told the audience, "as I got more comfortable with the procedure, I started tackling these more challenging patients, achieving a favorable outcome in a lot of them." He went on to comment that, if at all possible, he favors EK over PK, adding that can

always revert to PK if EK is unsuccessful. "You have to make sure that the patient understands the various issues related to their specialized ocular circumstances."

DSEK & DMEK

DSEK. According to Dr. Raber, most studies have failed to demonstrate a correlation between preoperative donor thickness and postoperative visual acuity. However, he reported, studies have shown that donor thickness decreases postoperatively and some have even suggested a correlation with the postoperative donor thickness and visual acuity, although that's debatable as well.

"People are now moving to ultra-thin Descemet's stripping endothelial keratoplasty (DSEK)," he informed attendees, "where the donor button is prepared with either a double or single microkeratome pass."

He shared that he started doing EK in the early 2000s, and that he began with deep lamellar endothelial keratoplasty (DLEK), which worked, but it was a tedious, technically demanding procedure.

DMEK. "I personally haven't been that impressed with the few patients I've seen come through my office with Descemet's membrane endothelial keratoplasty (DMEK)," Dr. Raber admitted, "but everyone who's doing it says they do get better (more 20/20 to 20/25) visual acuity." He has started doing DMEK and still has not been overwhelmed with the visual results compared to his standard ultra-thin DSEK patients with donor thickness between 50µm to 90µm. Next, Dr. Raber listed other stated advantages of DMEK compared to

EK, which include: more rapid visual rehabilitation, less (or no) induced hyperopia, a smaller incision (2.8 mm to 3.4 mm), less interface issues, reduced immunologic rejection, and more physiologic pachymetry.

As far as disadvantages of DMEK compared to EK, it's technically more difficult, Dr. Raber pointed out, also adding that "there's a higher donor detachment rate, higher primary graft failure rate (at least in your first cases), longer surgical time (at least in your first cases), and you can lose good donor tissue because of unsuccessful stripping of Descemet's membrane."

Disadvantages aside, DMEK also carries with it several contraindications, which Dr. Raber reviewed in closing his presentation. The list included a post-vitrectomized eye (because you have to have the chamber shallow to get this thing to unfold); a disorganized anterior segment; an AC IOL; aphakia; an opaque cornea (because of limited anterior chamber visualization); and a dilated pupil (you want to protect the lens and the endothelium of the DMEK, so you want a constricted pupil).

Oculoplastics for the Cataract Surgeon

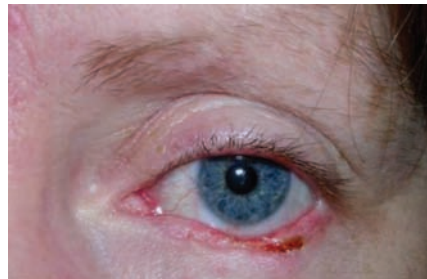
Basal cell carcinoma accounts for about 90 percent of the eyelid lesions we see, San Francisco professor Robert C. Kersten, MD, announced at the start of his presentation. He went on to inform the audience that squamous cell carcinoma accounts for <5 percent, sebaceous cell carcinoma accounts for <5 percent, and malignant melanoma is quite rare, accounting for <1 percent of malignant cases. "Looking at a large series of my patients, I've found that about 25 percent of the Caucasians had blue or green irides, yet they were responsible for 90 percent of the basal cells and squamous cells."

MALIGNANT LESIONS

Referring to malignant lesions, he noted that the main thing is to recognize their characteristics and how they differ from be-

MALIGNANT LESIONS MASQUERADE AS A NUMBER OF DIFFERENT CLINICAL DIAGNOSES

- "papillomas"
- epithelial inclusion cyst
- melanocytic nevi
- hidrocystoma
- trichoepithelioma



Trichiasis (left) and alteration of normal eyelid structure (right) are common characteristics of malignant lesions.

nign lesions. Below are the characteristics of typical malignant lesions that he described.

- **Irregularity.** If you bisect an irregular lesion, you can't fold it over and superimpose it on itself because of its irregular outline, and that's because of a disordered growth pattern.

- **Induration.** A benign lesion is usually kind of squishy and soft like the adjacent flesh when you palpate them, but malignant lesions tend to be firm and hard.

