Supplement to

November/December 2010

Advanced

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Today and Tomorrow

in Refractive and Cataract Surgery

A Virtual Symposium, Enduring Print Supplement, and Interactive Digital Journal

crt Optometric Council on Refractive Technology

Produced by the Optometric Council for Refractive Technology and Bryn Mawr Communications LLC, publisher of *Advanced Ocular Care*

Important Safety Information – TECNIS Multifocal IOL

Caution: Federal law restricts this device to sale by or on the order of a physician.

Indications: TECNIS® Multifocal intraocular lenses are indicated for primary implantation for the visual correction of aphakia in adult patients with and without presbyopia in whom a cataractous lens has been removed by phacoemulsification and who desire near, intermediate, and distance vision with increased spectacle independence. The intraocular lenses are intended to be placed in the capsular bag.

Warnings: Physicians considering lens implantation under any of the conditions described in the Directions for Use labeling should weigh the potential risk/benefit ratio prior to implanting a lens. Some visual effects associated with multifocal IOLs may be expected because of the superposition of focused and unfocused images. These may include a perception of halos/glare around lights under nighttime conditions. It is expected that, in a small percentage of patients, the observation of such phenomena will be annoying and may be perceived as a hindrance, particularly in low illumination conditions. On rare occasions these visual effects may be significant enough that the patient will request removal of the multifocal IOL. Under low-contrast conditions, contrast sensitivity is reduced with a multifocal lens compared to a monofocal lens. Therefore, patients with multifocal lenses should exercise caution when driving at night or in poor visibility conditions. Patients with a predicted postoperative astigmatism >1.0 D may not be suitable candidates for multifocal IOL implantation since they may not fully benefit from a multifocal IOL in terms of potential spectacle independence.

Precautions: The central one millimeter area of the lens creates a far image focus, therefore patients with abnormally small pupils (~1 mm) should achieve, at a minimum, the prescribed distance vision under photopic conditions; however, because this multifocal design has not been tested in patients with abnormally small pupils, it is unclear whether such patients will derive any near vision benefit. Autorefractors may not provide optimal postoperative refraction of multifocal patients; manual refraction is strongly recommended. In contact lens wearers, surgeons should establish corneal stability without contact lenses prior to determining IOL power. Care should be taken when performing wavefront measurements as two different wavefronts are produced (one will be in focus (either far or near) and the other wavefront will be out of focus); therefore incorrect interpretation of the wavefront measurements is possible. The long-term effects of intraocular lens implantation have not been determined; therefore implant patients should be monitored postoperatively on a regular basis. Secondary glaucoma has been reported occasionally in patients with controlled glaucoma who received lens implants. The intraocular pressure of implant patients with glaucoma should be carefully monitored postoperatively. Do not resterilize or autoclave. Use only sterile irrigating solutions such as balanced salt solution or sterile normal saline. Do not store in direct sunlight or over 45° C. Emmetropia should be targeted as this lens is designed for optimum visual performance when emmetropia is achieved. Care should be taken to achieve centration.

Adverse Events: The most frequently reported adverse event that occurred during the clinical trial of the TECNIS® Multifocal lens was macular edema, which occurred at a rate of 2.6%. Other reported reactions occurring in 0.3%-1.2% of patients were hypopyon, endophthalmitis, and secondary surgical intervention (including biometry error, retinal repair, iris prolapse/wound repair, trabeculectomy, lens repositioning, and patient dissatisfaction).

Attention: Reference the Directions for Use for a complete listing of indications, warnings, and precautions.

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Today *and* Tomorrow

in Refractive and Cataract Surgery

The OCRT and BMC, the publisher of *Advanced Ocular Care*, have teamed up to develop this multimedia initiative presenting education from prominent thought leaders regarding current trends in refractive and cataract surgery. This enduring print supplement showcases new techniques and discusses cutting-edge treatments and diagnostic modalities. Be sure to access the digital version of this interactive journal to view additional multimedia content. Look for the OCRT button at www.advancedocularcare.com. We hope you find this virtual symposium educational and thought-provoking!

About OCRT:

Organized in 2002 and chartered in 2004, the OCRT is optometry's voice in the field of refractive surgery and other technologies. Its mission is to bring together optometrists and researchers with an interest in refractive technologies, providing a forum for education and interaction. Optometric involvement in refractive technology grows by the day. The OCRT gives those professionals a forum for discussion and allows them to present as key players in supporting patients interested in altering their refractive status. The OCRT and its members act as a resource for optometric colleagues who are not directly involved in refractive surgical care but whose patients seek such care. The OCRT's mission is to advance the art and science of refractive technology and the knowledge and skills of optometrists participating in refractive technology, as well as provide clinical and practice management education to optometrists through various forms of communication and forums.

