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CLINICAL DIAGNOSIS | SURGERY | DRUG THERAPY

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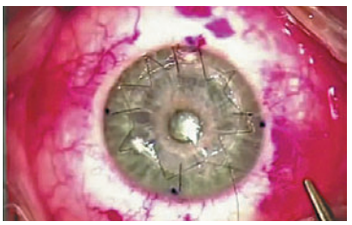
TAMING AND CONQUERING ECTASIA



JACKSONVILLE, FL :: **IN CASES OF ECTASIA**, Arun C. Gulani, MD, suggests the word not even be used. Using names like "ectasia" may cause trepidation and knee-jerk reactions among surgeons and despair among patients, he noted.

In addition to the natural cause of keratoconus, ectasia can arise from LASIK, automated lamellar keratoplasty, radial keratotomy, or trauma. The cause, technology that caused it, name of the surgeon, or state or country where it was done is immaterial when ectasia is approached in a holistic vision rehabilitative mode.

(See story on page 6 : Ectasia)

Surgery

SCLERAL APPROACH REFINED FOR PRESBYOPIA

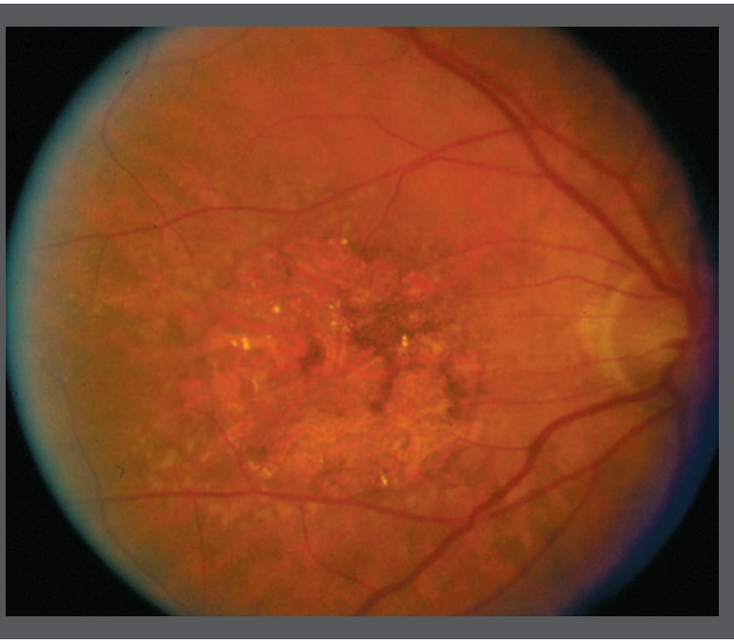
NEW YORK :: **OVER THE PAST 12 MONTHS**, refinements in the design of scleral implants (PresVIEW Scleral Implants, Refocus Group) and advancements in their implantation (PresVIEW Procedure, Refocus Group) have made the minimally invasive procedure for presbyopia correction—and glaucoma treatment—more precise, faster, and importantly, more comfortable for the patient.

(See story on page 8 : Presbyopia)

YEAR IN REVIEW *RETINA: DRUG THERAPY*

Retina drug therapies ever evolving

Medical advances run gamut from AMD to symptomatic vitreomacular adhesion



Drug shows promise

Anti-factor D is an injectable drug recently studied in a phase II trial for the treatment of geography atrophy. The results show that in patients with complement factor I, there is a 44% reduction in the progression to geographic atrophy with monthly injections. *(Image courtesy of David F. Williams, MD)*

By Lynda Charters;
Reviewed by Pravin U. Dugel, MD, Sharon Fekrat, MD, and Paul Hahn, MD, PhD

THANKS TO DRUG therapy advances in 2013, retina patients can benefit from pharmacologic vitreolysis and improved monitoring of oral hydroxychloroquine use.

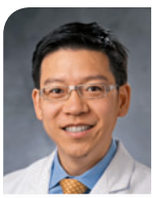
Likewise, clinical studies are testing new pharmaceutical agents designed to treat both the dry and wet forms of age-related macular degeneration (AMD).

Trials also hold the promise of combination therapies for AMD as well as diabetic macular edema (DME) and retinal vein occlusion (RVO).

However, the Age-Related Eye Disease 2 (AREDS2) Study proved to be inconclusive.

PHARMACOLOGIC VITREOLYSIS

One highlight of drug delivery during the past year is the commercial availability of ocriplasmin (Jetrea, ThromboGenics) to induce vitreolysis pharmacologically.



Dr. Hahn

"This is a revolutionary formulation in that it is the first of its kind that is designed to pharmacologically treat patients with symptomatic vitreomacular adhesion, which can lead ultimately to macular hole formation," said Paul Hahn, MD, PhD, assistant professor of ophthalmology, Duke Eye Center, Duke University School of Medicine, Durham, NC.

(Continues on page 18 : Retina drugs)