- **Ulceration.** Bleeding, non-healing ulcers are a key indication of malignancy that occur because these disordered growths will outgrow their blood supply, which breaks down the surface epithelium. If a patient tells you he has a non-healing sore anywhere, think about the possibility of a malignant lesion.

- **Telangiectasia.** Basal cell carcinomas specifically tend to have telangiectatic borders because of the new blood vessels caused by the tumor.

- **"Pearly borders."** These look like little nodules, or sort of pearly things around the edge, along with some central umbilication.

- **Altered eyelid architecture.** The tarsus may be distorted and ectopic and no longer identifiable along the tarsal plate. If you detect any alteration of eyelid architecture, think about malignancy.

- **Trichiasis.** When you see trichiasis, you need to explain why it is happening. Medicare has a diagnosis code for trichiasis without entropion, but almost all trichiasis is associated with some degree of mild superficial cicatricial entropion.

"Another thing to remember about malignant lesions," he added, "is that they're not painful or tender." As far as risk

factors go, Dr. Kersten pointed out that patients with red hair, blue eyes and freckles, as well as Fitzpatrick Type I patients are at the greatest risk of developing cutaneous malignancy. He also noted that history of sun exposure is obviously important here, and that smoking is a significant risk factor for basal and squamous cell carcinoma. "What's more," he added, "a person who has had one basal cell carcinoma has a 50 percent chance of having a second one within five years. And if they have a squamous cell carcinoma, then 90 percent of the time, they'll have a second squamous cell within five years."

Next, Dr. Kersten posed the question: How do we make the diagnosis of melanoma?

MAKING THE DIAGNOSIS

He noted that recent onset of a pigmented lesion is a red flag, as are change in the color, shape, or size of a pigmented lesion. He then referred back to the list of characteristics he had just reviewed, and added that, as a rule of thumb, any lesion >10mm—that's the size of an eraser on a No. 2 lead pencil—should raise concern of malignancy.

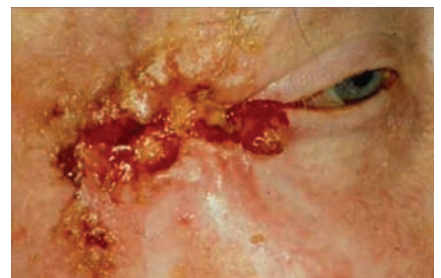
Dr. Kersten also pointed out that the vast majority of melanomas seen in the

periocular region arise from the malignant region, which is a pre-malignant lesion of a radial growth without any vertical invasion. "When we see these," he noted, "we want to biopsy with a punch, rather than taking a snip with Westcott scissors." He explained that this is because the depth of these lesions is important in terms of the prognosis and whether they will need to have a sentinel lymph node biopsy done at the same time, as well as whether the lesion will be a candidate for adjuvant therapy." Addressing a question from an audience member, Dr. Kersten said that if you biopsy a conjunctival melanoma, there is a risk of spread, but multiple studies have shown no increased risk of dissemination with a biopsy of cutaneous melanoma.

So, when is a biopsy necessary?

TO BIOPSY OR NOT

According to Dr. Kersten, the large majority of lid lesions that will come across your doorstep are going to be benign. He then shared that he performs a biopsy on any lesion that has any irregular characteristics. And if a lesion looks benign, yet the patient wants it removed, he will do so. To help him figure out if there was any benefit in sending these seemingly benign lesions out for pathology, Dr. Kersten said he conducted a prospective study of 864 cutaneous eyelid lesions in 788 consecutive patients over seven years. "I had 153 lesions that I clinically said were malignant, and I was right in 140, but 13 cases were benign," he reported. "What was more disturbing is that all 13 of those clinically benign lesions were pathologically malignant, so I was right



A large percentage of lid lesions will be benign, but it's important that you do a biopsy if you aren't sure.



98 percent of the time, but I wasn't right 100 percent of the time."

He also thought it interesting that in six cases where he thought the lesion was malignant, the pathologist said they were benign. "If you have a high index of suspicion, you can't trust the pathologist," he advised. "You have to trust your own suspicion. When we had them go back and re-section/re-biopsy, we found that all six of these lesions were, in fact, malignant."