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Innovations in Technology: Anterior, Posterior Segment Disease

BY PAUL M. KARPECKI, OD, FAAO

With more advances in technology that improve surgical outcomes and the patient's experience, clinicians have an obligation to stay apprised of all new developments. Innovations in pharmaceuticals have created a category of premium therapeutics, which are directly tied to improving surgical results and patients' comfort. Diagnostics are improving, allowing for even more accurate measurements for clinicians and surgeons. At a time when patients are demanding near-perfect outcomes, these technological advancements make it easier for eye care professionals to uphold high standards and provide the best quality of vision for patients.

NEW THERAPEUTICS

Zirgan

A new therapeutic, Zirgan 0.15% (ganciclovir ophthalmic gel; Sirion Therapeutics, Inc.), is now FDA approved for the treatment of acute herpetic keratitis. Ganciclovir has been used in Europe for more than 10 years as a mainstay therapy for epithelial herpetic disease. Zirgan's dosing regimen is one drop administered to the affected eye five times per day until the patient's dendritic ulcer heals and then one drop t.i.d. for 1 week.

Ganciclovir has a prodrug formulation so it penetrates only the cells infected with herpetic keratitis, thus sparing healthy cells. The gel-like agent is supplied in a 5-g tube, which will last the course of treatment. Patients can expect blurring for about 1 to 2 minutes before the drop blends into their tears. Because the formulation is close to the same pH and osmolarity of healthy tears, it is well tolerated, and no refrigeration is required.[1]

AzaSite

AzaSite (azithromycin ophthalmic solution 1%; Inspire Pharmaceuticals, Inc.) has changed the practice of eye care. It is FDA approved for the treatment of bacterial conjunctivitis. Recent research has shown the drug's ability to achieve high tissue concentration,[2] therefore, many doctors have used it off label for the management of lid disease.

A rabbit study evaluated the ocular pharmacokinetics of AzaSite after multiple doses were administered according to the approved regimen of two drops b.i.d. for 2 days followed by one drop q.d. for 5 days (a total of nine doses [data on file with Inspire Pharmaceuticals, Inc.]). Ocular tissue samples were obtained at various time points before, during, and after the regimen. Peak conjunctival concentrations continued to increase throughout the dosing regimen, and measurable levels were observed 5 days after the last dose. Extremely high tissue concentrations were observed out to day 12.

A clinical study was conducted in patients with meibomian gland disease who were unresponsive to warm lid massage therapy.[3] The study sought to assess the efficacy of topical azithromycin 1% solution applied once daily for 1 month. The meibomian gland's secretions among these patients tend to have a more ordered structure and a higher phase transition temperature. The data from this pilot study indicate that once-daily dosing with AzaSite altered the structure and behavior of the meibomian gland's lipids toward those of normal secretions.

Besivance

Besivance (besifloxacin 0.6%; Bausch + Lomb) is a new fluoroquinolone recently FDA approved for the treatment of bacterial conjunctivitis. The agent has shown activity against susceptible isolates of gram-positive bacteria such as methicillin-resistant *Staphylococcus aureus* and *Staphylococcus epidermidis,* and gram-negative bacteria. Besivance is dosed t.i.d. every 4 to 12 hours. The drug has no systemic form, which hopefully will reduce the risk of resistance.

The mechanism of action of Besivance is similar to other fourth-generation fluoroquinolones in that it applies to DNA gyrase as well as topoisomerase IV. What sets Besivance apart from other fluoroquinolones is that it is chlorinated, more balanced, and provides more complete inhibition. The drug shows superior potency as measured by IC_{90} values against ciprofloxacin-resistant *S epidermis, Streptococcus pneumoniae,* and *S aureus.*[4-6]

Durezol

Durezol 0.05% (difluprednate ophthalmic emulsion; Alcon Laboratories, Inc.) is a topical corticosteroid used to treat postoperative inflammation and pain associated with ocular surgery. According to early studies in which b.i.d. and q.i.d. dosing of Durezol was compared with placebo, Durezol-treated patients achieved a statistically higher percentage of clearing of the anterior chamber cells.[7] Treated patients also had higher reduction in mean corneal edema and mean pain/discomfort when compared with placebo.

Many of us on the OCRT have been successfully using this drug in postsurgical cases. Importantly, if you are using Durezol in your clinical practice, the dosing is typically half that of prednisolone.

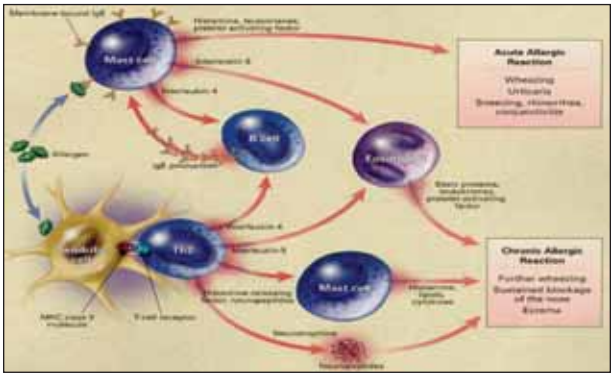
Zymaxid and Bromday

Two other medications were recently approved, Zymaxid (gatifloxacin ophthalmic solution; Allergan, Inc.) and Bromday (bromfenac ophthalmic solution, 0.09%; Ista Pharmaceuticals, Inc.). Zymaxid is a 0.5% concentration of

Zymar (gatifloxacin ophthalmic solution, 0.3%; Allergan, Inc.), and Bromday offers a once-daily dose of bromfenac.