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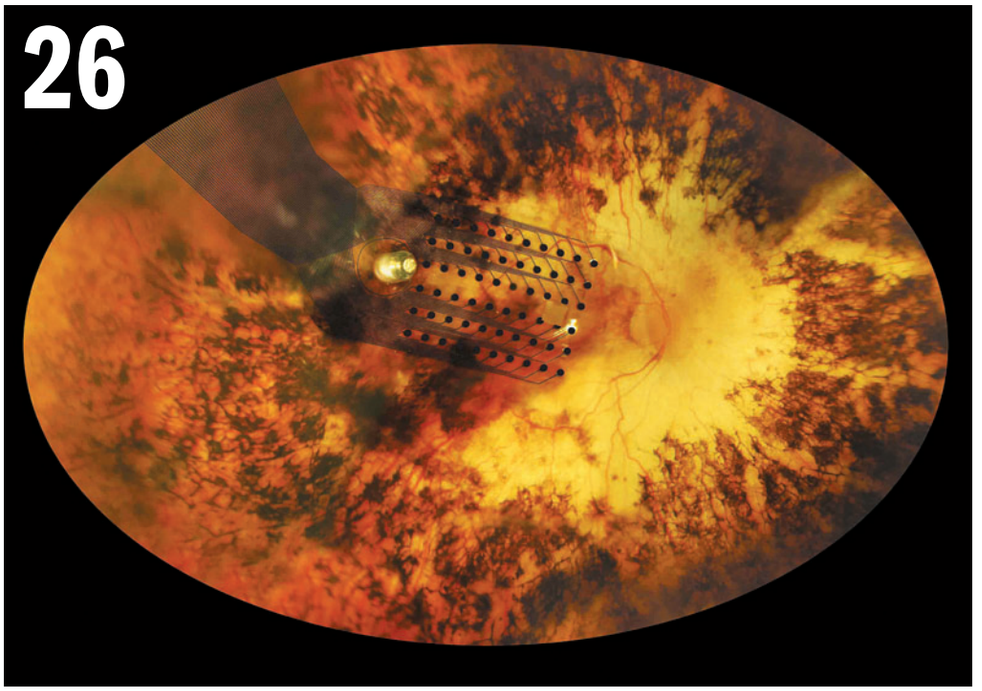

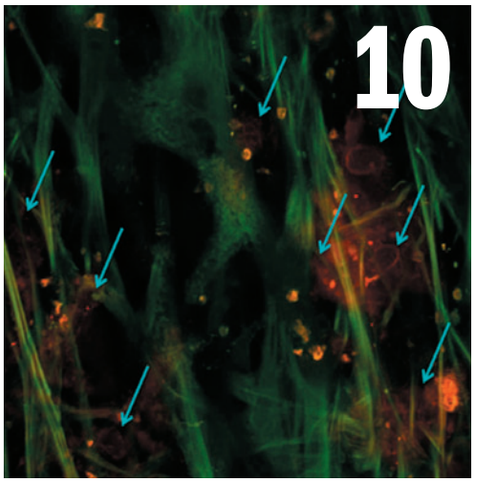

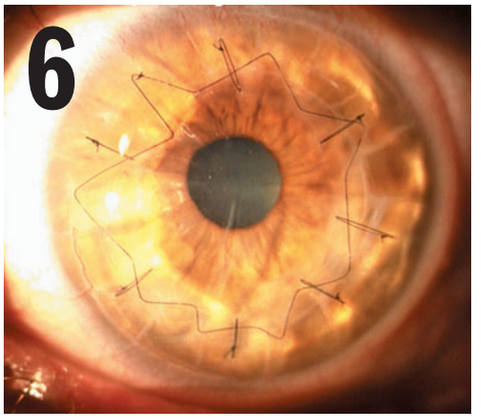

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In Every Issue

YEAR IN REVIEW

RETINA & GLAUCOMA

Special Report on page 10

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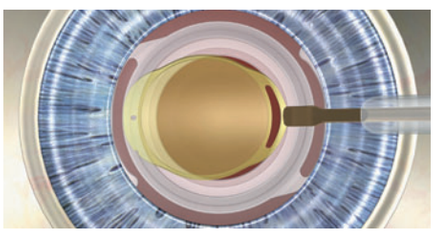

All the more reason to smile

Researchers grin over the importance of the orbicularis oculi

By Peter J. McDonnell, MD

director of the Wilmer Eye Institute, Johns Hopkins University School of Medicine, Baltimore, and chief medical editor of *Ophthalmology Times*.

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"Hey, hobo man, hey, Dapper Dan
You've both got your style
But brother you're never fully dressed
Without a smile."
—Soundtrack from the motion picture, "Annie"

MATTHEW HERTENSTEIN is a psychologist at DePauw University, Greencastle, IN, who has studied the photos of children and high school students and then determined what happened to them later in their lives.

People who smile more warmly in their photos when they are young will allegedly live longer and happier lives. A "warmer smile," according to the definition of psychologists, demonstrates contraction of the orbicularis oculi. This muscle gives "that proverbial 'twinkle' in your eyes," according to folks who study smiles.

WHAT ARE THE DATA?

- **According to a study of college yearbook photos published in 2009, those who smiled least in their photographs were about five times more likely to divorce at some point in their lives compared with those who smiled most.**
- **A second study of people aged 55 to 91 years examined their photos from childhood (average age, 10 years). The more smiley the subjects, the less likely they were to experience divorce.**
- **A 2001 study found that women with warm smiles in their college yearbook photos experienced less anxiety, sadness, and despair in the 30 years after graduation.**
- **Professional baseball players smiling warmly in photographs taken in the early 1950s lived, on average, until the age of 80. Sadly, the ballplayers who weren't smiling died, on average, at the age of 73.**

According to Prof. Hertenstein, "smiling behavior predicts surprisingly large number of outcomes that people care about. But, your smile, or lack thereof, is not the great determinant of your destiny. Individual cases will certainly vary."

WHAT DOES YOUR PHOTO SAY ABOUT YOU?

Upon reading this, I quickly inspected my photo in this publication, as well as those on my walls and shelves. From that exercise, I concluded:

- **My orbicularis oculi musculature is being used, and therefore, I will live to be at least 80 years old.**
- **It is kind of pathetic for a grown man my age to have so many photographs of himself in his office.**

These data about smiling yearbook photos reminded me of the time the photographer came to my grammar school, St. Peter's, in my little Jersey shore town. Our mothers took us for haircuts the day before, combed our hair that morning, and made us dress nicely (we wore uniforms with clip-on ties).

"Be sure to smile," they said.

But a couple friends and I agreed that we did not want our photos taken and we would refuse to smile for the dumb photographer. When the time came, I sat down on the stool with the fake background and didn't smile.