CONCLUSION

So, to conclude, Dr. Kersten admitted that it is not possible to clinically differentiate malignant from benign eyelid lesions with 100 percent accuracy. His parting advice was, "If it appears malignant, then you should biopsy it. If it appears benign, then it's fine to observe it, but if you excise it, then you should send it off for pathology. And if pathology and clinical appearance don't agree, then perform a serial section and re-biopsy. And finally, if the patient notices any changes, have them follow-up."

Dysphotopsia: Why and What Do I Do?

This subject was broken down into two lectures: one on positive dysphotopsia, by Alan Crandall, MD, and one on negative dysphotopsia, by Samuel Masket, MD.

POSITIVE DYSPHOTOPSIA—Dr. Crandall presented first, and he began by clarifying that dysphotopsia refers to any photic phenomena described by a patient. He then offered that he believes dysphotopsia is much more common than we give credit for.

"Positive dysphotopsias (e.g., glare, halos, streaks, flashes) are generally seen in someone who has had nearly perfect surgery," he explained, noting the importance of recognizing that they can be induced by any bright light—even one that doesn't directly shine in a patient's face.

THE ROOT OF THE PROBLEM

Dr. Crandall gave the example of a patient with 20/20 vision who is shielding her eyes and complaining of dysphotopsia. The first thing to do, he advised, is to make sure:

- She doesn't have residual refractive error
- She doesn't have capsule opacities
- Her cornea is pristine
- She doesn't have CME.

He explained that all of the above can cause positive dysphotopsia. "But if we can check off everything on the list, and the patient claims everything is perfect and her surface looks good, what do we do?" He stressed that physicians really need to listen to patients. "Positive dysphotopsia is a real phenomenon that is most often lens-related," he noted, "and I have seen it with all the different lenses. You can do your patient a real service by addressing the issue."

RESOLVING POSITIVE DYSPHOTOPSIA

We have dysphotopsia programs and forms we can fill out, but they can be a bit difficult, so what do you do for patients who have had a capsulotomy, which unfortunately, many of these patients have?

Dr. Crandall noted that surgeons sometimes have a tendency when implanting intraocular lenses to assume they'll be all right as long as they're in the bag—even if an instrument mark is evident, "but if you notice damage to the implant—especially in the center—just take it out and put in another one, because it's not going to get better with time," he explained.

He then added that you don't want to put in too much viscoelastic because then you will have to do a lot of viscodissection to get the lens out. "I usually open it to about 4.00mm to 4.5mm," he said, "and the first thing I do is try to get into that rhexis." The best instrument for this, according to Dr. Crandall, is the 32-gauge viscocanalostomy cannula, though he admits that retrobulbar needles are also nice used often, as are femto spatulas.

"The issue with any single-piece lens

is right around the haptic," he noted, adding that, "if you pull centrally, you're going to have problems with the lens with stripping zonules." Dr. Crandall said that he never pulls to the center, but instead tries to rotate bimanually to make sure it's free, and if it's not, then he goes back. Another tip: Make sure you have enough space and use a viscoelastic that works for you.

Furthermore, Dr. Crandall pointed out that the edge of the rhexis is pretty strong, so sometimes you can use that as a second instrument to help. "One of the things I consider at this point is to leave the haptics alone and try to prolapse the optic out through the anterior. And then I use micro forceps. You can go in with a cyclodialysis spatula, fold it in the eye and it comes out pretty easily." Once all is said and done, Dr. Crandall suggests cleaning out the rest of it and putting in a capsular tension ring, followed by a new lens.

NEGATIVE DYSPHOTOPSIA

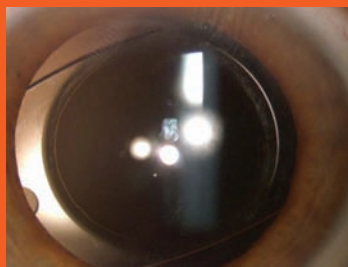
Dysphotopsias—the undesired optical phenomena following surgery—are the number-one cause of patient dissatisfaction after uncomplicated cataract surgery, Dr. Masket commented, following up Dr. Crandall's presentation. "Positive dysphotopsia may be observed after both perfect and imperfect surgery, but negative dysphotopsia has only been associated with what we consider to be anatomically perfect cataract surgery," he said. That makes the condition equally frustrating to patient and surgeon. He added that, "patients may be quite uncomfortable and vocal with their symptoms with either of the dysphotopsias." Positive dysphotopsia is fairly well understood, he stated, "but negative dysphotopsia has been an enigma."