Bepreve

Bepreve (1.5% bepotastine besilate ophthalmic solution; Ista Pharmaceuticals, Inc.) is approved for the treatment of ocular itching associated with allergic conjunctivitis. This histamine antagonist/mast-cell stabilizer is very H1 receptor specific, minimizing drying of the ocular surface. The drug suppresses eosinophilia infiltration into inflammatory sites.



In clinical studies, Bepreve has demonstrated a rapid onset of action against ocular itch.[8] The drop is comfortable, although, up to 25% of patients in the clinical trial reported that the drops' instillation was associated with a taste. In my practice, we have not received any complaints; however, I do educate my patients about this possible side effect. I put it in the context that in clinical trials, the drug was also associated with improvement in a number of secondary, nonophthalmic symptoms, such as nasal congestion, rhinorrhea, nasal pruitius, and ear and/or palate itching.[9]

Artificial Tears

The area of artificial tears has also been important for our management of dry eye disease. In my practice, my colleagues and I provide patients with three or four different regimens. Soothe XP (Bausch + Lomb) is our patients' treatment of choice, especially for those with meibomian gland disease. Research demonstrates that Soothe XP doubles the lipid layer thickness of tears.[10]

We have found that for patients with moderate-to-severe advanced dry eye (eg, epithelial basement membrane dystrophy, recurrent corneal erosion, or significant staining), FreshKote (Focus Laboratories, Inc.) is the preferred drop due to its significant oncotic pressure.

Blink Contact Lens (Abbott Medical Optics Inc.) is preferred by our contact lens wearers and in those with some corneal staining. Blink Tears (Abbott Medical Optics Inc.) works extremely well in our postoperative patients, who say the drop is comfortable and provides them with higher quality vision. This artificial tear contains polyethylene glycol 400 (0.25%), sodium hyaluronate as a viscosity enhancer, the preservative Ocupure (Abbott Medical Optics Inc.), and electrolytes for enhanced ocular health.

Patients with general aqueous-deficient dry eye disease do well with artificial tears such as Optive (Allergan, Inc.) and Systane Ultra (Alcon Laboratories, Inc.). If the patient has significant staining, I find that Soothe Xtra Hydration (Bausch + Lomb) and Blink Gel (Abbott Medical Optics Inc.) seem to do very well. If patients who are using good artificial tears still have signs or symptoms or require drops more than three times a day, targeted medications such as loteprednol and Restasis (cyclosporine; Allergan, Inc.) are necessary.

NEW TECHNOLOGIES

TearLab

The TearLab Osmolarity System (TearLab Corporation, San Diego, CA) is a point-of-care testing device that collects patients' tears and provides a measurement. Tear osmolarity is close to becoming the gold standard as a precursor for dry eye disease.[11] The TearLab instrument can collect and analyze a 50-nL sample of tear fluid in 10 seconds. The precision of this measurement reportedly exceeds that of other common in-office laboratory tests for dye eye diagnosis, and it is safe and simple to use. An osmolarity scale for dry eye has been developed, permitting the clinician to determine severity and monitor therapeutic progress.[12] Of interest, it was also observed that intereye variability of osmolarity increased with the severity of dry eye.

I have found the TearLab System to have the highest positive predictive value for dry eye diagnosis versus Schirmer's, tear breakup time, staining, or tear meniscus height.

TrueVision 3D Visualization and Guidance Platform

There has been quite a buzz around the area of microsurgery with the high-definition, three-dimensional surgical visualization system from TrueVision Systems, Inc. (Santa Barbara, CA). This technology provides both primary and secondary visualization in anterior segment surgery.

The TrueVision platform includes a three-dimensional video camera that attaches to the microscope, a workstation that processes the images through a dual projection system, and a widescreen display panel. The system is ergonomically sound for surgeons, allows for a full view of procedures for the OR staff, and is useful for patient education. This system presents opportunities for surgical guidance of free-hand procedures in ophthalmology, neurosurgery, ear, nose, and throat surgery, and spine surgery, to name a few.

Corneal Collagen Cross-Linking

Another exciting technology is corneal collagen cross-linking for use in patients with keratoconus and keratectasia

after refractive surgery. This technology requires an early diagnosis, because it halts the disease's progression but does not cure or reverse it.