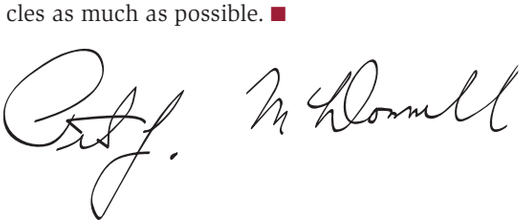
"Who are you supposed to be?" said the photographer. "Elvis Pretzel?"

To a 7-year-old boy, this was such a hilarious joke that I burst into laughter, and he took the photo.

"Thank you," he said, and we were done.

What does this research mean for you, dear *Ophthalmology Times* reader?

My own theory is there may well be something to this idea that smiling is good for us, and we would be wise—in our clinics and operating rooms—to exercise our orbicularis muscles as much as possible. ■



Reference

• Hertenstein M. The Tell: The Little Clues That Reveal Big Truths About Who We Are. Basic Books, 2013.

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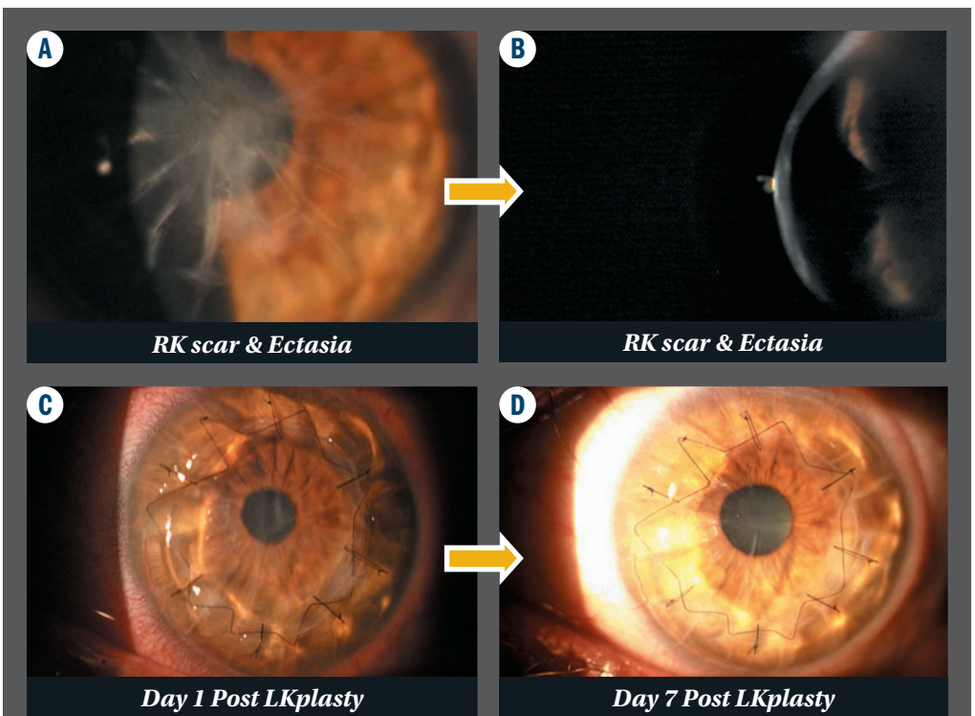
Taming and conquering ectasia

How Gulani 5S system serves as sorter to demystify refractive complication, aim for BVP

Gloves Off with Gulani; *By Arun C. Gulani, MD*

TAKE-HOME

- ***Approach cases of ectasia using the 5S classification system to break down the condition into manageable components as part of a plan toward best vision potential.***



LKplasty: Post-RK Ectasia and Scar

Hand lamellar keratoplasty in a case of multiple RK/AK ectasia with central dense scarring and thinning. Day 1 and Day 7 postop appearance of lamellar keratoplasty using non-radial anchor sutures and asymmetric anti-torque Barraquer suture which was also intricately arranged to buttress the intersecting RK-AK incisions.
(Images courtesy of Arun C. Gulani, MD)

JACKSONVILLE, FL ::

In cases of ectasia, I would first suggest that we not even use that word. Using names like "ectasia" may cause trepidation and knee-jerk reactions among surgeons and despair among patients.

In addition to the natural cause of keratoconus, ectasia can arise from LASIK, automated lamellar keratoplasty, radial keratotomy, and trauma. The cause, technology that caused it, name of the surgeon, or state or country where it was done is immaterial when we approach ectasia in a holistic vision rehabilitative mode.

The backbone behind technique selection and plan formation for any patient—including those with ectasia—is the 5S system classification of Sight, Scar, Shape, Strength, and Sit.

The 5S system can be used to melt down the complexity of this condition into basics. Take the worst and most feared complication of visual corrective surgery and reverse it by using the principles of refractive surgery as an art to return the patient not only to usable vision, but also to best vision potential (BVP).

To my fellows, I like to introduce the 5S system as a "coin sorter." Throw any surgical complication into it and watch it break the complex and scary giant into manageable components. Then, like Lego pieces, use this to plan surgery toward BVP (see "*Vision á la carte: Designing Vision*," Ophthalmology Times, *Sept. 15, 2013, Page 31; "Multifocal IOL nightmare: Reversed to 20/20,"* Ophthalmology Times, *Oct. 1, 2013, page 18)*.

The most common cases of ectasia usually have the following 5S factors affected: Sight (vision potential), Strength (decreased thickness), and Shape (irregular astigmatism/myopia).

ENTER INTRASTROMAL CORNEAL RING SEGMENTS

Looking at the most common case scenario—post-LASIK ectasia—approaching the affected factors can be undertaken using intrastromal corneal ring segments (Intacs, Addition Technology) in uniquely designed configurations to induce directional optical manipulations with ring segments single and paired, superficial and deep, thick and thin segments, and intended axis entry.