PUPIL SIZE

When dealing with negative dysphotopsia, Dr. Masket explained, in general, the smaller the pupil, the greater the symptoms. It's pathognomonic, albeit counterintuitive, that symptoms of negative dysphotopsia abate with pupil dilation. He says he has never seen a true negative



LEARNING FROM EXPERIENCE



This patient's negative dysphotopsia symptoms remained even after her IOL was replaced.

Here's a case that dispels some myths, according to Dr. Masket.

A female patient had perfect cataract surgery done by femtosecond laser technique with a single-piece acrylic intraocular lens (IOL) in an eye that had previous hyperopic laser-assisted in situ keratomileusis. The patient had very symptomatic negative dysphotopsia and was referred to a second doctor, who performed an IOL exchange for an in-the-bag, single-piece collamer lens oriented nasally and temporally. The symptoms were completely unchanged.

"One case doesn't make a series or establish a disease," Dr. Masket commented, "but it is very instructive and indicates that negative dysphotopsia symptoms were not helped when the new lens, despite its different material, edge design and orientation, was implanted into the capsule bag."

He went on to note that he did learn that negative dysphotopsia could be treated either with sulcus-placed lenses, piggyback lenses, or event better: reverse optic capture, where the optic is basically in the sulcus, but the loops are in the bag for support. "We found that symptoms could only be helped if we covered the anterior capsulorhexis with the optic edge and we confirmed this in ray-tracing studies," he stated.

dysphotopsia patient where the symptoms don't get better with pupil dilation.

SURGICAL EXPERIENCE

In "piggybacking" low power intraocular lenses (IOLs), Dr. Masket shared that he had success in eight out of 10, noting that "reverse optic capture" has been successful in virtually all cases. "We've done this primarily—that is, in the second eye of people who are symptomatic in the first eye—eight or nine times now," he noted, "and it's worked in each case." However, he admits that he doesn't know if those eyes would have been symptomatic, as some patients note the condition in only one eye, another curiosity of negative dysphotopsia. "But in secondary eyes, we've taken existing lenses and then popped the optic anteriorly, leaving the haptics in the capsule bag, and we've been successful in reducing symptoms in all 14 cases." Bag-to-sulcus exchange has worked two out of three times, he noted. "We've been able to help the great majority of patients who have been referred for these problems."

He described the primary reverse optic capture procedure: "In this particular situation, when the optic is not placed in the capsule bag, the bag will develop fibrosis rapidly, so I clean anterior subcapsular lens epithelial cells aggressively and implant a relatively rigid capsular tension ring in an attempt to prevent contraction of the capsule." The optic is implanted routinely, however, after removing the visco

agent from behind the IOL, Dr. Masket places a spatula under the optic and with a Sinsky hook, elevates the edge over the anterior capsulotomy. "Obviously, the capsulotomy must be smaller than the optic—and well-centered," he noted. "The advent of femtosecond lasers has greatly helped with this," he added.

As a primary procedure, he said that he uses three-piece lenses because they are easier to manipulate for this purpose. "The majority of lenses we've used to match the fellow eye have been acrylic," he told the attendees, "and we've not seen iris chafe because the optic sits back away from the iris."

Dr. Masket and his partner Nicole Fram found that negative dysphotopsia¹ can be associated with any incision and any in-the-bag IOL and only with anatomically perfect surgery. "For early symptoms," he said, "we saw cases where the incision was superiorly placed and fully covered by the lid, causing doubt that the incision is the etiology for the symptoms. Moreover, negative dysphotopsia has never been reported with astigmatic keratotomy, radial keratotomy, corneal transplant incisions or LASIK flaps, so I really don't think it's the incision." He also noted that one of the real mysteries regarding negative dysphotopsia is that a patient can be anatomically identical between the two eyes and have symptoms in one eye and not the other. And, it's not been reported with sulcus-placed posterior chamber IOLs or anterior chamber IOLs.