Early research indicates that older patients did not experience a progression of keratoconus after diagnosis.[13] Conversely, younger patients with keratoconus are almost expected to require corneal transplant soon after diagnosis. The corneas of older patients have been exposed to ultraviolet (UVA) light for longer and they have more riboflavin.

Corneal collagen cross-linking involves the application of riboflavin drops combined with UVA exposure that strengthens the covalent bonds between collagen fibers. Riboflavin, which works as a photomediator, absorbs UV light so that it does not permeate the cornea. In essence, this technology makes the cornea more rigid. In addition to halting keratoconus, patients can achieve about 3.00 D to 3.50 D improvement in keratometric value;[14] there are no long-term data. Topcon Medical Systems, Inc. (Oakland, NJ), is currently conducting a large, multicenter trial of this technology.

TelScreen and Eyemaginations

TelScreen (Louisville, KY) and Eyemaginations, Inc. (Towson, MD), are companies that provide imaging software and animation technology essential for use in the office and for patient education.

TelScreen designs, manufactures, and services software for slit lamps, fundus equipment, and binocular indirect ophthalmoscopes. While I examine a patient at the slit lamp, I can capture what I see at any point by pressing a foot pedal. I can then show this image or video to the patient.

Eyemaginations' educational materials help us educate patients with easy-to-understand explanations of disease states and treatment options. These valuable materials also save busy practitioners time.

CONCLUSION

It is a very exciting time for eye care practitioners! After reviewing the available technologies, it is amazing to think of where we were just 5 years ago and where we are today.

As eye care gatekeepers, we need to be aware of the new technologies and advancements. Today, about 60% of our patients are gathering information from the Internet before a consultation, so we need to be prepared to answer their questions. This knowledge and successful patient education can also grow your practice simply by patients' word of mouth.

Paul Karpecki, OD, is a past president of the OCRT. He is a consultant to Abbott Medical Optics Inc.; Alcon Laboratories, Inc.; Allergan, Inc.; Bausch + Lomb; Eyemaginations, Inc.; Inspire Pharmaceuticals, Inc.; Ista Pharmaceuticals; TelScreen; Topcon Medical Systems, Inc.; and TrueVision Systems, Inc. He is also a shareholder in and a member of the board of directors for TearLab Corporation. Dr. Karpecki may be reached at paul@karpecki.com.

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Femtosecond Lasers for Cataracts

BY RICHARD N. BAKER, OD, FAAO

Successful traditional phacoemulsification cataract surgery is highly dependent on the surgeon's skill. Even accomplished surgeons occasionally have an inconsistent experience intraoperatively, which can be made worse by the cascading effects of each surgical step.

At Slade & Baker Vision in Houston, we have one of the first femtosecond lasers for cataract surgery. The LenSx femtosecond laser (LenSx Laser, Inc., Aliso Viejo, CA) received FDA clearance to create anterior capsulotomies in August 2009, followed by clearance for the creation of corneal incisions in December 2009. The laser enhances the surgeon's ability to predictably create a well-centered anterior capsulorhexis of an exact diameter and to effectively fragment the lens for removal with minimized phaco time and power. Recently, Alcon Laboratories, Inc. (Forth Worth, TX), announced an agreement to acquire LenSx in a deal worth up to $744 million. LenSx plans to sell its first femtosecond laser for cataract surgery by the end of 2010 with a global launch in 2011. The laser is still in the development phase.

I am impressed with the safety and efficacy of this technol-

ogy and the improvement it represents in creating the capsulorhexis. I believe cataract surgeons can now provide patients with improved UCVA, reduced astigmatism, and control of their induced spherical error. The laser enables surgeons to standardize their incisions, effectively place an IOL, and treat preexisiting astigmatism with corneal incisions at the time of surgery.

Surgeons are already familiar with performing LASIK using the femtosecond laser. The same masterminds behind the IntraLase (Abbott Medical Optics Inc., Santa Ana, California) technology have reconfigured the femtosecond laser for cataract surgical applications. The femtosecond laser can be focused onto the anterior capsule and into the crystalline lens.

This reconfiguration provides the means to perform a capsulorhexis. The laser already can create corneal incisions, which aids in making entrance wounds and arcuate incisions and, therefore, improves the accuracy and safety of cataract surgery by providing increased wound stability. By applying the femtosecond laser to the anterior capsule, the surgeon has a foolproof way of achieving a perfectly centered capsulorhexis with a precise diameter. The anterior capsule can be removed without any tearing, and the capsular bag's structural integrity can be maintained.

CLINICAL APPLICATIONS OF THE LENSX LASER

More than 400 eyes have undergone capsulotomy and lens fragmentation with the LenSx femtosecond laser. In our collective experience at Slade & Baker Vision, we achieved perfect centration with a precise diameter within ±0.25 mm. We have incurred no radial tears, and we found it easy to remove the capsule with no adverse effects. The symmetry and size of the capsulotomy influences the centration of the IOL. It can be difficult to create an anterior capsulotomy manually in a perfect circle, at a precise diameter, and at an exact location.