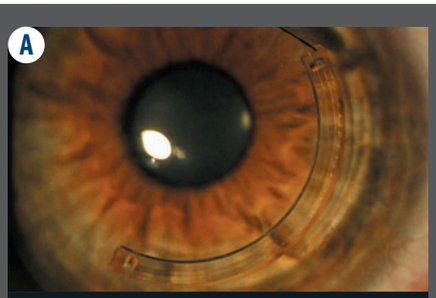
By using directional entry into the cornea, for example, the intrastromal corneal ring segments can be uniquely arranged not only to flatten the cornea (decreasing keratometry and myopia), but also to correct astigmatism (axis oriented entry of the intrastromal corneal ring segments) and correct the strength (although this will not add tissue, it will add strength, like braces)—resulting in improved configuration, which translates to improved sight.

Once this stability is achieved, residual astigmatism (the most common residual refractive error following these cases) can be addressed by laser PRK, as removal of astigmatism with the excimer laser utilizes the least amount of tissue ablation and also the already placed intrastromal corneal ring segments, like braces, will provide supportive strength to tissue removal.

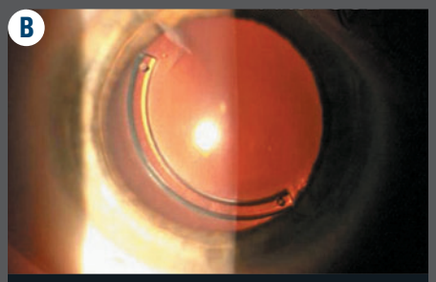
This can further be followed, in the near future, by collagen crosslinking (CXL) to make the achieved outcome permanent.

PRESENCE OF SCAR

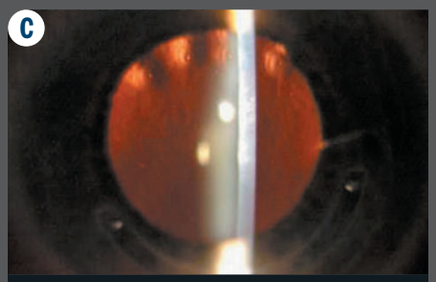
Now, take a scenario in which the most



Before CXL



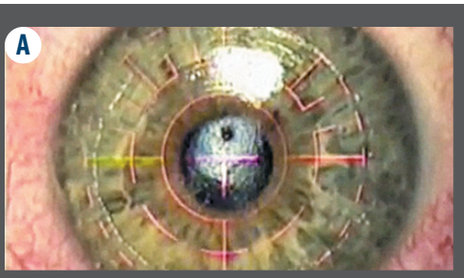
After CXL

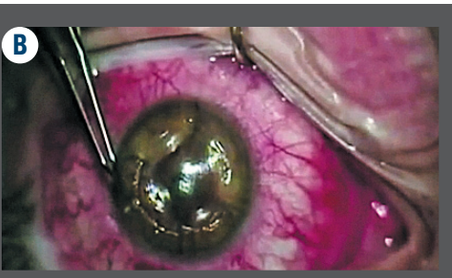


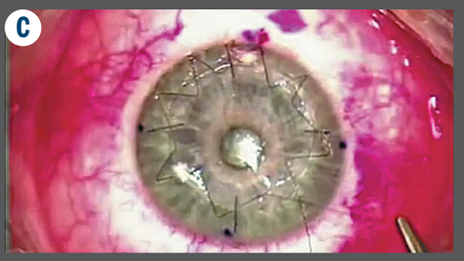
After CXL and CK

LASIK Ectasia: Intacs before/after CXL

Intacs can be used before and after collagen crosslinking.







VIDEO Watch these ectasia videos by following these links:

A Ectasia http://bit.ly/ITL8hJ

B Ectasia Lamellar Keratoplasty RK http://bit.ly/1kG2tXL

C Ectasia Lamellar Keratoplasty http://bit.ly/1dwLUv5 *(Videos courtesy of Arun C. Gulani, MD)*

commonly affected three Ss of ectasia are present with the additional fourth S of Scar.

In cases of corneal ectasia with scar, in addition to the involvement of strength and shape, lamellar keratoplasty can be used, such that the tissue lamella that is replaced adds strength by adding thickness, removes the scar, and also aids with shape by decreasing the keratometry by flattening, thus decreasing ectatic myopia.

In most cases, the astigmatism will be either neutral or slightly decreased.

Having corrected these S factors, 6 months after suture removal and stability, excimer laser in PRK mode could be used to correct the refractive error back to emmetropia, and in the near future, once again, CXL to make the procedure permanent.

Additionally, intraocular surgery can be undertaken to manipulate the eye optically either before or after corneal stabilization using phakic or pseudophakic lens implants.

For example, if the patient is at the age of cataracts, a surgeon can actually utilize toric IOLs to correct the patient's refractive error and induce a level of myopia for future laser flattening (decreasing keratometry) and smoothing of the cornea.

Laser PRK in the myopic mode should be used as the final wand in re-establishing emmetropia and final contour to vision.

Plus, all steps prior to this would optically arrange or manipulate the eye toward a stable myopic astigmatism outcome to use the cornea as what I call a "laser vision rehabilitative platform" (given its easy accessibility).

CXL can be used in all such cases as a final "permanizing" procedure, as opposed to using it as a first step in "cementing" the ectasia.

I use the analogy of a bent, scoliotic spine here. Rather than cementing (akin to CXL) the bent, scoliotic spine so it will not bend anymore, I would rather first correct that curvature to best functional use (akin to vision and anatomy), using whatever means (akin to ectasia, intrastromal corneal ring segments/lamellar Kplasty/CK), and only then proceed with cementing or permanizing the outcome (akin to CXL).

The point is to take the patient with ectasia closer—with every step—to the end zone.