AN ANTI-DYSPHOTOPIC IOL IS BORN

The concept of bringing the optic or part of the optic anterior to the capsulorhexis while leaving the rest of the lens in the bag was appealing to Dr. Masket, so he designed an anti-dysphotopic IOL, which has been made in Germany by Morcher. "This IOL received CE mark approval and Burkhard Dick, MD, has done five human implants, all of which have been free of negative and positive dysphotopsias," he said, adding, "there has been no evidence at six-months of any iris chafe from the anterior projection."

EARLY SYMPTOMS

In the early postop period, negative dysphotopsia is common, Dr. Masket told the room. "I believe that neuroadaptation allows the symptoms to abate in the great majority of people," he continued. "From day one to six months, I do not intervene surgically, expecting adaptation. I do tell patients that glasses with a thick temporal frame tend to block temporal light, which also reduces symptoms. I also assure them that their symptoms are both real and well-understood and that in all likelihood, will go away." And if their symptoms persist beyond six months, he tells patients that there are surgical solutions. He said that the majority of people either adapt or prefer not to have another operation.

1. Masket S, Fram NR. Pseudophakic negative dysphotopsia: surgical management and new theory of etiology. *J Cataract Refract Surg.* 2011;37:1199-1207.

2. Hong X, Liu Y, Karakelle M, et al. Ray-tracing optical modeling of negative dysphotopsia. *J Biomed Opt.* 16(12), 125001 (November 22, 2011).

Self-Assessment Questions

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1. The Hydrus Microstent dilates Schlemm's canal for roughly ___ clock hours in the ___ quadrant.

- a. 3, temporal
- b. 3, nasal
- c. 4, nasal
- d. 6, temporal

2. According to Dr. Condon, what is the benefit of hanging the infusion bottle high?

- a. It allows the ophthalmic viscosurgical device to come out rapidly.
- b. It allows fluid direct access into the area.
- c. It controls cyclodialysis.
- d. It preserves the view of the landmarks.

3. What is the maximum megapixels your smartphone should have when using it for ophthalmic photography?

- a. 4
- b. 5
- c. 8
- d. There is no maximum.

4. What can be created with the cap from a Gillette shaving foam travel pack container?

- a. A slit lamp adaptor
- b. A transilluminator
- c. A rheostat
- d. A diffuser

5. Which of the following can be included with recorded images:

- a. Name
- b. Facial picture
- c. Medical record number
- d. Date of birth

6. Which of the following distances is not a consideration in IOL power calculation formulas?

- a. Axial length from the interior corneal surface to the retina
- b. The anterior chamber depth from the anterior corneal surface to the lens plane
- c. The vertex distance from the target refraction to the eye
- d. They all should be considered

7. Which ELP formula calculates an offset?

- a. Haigis
- b. SRK/T
- c. Hoffer Q
- d. None of the above

8. With ultrasound, axial length is measured to _____.

- a. The internal limiting membrane.
- b. The retinal pigment epithelium.
- c. The ganglion cell layer.
- d. The choroid.

9. Which of the following does not affect the refractive effect of an IOL?

- a. Refractive power.
- b. Diameter
- c. Spherical aberration.
- d. Manufacturing tolerance.

10. The effective toricity of an IOL can vary depending on:

- a. The lens material.
- b. The presence of haptics.
- c. The lens power.
- d. None of the above.

11. Lindberg is credited with describing _____ in 1917.

- a. The importance of capsule support during phacoemulsification.
- b. Open-angle glaucoma.
- c. Endothelial loss.
- d. Pseudoexfoliation syndrome.

12. Which of the following is not included in Dr. Condon's list of things that can be safely placed prior to phacoemulsification?

- a. Viscoelastic.
- b. MST capsule retractors.
- c. Capsular tension segments.
- d. Iris hooks.

13. What should a surgeon do about a Salzmann's nodule on a cataract surgery patient?

- a. Leave it be and monitor it.
- b. Get it biopsied prior to surgery.
- c. Remove it prior to surgery.
- d. Remove it after surgery.

14. Which is not an example of a medical treatment for recurrent erosion:

- a. Bandage contact lens.
- b. Topical steroid.
- c. Hyperosmotic agent.
- d. They are all examples of medical treatment for recurrent erosion.