The LenSx femtosecond laser is guided by optical coherence tomography, and it addresses incision creation, including limbal relaxing incisions, capsulotomy; nuclear fragmentation; cortical removal; and the IOL's insertion. Even with the new technology, it is imperative that practitioners take real-time measurements while the eye is fixated and applanated in the OR. The laser's scanning and image processing is rapid, and the computer-guided technology gives surgeons total control. The precise laser surgical incisions are self-sealing.

A 4-mm capsulorhexis results in a longer postoperative effective lens positioning than a 6-mm capsulorhexis. To ensure that an IOL's position in the capsular bag matches the anticipated formula used to calculate its power, the capsulorhexis should be round, centered, and smaller than the IOL's optic. It is crucial to have a consistent capsulorhexis diameter for predictable refractive outcomes. According to unpublished clinical data, attempted-versus-achieved refractive outcomes are more predictable. The standard deviation of attempted versus achieved is smaller than a manual

More than 400 eyes have undergone capsulotomy and lens fragmentation with the LenSx femtosecond laser.

cataract surgery treatment. Not only is the first goal of femtosecond cataract surgery to achieve a safer procedure, it is also to improve accuracy, making lens implantation more predictable.

After successfully accomplishing a safe capsulorhexis, the surgeon can begin laser fragmentation of the lens. If the nucleus is hard, the surgeon can use a divide-and-conquer technique with the laser. This shortens the phaco time and energy to complete the removal. If the lens is soft, a concentric cylinder circle pattern by the laser can be employed to liquefy the soft lens. This technique results in lens removal by using only aspiration and minimal phaco power.

In the cases performed so far, the LenSx femtosecond laser has reduced the phaco power needed inside the eye by 54%, and we expect that to decrease further as development of the nomograms continues. Less phaco power results in a gentler procedure because there is a 60% reduction in endothelial cell loss when compared with manual cataract surgery (A. Storr-Paulsen, MD, et al, unpublished literature review).

CONCLUSION

LenSx's femtosecond laser will transform cataract surgery into an all-laser procedure that uses computer-driven technology to deliver improved safety and precision. I believe patients' acceptance and interest will continue to drive the development of this technology. We as optometrists should remain current regarding the advances in eye care that affect our patients.

Richard N. Baker, OD, FAAO, is with Slade & Baker Vision in Houston. He acknowledged no financial interest in the company or product mentioned herein. Dr. Baker may be reached at rnb@visiontexas.com.

Astigmatism and Cataract Surgery

BY THOMAS M. CHESTER, OD, FAAO

More and more, patients demand spectacle independence after cataract surgery. The magnitude of this insistence will continue to increase as patients that previously underwent refractive surgery present for cataract surgery, because today's savvy patients perceive cataract surgery as a refractive procedure. To meet these patients' expectations, eye care providers must be familiar with current technology—and its limitations—in order to provide optimal outcomes.

PERIOPERATIVE CONSIDERATIONS

Preoperatively, clinicians sometimes make refractive decisions that can be skewed by a cloudy crystalline lens, for example, which ultimately affects the patient's subjective responses. IOL power calculations may be less than accurate when they are based on a compilation of historical data. Furthermore, practitioners are not necessarily aware of what the patient's final refraction will be until well into the postoperative period, which can be anywhere from 30 to 90 days.

Surgeons would ideally prefer to assess and treat astigmatism intraoperatively. To do so, however, there are several questions that must be addressed: was the correct IOL power chosen, is the toric axis optimally placed, and/or what is the effect of limbal relaxing incisions (LRIs)? These questions, along with the two major refractive issues of cataract surgery—IOL power calculations and astigmatic correction—can be answered.

Most patients who put heavy demands on their vision are not satisfied with a two-thirds chance of being within 0.60 D of their target refraction. In my experience, ORange intraoperative wavefront aberrometer (WaveTec Vision, Aliso Viejo, CA) provides a solution. This system can determine the IOL's power prior to implantation in aphakic eyes and confirm the refractive target in pseudophakic eyes.

A second intraoperative concern relates to astigmatism. A significant number of all IOL patients have at least 0.75 D of astigmatism. ORange can help the surgeon optimize the axis' placement, reduce mean residual cylinder, and aid in assessing the effect of the LRIs. The physician can then make real-time adjustments to refine patients' outcomes.

Usually, astigmatism of less than 1.00 D can be corrected using LRIs. When placing LRIs, the surgeon must consider their depth, length, zone, and axis. Other factors to consider are the patient's age and corneal thickness, both of which could contribute to regression over time.

For patients with more than 1.00 D of astigmatism, toric IOLs are generally the ideal choice with considerations for axis and power. Typically, this option is more stable with time, but keep in mind, a 4º shift of the IOL off-axis reduces the cylinder correction by about 14%; a 10º shift off-axis reduces cylinder correction by 34%. If the IOL shifts by 30º, there is no change to the cylinder, but if the shift is greater than 30º, increased astigmatism results.