Maintain the principles of Corneoplastique, keeping all surgical steps brief, elegant, visually promising, least interventional, with all standard surgeries (like penetrating keratoplasty) acting as backup, and return patients to the very goal they began this journey with—BVP—restoring not only vision, but faith and hope. ■

References

- Gulani AC, Nordan LT, Alpins N, Stamatelatos G. *Excimer laser photorefractive keratectomy for keratoconus.* In: Wang M, ed. Keratoconus and Keratoectasia Prevention, Diagnosis and Treatment. Thorofare, NJ:Slack Inc.;2009:145-151.
- Gulani AC, Boxer Wachler B. *Reshaping keratoconus: Laser PRK followed by corneal crosslinking. Mastering corneal collagen crosslinking techniques.* In: Textbook of Ophthalmology. New Delhi, India: Jaypee Brothers Medical Publishing;2009:120-131.
- Gulani, AC. Think outside the cone: Raising keratoconus surgery to an art. *Advanced Ocular Care.* Nov/Dec 2010.
- Gulani AC. *Shaping the Future and Reshaping the Past: The Art of Vision Surgery. Chapter 98.* In: *Copeland and Afshari's Principles and Practice of Cornea.* New Delhi, India: Jaypee Brothers Medical Publishers, 2013;2:1252-1273.
- Gulani AC. Reversing LASIK and premium IOL woes: Taking a logical, stepwise approach and fighting for every line of visual acuity will pay dividends for you and your patients. *Review of Ophthalmology.* 2013;20:104-155. http://www.revophth.com/content/d/refractive_surgery/i/2393/c/40623/
- Gulani AC. Corneoplastique: Art of visual surgery. *Video Journal of Cataract and Refractive Surgery.* 2006;22(3).
- Gulani AC. *Principles of Surgical Treatment of Irregular Astigmatism in Unstable Corneas. Textbook of Irregular Astigmatism. Diagnosis and Treatment.* Thorofare, NJ: SLACK Inc.; 2007:251-261.
- Gulani AC. Corneoplastique. *Techniques in Ophthalmology.* 2007;5:11-20.
- Gulani AC. Corneoplastique. *Video Journal of Ophthalmology.* 2007;22(3).

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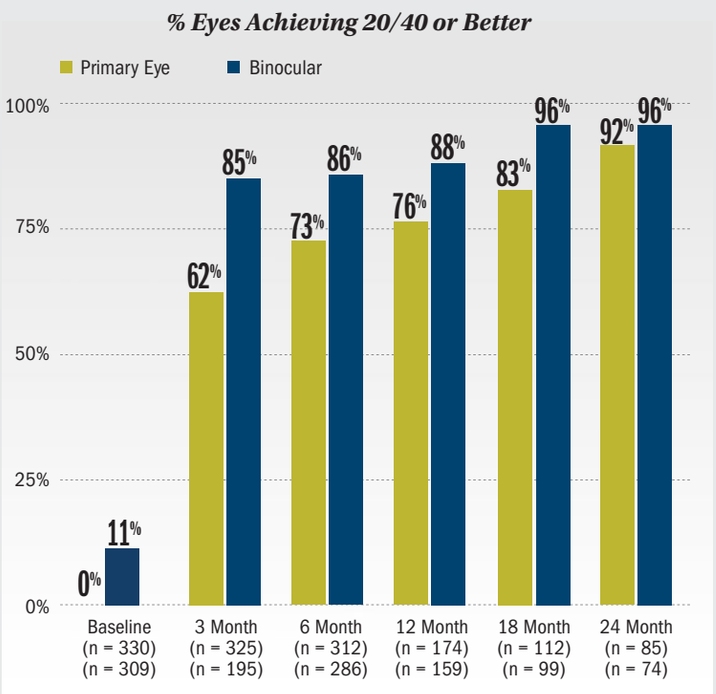
Dr. Gulani is director of the Gulani Vision Institute.

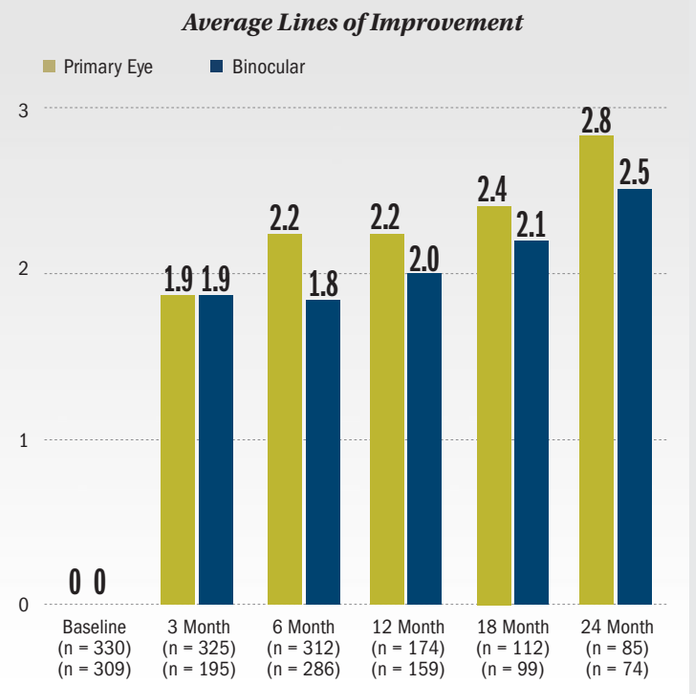
Scleral approach refined for presbyopia

Results positive for enhancements in design, surgical technique of scleral implant surgery

By Lynda Charters; *Reviewed by Barrie D. Soloway, MD*

Distance Corrected Near Visual Acuity @ 40cm – Sloan EDTRS Chart





Early data from the ongoing IDE FDA pivotal study showed that the percentage of binocular eyes achieving 20/40 or better vision at 24-months follow-up to be 97%, with an average increase of 3 lines of near acuity.