15. Which of the following is not a relative contraindication for EK?

- a. Long-standing bullous keratopathy
- b. Posterior chamber intraocular lens
- c. Monochamber globe
- d. Anterior segment disorganization.

16. Compared to EK, DMEK:

- a. Has a lower primary graft failure rate.
- b. Has a lower donor detachment rate.
- c. Can cause you to lose good donor tissue.
- d. Is technically less difficult.

17. A benign lesion:

- a. Is soft when palpated.
- b. May be painful or tender.
- c. Both a and b.
- d. None of the above.

18. Which of the following is not a possible cause of positive dysphotopsia?

- a. Diabetes.
- b. Cystoid macular edema.
- c. Capsule opacities.
- d. Residual refractive error.

19. In general, when dealing with negative dysphotopsia, the _____ the pupil, the _____ the symptom in a symptomatic patient.

- a. Smaller, lesser.
- b. Bigger, greater.
- c. Bigger, lesser.
- d. Smaller, greater.

20. Which of the following can influence asymptomatic negative dysphotopsia:

- a. Index of refraction
- b. Placement
- c. Reverse optic capture.
- d. None of the above.

Examination Answer Sheet

2.0 CME Hours

Expiration Date: July 31, 2015

Reaching New Peaks in Ophthalmic Surgery

Directions: Select one answer for each question in the exam and evaluation by completely darkening the appropriate circle. An identifier is required to process your exam. This is used for internal processing purposes only.

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5 = Strongly Agree 4 = Agree 3 = Neutral 2 = Disagree 1 = Strongly Disagree

Rate the extent to which the activity met the identified objectives:

Examination				
1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	D
6.	A	B	C	D
7.	A	B	C	D
8.	A	B	C	D
9.	A	B	C	D
10.	A	B	C	D
11.	A	B	C	D
12.	A	B	C	D
13.	A	B	C	D
14.	A	B	C	D
15.	A	B	C	D
16.	A	B	C	D
17.	A	B	C	D
18.	A	B	C	D
19.	A	B	C	D
20.	A	B	C	D

- 1. Implement the newest techniques in cataract, refractive, and glaucoma surgery. 5 4 3 2 1
- 2. Evaluate a cataract surgery patient for premium IOLs and be able to present the best option. 5 4 3 2 1
- 3. Identify risk factors for failure with premium IOLs. 5 4 3 2 1
- 4. Outline the newest changes in the field of femtosecond cataract surgery, the newly approved platforms, and their relative merits and disadvantages. 5 4 3 2 1
- 5. Utilize the best surgical approach in challenging cataract cases. 5 4 3 2 1
- 6. Discuss the newest glaucoma surgical tools and their proper use. 5 4 3 2 1
- 7. Explain the many options in corneal surgery and the differences among the many lamellar interventions. 5 4 3 2 1
- 8. Employ strategies to fine tune modern LASIK surgery and patient selection. 5 4 3 2 1
- 9. Discuss management of the "unhappy" LASIK patient and the potential causes. 5 4 3 2 1
- 10. Put into practice the new options in the management of glaucoma. 5 4 3 2 1

Rate the overall effectiveness of the activity. The content presented:

- 11. Was timely and will influence how I practice. 5 4 3 2 1
- 12. Enhanced my current knowledge base. 5 4 3 2 1
- 13. Addressed my most pressing questions. 5 4 3 2 1
- 14. Provided new ideas or information I expect to use. 5 4 3 2 1
- 15. Addressed competencies identified by my specialty. 5 4 3 2 1
- 16. Avoided commercial bias or influence. 5 4 3 2 1

Name one thing you intend to change in your practice as a result of completing this activity:

Please list any clinical issues/problems within your scope of practice you would like to see addressed in future educational activities:

Additional comments about this activity:

Please print clearly and retain a copy for your records.

First Name _____

Last Name _____

E-Mail* _____

The following is your: Home Address Business Address

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Telephone # _____ - _____ - _____ Fax # _____ - _____ - _____

Profession: Physician Physician Assistant Other

By submitting this answer sheet, I certify that I have read the lesson in its entirety and completed the self-assessment exam personally based on the material presented. I have not obtained the answers to this exam by any fraudulent or improper means. I also certify my actual time spent to complete this education activity is _____ hours (not to exceed 2.0 hours).

Signature _____ Date _____

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