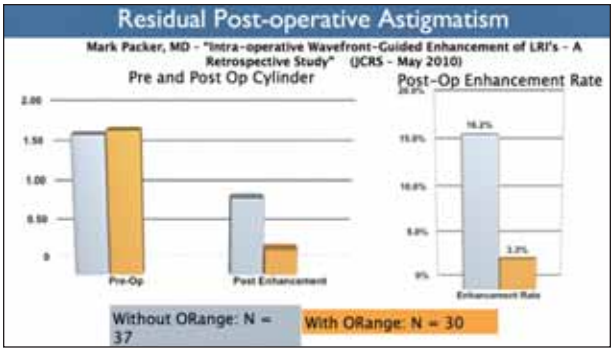

Figure 1. A reduction in the amount of residual astigmatism was associated with the use of ORange.

THE IMPACT OF REAL-TIME ABERROMETRY

My partner, William F. Wiley, MD, and I performed a retrospective chart analysis (unpublished data) of 47 eyes of 36 patients that chose to have astigmatism corrected with a toric IOL. The patients were divided into two groups. In the control group (n = 23 eyes), he used the manufacturers' toric IOL calculator. In the test group (n = 24 eyes), he used ORange's aphakic calculations for IOL power and pseudophakic calculations for the final axis orientation.

We found a dramatic difference between the residual cylinder at 1 month postoperatively with 0.61 ±0.54 D in the control group versus 0.16 D ±0.22 D in the ORange group. Furthermore, the percentage of patients who were within 0.50 D spherical equivalent was 56.5% in the control group and 95.8% in the ORange group. Additionally, 86.9% in the control group were within 1.00 D spherical equivalent, while 100% in the ORange group were within 1.00 D.

In our experience, residual astigmatism is infrequent when using ORange. When there is visually significant residual astigmatism, however, care should be taken to rotate the toric IOL within the first week postoperatively. If the patient has more than 1.00 D of residual astigmatism, we would recommend performing an excimer laser treatment no sooner than 3 to 6 months after the initial surgery. If less than 1.00 D of residual astigmatism occurs, we may perform an LRI, which can be done relatively soon after the initial procedure.

Mark Packer, MD, performed a study to determine the effect of performing intraoperative aberrometry using ORange on LRIs and the subsequent rate of excimer laser enhancements.[1] This study also incorporated a chart review comparing eyes before and after the ORange option.

The control group included 37 eyes of 27 patients, and the ORange group included 30 eyes of 21 patients. Noteworthy is that eight eyes of six patients were enhanced by extending LRIs while in the OR, a determination that was based on intraoperative aberrometry.

The results demonstrate that a subsequent, substantial reduction in the amount of residual astigmatism was associated with the use of ORange (Figure 1). Additionally, there was a drop in the frequency of postoperative laser enhancements from about 16% to about 3%.

The economic impact of reducing astigmatism cannot be understated. Treating astigmatism during cataract surgery decreases enhancements, and it provides physicians with a competitive edge that can increase procedural volume and fees for premium services. As practitioners have increased confidence with this technology, they can convert greater numbers of patients to new-technology IOLs.

CONCLUSION

ORange improves the surgeon's ability to treat astigmatism during cataract surgery. The system provides increased confidence in the data obtained intraoperatively, it improves patients' satisfaction and referrals, it minimizes enhancements, and it helps deliver on the promise of premium IOLs, both for patients and practitioners. I believe this diagnostic system will soon become the standard of care for those who want to maximize their outcomes.

Thomas M. Chester, OD, FAAO, is clinical director at the Cleveland Eye Clinic, Cleveland, Ohio. He acknowledged no financial interest in the products or companies mentioned herein. Dr. Chester may be reached at (216) 621-6132; drchester@clevelandeyeclinic.com.

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Update on Laser Vision Correction

BY WILLIAM J. TULLO, OD, FAAO

The inception of laser vision correction occurred approximately 10 years ago in the United States and 15 years ago internationally. Since then, practitioners have accumulated much experience with the procedure and have amassed an abundance of studies in the peer-reviewed literature about the procedure's safety. This information enables us as practitioners to reexamine the basic questions we ask ourselves and our patients as we try to identify the ideal laser vision candidates and produce evermore favorable outcomes resulting in more satisfied patients.

IS LASIK SAFE AND EFFICACIOUS?

Multiple studies in the literature describe the safety and efficacy of LASIK. Two studies in particular published within the past 2 years, one prospective and one retrospective regarding LASIK outcomes, included a combined 70,000 eyes that had undergone the procedure.[1,2] Taken together, these studies convincingly demonstrate that LASIK is safe and effective for correcting mild-to-moderate myopia and myopic astigmatism. More LASIK patients achieve better UCVAs than ever before. Incremental advancements in laser vision technology have resulted in an obvious difference between current surgical results and those of years past.