TAKE-HOME

- ***Refinements in both the design of scleral implants to treat presbyopia—and glaucoma—and in the surgical implantation technique have improved markedly over the year, making the devices easier to implant and the surgery time shorter.***

NEW YORK ::

OVER THE PAST 12 months, refinements in the design of scleral implants (PresVIEW Scleral Implants, Refocus Group) and advancements in their implantation (PresVIEW Procedure, Refocus Group) have made the minimally invasive procedure for presbyopia correction—and glaucoma treatment—more precise, faster, and importantly, more comfortable for the patient.

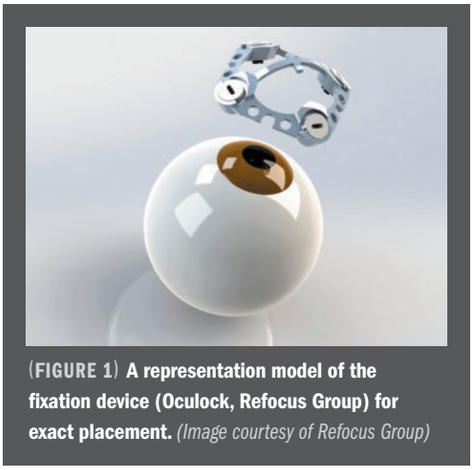
During implantation, explained Barrie D. Soloway, MD, the basic procedure includes:

- Determination of the positions of the four scleral implants.
- Creation of four lamellar scleral tunnels to accommodate the devices.
- Insertion of the devices.
- Closure of the conjunctiva.

PRECISE POSITIONING

From 1998 to 2007, in the initial FDA clinical trial when the scleral implants were first being evaluated, a Meridian marker was used in marking of the cornea and calipers were used to determine the positions of the implants and to specify the location of the footplate and its grips.

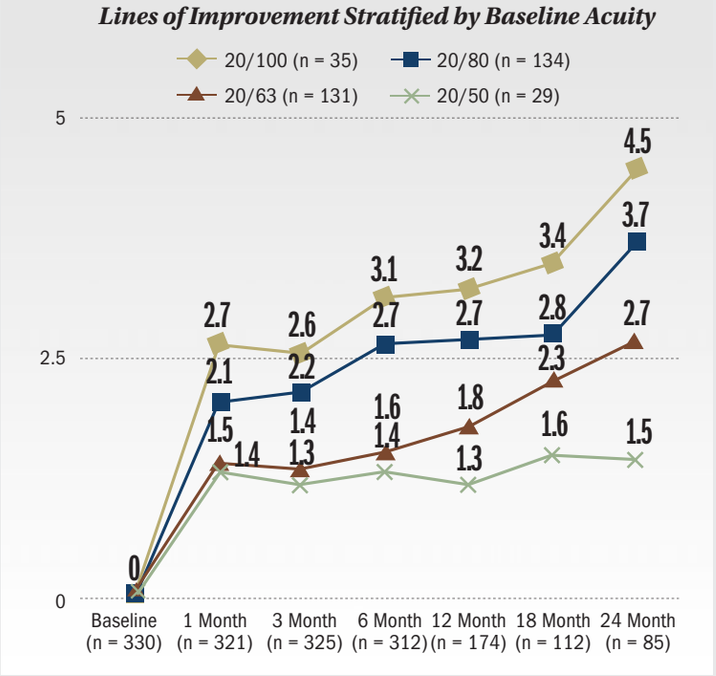
This inexact process resulted in a compounding of errors with multiple step measurements—and therefore, was less accurate in positioning the scleral implants, noted Dr. Soloway, director of vision correction, New York Eye and Ear Infirmary, New York, and medical director, Refocus Group.

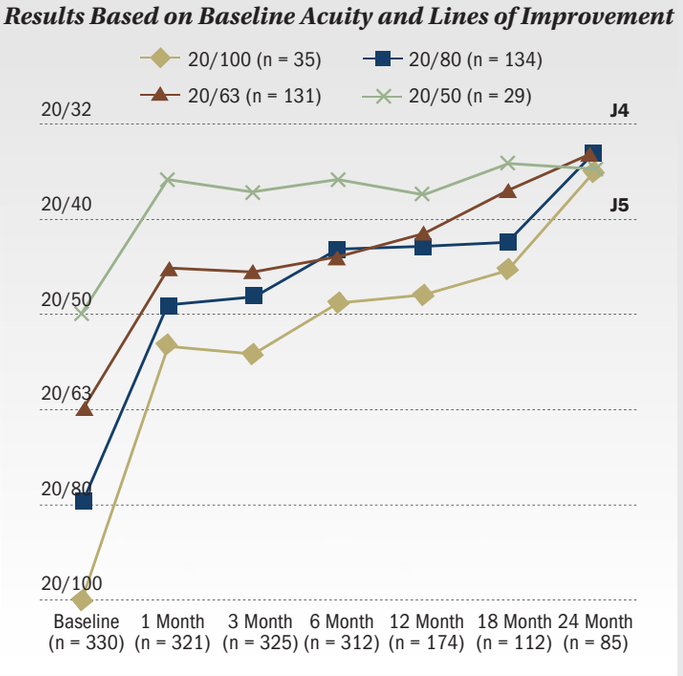


(FIGURE 1) A representation model of the fixation device (Oculock, Refocus Group) for exact placement. *(Image courtesy of Refocus Group)*

In the FDA pivotal clinical trial from 2008 to 2012, there was an initial evolution to improve accuracy, with specialized markers used to de-

Distance Corrected Near Visual Acuity@ 40cm – Sloan EDTRS Chart





Early data from the ongoing IDE FDA pivotal study showed that the percentage of binocular eyes achieving 20/40 or better vision at 24-months follow-up to be 97%, with an average increase of 3 lines of near acuity. *(Figures courtesy of Barrie D. Soloway, MD)*

termine the position of the scleral implants. However, the surgeon still was required to line up the marks visually with the instrumentation.