So are patients satisfied with today's laser vision correction surgery? In my experience, the majority of patients who undergo laser vision correction are pleased with their outcomes. According to the literature, approximately 96% of patients who have undergone laser vision correction say the procedure has improved their quality of life.[3,4] Furthermore, a study from the United Kingdom indicates that upwards of 96% of patients would recommend this surgery to their friends and family.

Which procedure is better, LASIK or PRK? Conventional LASIK (performed with a mechanical microkeratome and without wavefront information) may be safer and more efficacious than conventional PRK.[5] Currently the majority of laser vision correction is performed with either wavefront-guided or wavefront-optimized platforms. Newer studies have shown that LASIK and PRK using these technologies produce virtually indistinguishable outcomes.[6,7]

Is there a limit as to how much myopia can be corrected with these procedures? The upper limit of myopic correction that surgeons are willing to consider with LASIK is decreasing.[8] Years ago, it was not unusual for surgeons to attempt 12.00 D or more of myopic correction. Today, the average upper limit of myopic correction has been reduced to 10.00 D in surveys of refractive surgeons.[8] Although the FDA recommends 250 µm as the minimal residual stromal depth, most surgeons currently leave 275 to 300 µm of tissue to attempt to reduce the risk of keratectasia.[8]

Although phakic IOLs are not FDA approved to treat astigmatism, they are available in the United States to correct myopia. Phakic IOLs may be safer, more predictable, and more efficacious with better quality of vision due to less induced higher-order aberrations for patients with moderate-to-high myopia compared with LASIK.[9] One study showed that individuals with 7.00 D or more of myopia preferred phakic IOL correction over LASIK.[9] Thus, we practitioners should consider discussing both phakic IOLs and LASIK with our patients with high myopia.

Because custom wavefront-optimized and wavefront-guided ablation profiles induce fewer higher-order aberrations than conventional excimer laser treatments, these ablation patterns give patients better quality of vision, contrast

sensitivity, and fewer night vision disturbances.[10-12] In my experience at TLC Laser Centers, the two leading laser technologies (Visx Advanced CustomVue [Abbott Medical Optics Inc., Santa Ana, CA] and the WaveLight Allegretto [Alcon Laboratories, Inc., Fort Worth, TX]) and ablation profiles are indistinguishable from each other, and both platforms provide patients with excellent results.

IMPROVEMENTS IN SAFETY

Corneal topographic analysis is the most important test for practitioners to perform when screening patients for laser vision correction, because it helps to identify those at risk for keratectasia. Corneal topography can help identify corneas that are at risk for developing keratoconus. Elevation topography has become the standard method for screening patients, as it can analyze the back surface of the cornea where keratectasia is thought to begin.

The Orbscan topographer (Bausch + Lomb, Rochester, NY) allows physicians to map both the anterior and posterior surfaces of the cornea using slit scanning and Placido disk technology. The machine also provides a pachymetric map of the cornea, which is an important component in the detection of corneal abnormalities. As with all technology, however, the Orbscan is not perfect; intertest repeatability and posterior surface elevation measurements can be problematic.[13]

The Pentacam Comprehensive Eye Scanner (Oculus, Inc., Lynnwood, WA) is a Scheimpflug topographic imaging system that allows direct measurement of the front and back elevations, similar to the Orbscan but without the need of a Placido disk. The Pentacam HR features 138,000 limbus-to-limbus elevation points with a technician-independent autofocus and autoacquisition system. The Pentacam system has shown to measure pachymetry equal to ultrasound pachymetry in postmyopic LASIK eyes.[14,15]

Posterior and anterior elevation, pachymetric, and keratometric parameters measured by the Pentacam camera can effectively discriminate keratoconus from healthy corneas serving as a useful diagnostic tool for disease staging.[16]

Recent advances in the Pentacam's technology are available in the Enhanced Ectasia display, created by Belin and Ambrosio[17] (Figure 1). This utilizes the combination of tomographic thickness profiles and enhanced elevation data profiles. This software allows clinicians to analyze a patient's corneal topography based on a normative database and has been demonstrated as more sensitive than standard techniques in detecting keratoconus and subclinical ectasia in candidates for corneal refractive surgery. It is important to consider the totality of a patient's clinical findings when determining his or her candidacy for laser vision correction, and clinicians should consider performing wavefront aberrometry. New technologies such as genetic screening, the Visante Optical Coherence Tomography device (Carl Zeiss Meditec, Inc., Dublin, CA), and the Galilei Dual Scheimpflug Analyzer (Ziemer Group, Port, Switzerland) may further enhance our ability to screen patients for the risk of ectasia prior to laser vision correction.

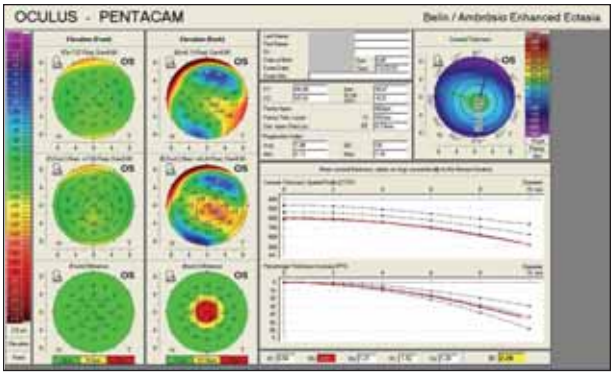

Figure 1. The Pentacam's Enhanced Ectasia display.

CONCLUSION

Ophthalmic practitioners have learned a lot during the past 15 years in terms of the safety and efficacy of laser vision correction. Today, we can confidently recommend this procedure to the appropriate patients. In the future, we need to continue to improve our patient selection process by using enhanced technology, clear informed consent processes, risk/benefit education for prospective patients, preoperative workups, and outcomes analysis and follow-up.

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Business Development, Networking

BY JO'EL STURM, OD

The key components to the successful development of an optometric or ophthalmic practice include patients' education, business networking, marketing, and social networking.

PATIENTS' EDUCATION

How much is too much? Is the process meant to protect patients or ourselves? As physicians, we have a desire to fully inform patients about procedures and practices. As the patients' most crucial advocate however, we should not scare them with a laundry list of possible complications. In my opinion, residents and doctors in training are often pushed to educate patients in an attempt to protect themselves from litigation. Instead, we should teach how to communicate in such a way that enables finding out what patients' goals are. Once all of the pertinent findings are assessed, the aim should be to discuss realistic expectations and concerns specific to the patient. Instead of cultivating the mindset that the consultation for surgery is for a doctor's protection, I prefer to teach eye care providers how to talk to patients, identify their objectives, and learn what questions to ask. Surgical consultations should be about protecting patients from making decisions that are wrong for them!

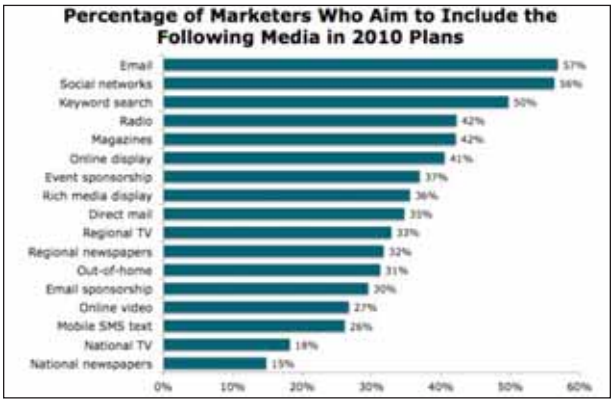
Beyond the consultation, we should protect ourselves with a nonnegotiable, consistent process for informed consent. This may include written consent forms, education with videos or online programs, and documentation of the informed consent dialogue.

NETWORKING

I am passionate about cultivating optometric referral networks because I firmly believe optometrists should be involved in surgical eye care. Surgical decisions are based on clinical findings, but understanding a patient's motivation for surgery is crucial for great outcomes. As optometrists, we know the ocular history of our patients and can provide an understanding of their motivation. Comanaging these patients provides the basis for strong relationships between ophthalmologists and optometrists that benefit our patients. The building blocks of a referral network are trust, mutual respect, and communication. When the referring OD is part of the process, patients know more about their options and are better prepared to make a decision regarding surgery.

NETWORKING

Marketing is challenging, and practices must decide what to do, and more importantly, what not to do, when it comes to direct marketing promotion. We must address questions such as: is this a branding campaign? How are we going to drive volume? Do we need to concentrate our focus more? Are we spotlighting a certain segment of our business or a certain population? What do we hope marketing will achieve? What is the return on this investment?



To determine appropriate budgets, we should identify expenditures that drive profitability and determine the expected margins based on accurate, historical expense data.

In some cities, marketing via print, TV, and radio could be cost-prohibitive. Before starting a campaign, compare the expected dollars spent per patient lead and compare that with social marketing or piloting a patient appreciation program (databases you already have).

In my experience, social media is today's marketing campaign. In 2010, according to the Centers for Media Research, over 50% of all business were including social media as a means to connect with customers (see chart). Social media is about content, conversation, and community. We as practitioners should commit a certain amount of our practice resources to this endeavor and monitor it to determine if its rewards will be significant.

CONCLUSION

Eye care is not immune to the changing landscape of health care. During the past 18 months, many different models of health care have taken shape. Foremost is the modification of electronic health records and how we use them as a means of exchanging health care information. Optometry must convert to the use of electronic health records and have an available portal that provides the optometric industry access to uplink health care information. This is key to dealing with the insurers, the basis for the patient-centered medical home care model, and will dictate who is a real player in the delivery of primary care. ■

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