The latest step in this evolution is the use of a fixation device (Oculock, Refocus Group) for exact placement (Figure 1).

"The [device] 'locks' onto the eye with four-point fixation and a scleratome physically 'docks' into the correct position on the eye," Dr. Soloway said. "This instrument facilitates efficient, accurate, and uniformly positioned tunnels."

ACCURATE TUNNEL CREATION

This step in the implantation process has evolved markedly from the initial use of a manual diamond blade between 1998 and 2004 requiring surgeon skill and judgment and resulting in tunnels that were potentially not uniformly deep. Surgeons then graduated to using an electric scleratome from 2004 to 2012. This proved to be a bulky instrument, and positioning of the tunnel was difficult because of the speed of transit and inertia, Dr. Soloway said.

The introduction of the disposable scleratome into the procedure in 2012 overcame these disadvantages.

The instrument that docks to the fixation device is lightweight, ergonomically designed, and is delivered sterile and pre-assembled. The surgical time is decreased and the procedure easier and safer, according to Dr. Soloway.

The implant originally was a one-piece device from 2000 to 2006 that was pushed into place and was difficult to thread through the tunnel. The implant first had a uniform width, but research over the long term showed these implants had a tendency to slip out of the tunnel, resulting in a return to the subjects' preoperative near vision.


Dr. Soloway

In 2007, a redesign of the scleral implant improved its stability in the eye by keeping it from shifting.

Each implant—which is the size of a grain of rice and constructed of polymethylmethacrylate—now has two interlocking parts: a split leg piece and a male head locking insert and is pulled into place by a shuttle and tubing. The shuttle threads through the tunnel and the tubing maintains a minimal cross section width until the implant clears the tunnel. The insert is locked into place.

Both ends of the implant are wider than the tunnel, which prevents slippage out of the tunnel.

TRANSFORMING SUTURING

Various suture methods have been used from 1998 to 2012 in U.S. clinical trials. However, these caused a foreign body sensation and reduced tear film stability.

A fibrin tissue sealant was introduced in 2010 that is currently used only internationally.

"This sealant has resulted in increased patient comfort, improved cosmesis, and improved tear film stability," Dr. Soloway said.

"This procedure is much easier to perform in 2013 compared with previous years," he said. "The advancements of the techniques have led to continued successful results seen in a FDA investigational device exemption clinical study and in international studies."

Early data from the ongoing IDE FDA pivotal study—presented in October at the European Society of Cataract and Refractive Surgeons in Amsterdam—showed that the percentage of binocular eyes achieving 20/40 or better vision at 24-months follow-up to be 97%, with an average increase of 3 lines of near acuity, Dr. Soloway said.

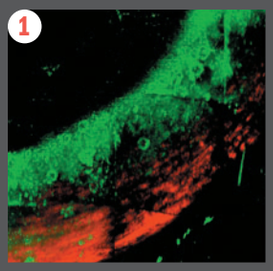
"The procedure has truly evolved," he said. "Surgical time has decreased significantly, results have improved, and we have consistent outcomes and much happier patients." ■

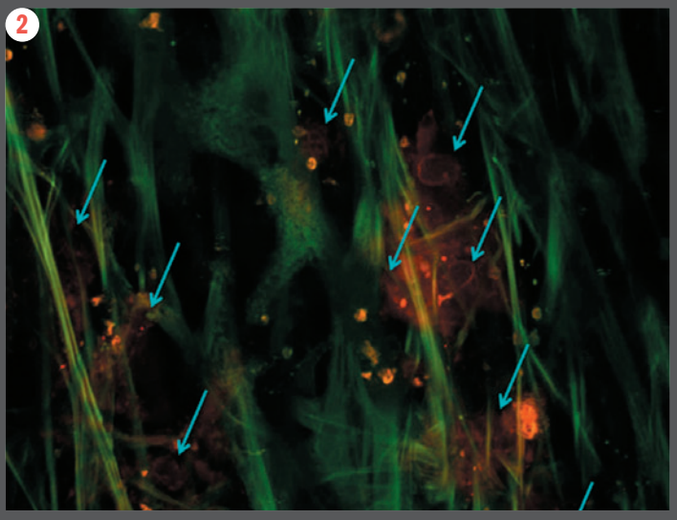
BARRIE D. SOLOWAY, MD

E: *bds@ihateglasses.com*

Dr. Soloway receives consulting and travel fees from Refocus Group Inc. This device and surgery is CE marked and available in Europe and elsewhere through Refocus Ocular BV, The Netherlands. The device is under FDA IDE in the United States with an earlier surgical procedure through Refocus Group Inc., Dallas.

GLAUCOMA: CLINICAL DIAGNOSIS





1 **A multiphoton microscopy scan of a mouse eye showing trabecular meshwork cells (green). Images were acquired in a whole eye with transscleral imaging.**

2 **Human trabecular meshwork imagined with multiphoton microscopy showing collagen beams (green) and meshwork cells (red) with some scattered pigment granules over the meshwork tissue.**
(Images courtesy of Malik Y. Kahook, MD)

GLAUCOMA DIAGNOSTICS RESEARCH FOCUSES ON NOVEL, EXISTING TOOLS

Lack of diagnostic advancements this past year has shifted the spotlight onto technology expansion

By Cheryl Guttman Krader;
Reviewed by Robert D. Fechtner, MD, Malik Kahook, MD, and Joel S. Schuman, MD

take-home

- **Glaucoma experts analyze the hardware and software developments that came out of 2013, while noting several changes that still need to be addressed for the best utilization of the technology.**

No major diagnostic advances for glaucoma emerged in 2013, so optical coherence tomography (OCT) continued to take center stage with increasing clinical use and ongoing software and hardware development.

"Spectral-domain OCT (SD-OCT) technology continues to get faster with new devices offering scanning speeds upward of 70,000 A-scans per second," said Joel S. Schuman, MD, Eye and Ear Foundation professor and chairman of ophthalmology, University of Pittsburgh School of Medicine (UPMC), and director, UPMC Eye Center. "The faster scanning allows more data to be collected with less artifact and improved scan quality."


Dr. Schuman

Observing that SD-OCT is becoming more widely adopted in clinical practice, Dr. Schuman stressed that this increasing use bespeaks a need for compatibility between platforms.

"There is a need for standardization of scanning routines and the ability to use data interchangeably between devices," Dr. Schuman explained. "We know this can be done because we have developed software for universal data analysis in our laboratory. Without this capability, clinicians cannot compare findings from serial scans performed using different platforms, and patients are the ones who lose."

Dr. Schuman also noted a need to provide clinicians with the actual digital data from the OCT delivered directly into their electronic health record (EHR).

"Imagine if a Word document created on one computer could not be used on another computer made by a different manufacturer," he said.

There is also intense interest in developing software that integrates structural and functional measures for glaucoma diagnosis and monitoring, as well as programs for combined analysis which becoming commercially available.

"It isn't totally clear yet that this new software provides a benefit to the patient or physician in allowing earlier or more accurate detection of disease or its progression," said Dr. Schuman. "However, this is an exciting new field and certainly a step in the right direction."


Dr. Fechtner

Robert D. Fechtner, MD, noted that EHRs likely provide an excellent opportunity for creating and using analytic tools integrating data from structural and functional testing. Rather than clinicians trying to assimilate the findings from visual function testing and diagnostic imaging, software could be developed that would automatically analyze the multitude of data contained in the EHR.

"Once we get beyond the basics of what EHRs are required to do, these systems have great clinical informatics potential, including as a tool allowing us to better care for our glaucoma patients," said Dr. Fechtner, professor, Institute of Ophthalmology and Visual Science,

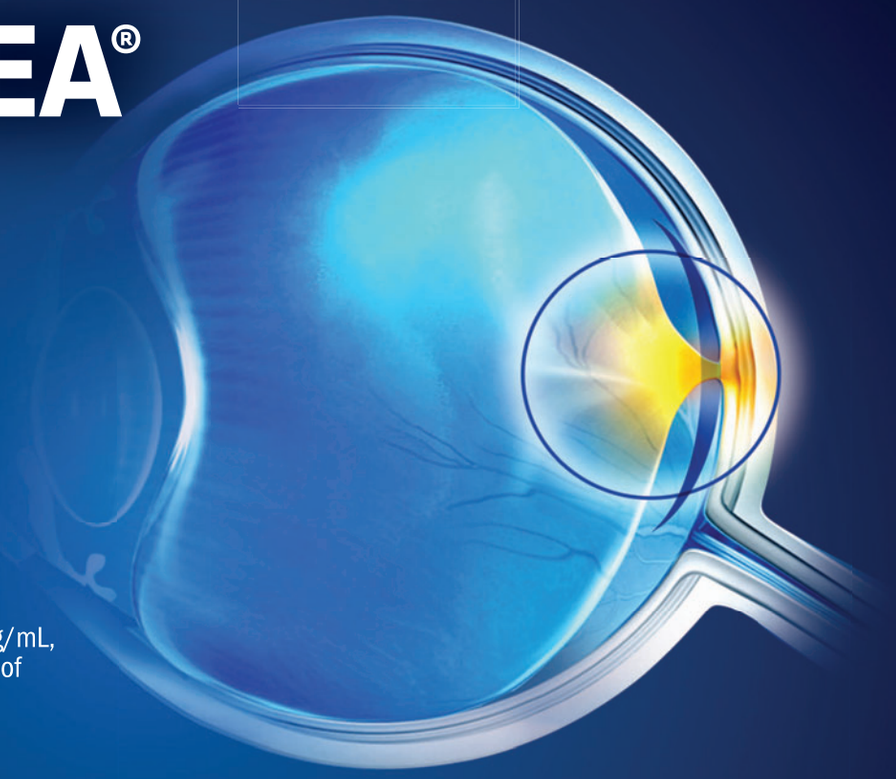
Continues on page 13 : ***Diagnosis***

ThromboGenics®

JETREA™
(ocriplasmin)
Intravitreal Injection, 2.5mg/mL

The FIRST AND ONLY pharmacologic treatment for symptomatic VMA

TAKE IMMEDIATE ACTION WITH JETREA®



Indication

JETREA® (ocriplasmin) Intravitreal Injection, 2.5 mg/mL, is a proteolytic enzyme indicated for the treatment of symptomatic vitreomacular adhesion (VMA).

IMPORTANT SAFETY INFORMATION

Warnings and Precautions

- A decrease of ≥3 lines of best-corrected visual acuity (BCVA) was experienced by 5.6% of patients treated with JETREA® and 3.2% of patients treated with vehicle in the controlled trials. The majority of these decreases in vision were due to progression of the condition with traction and many required surgical intervention. Patients should be monitored appropriately.
- Intravitreal injections are associated with intraocular inflammation/infection, intraocular hemorrhage, and increased intraocular pressure (IOP). Patients should be monitored and instructed to report any symptoms without delay. In the controlled trials, intraocular inflammation occurred in 7.1% of patients injected with JETREA® vs 3.7% of patients injected with vehicle. Most of the post-injection intraocular inflammation events were mild and transient. If the contralateral eye requires treatment with JETREA®, it is not recommended within 7 days of the initial injection in order to monitor the post-injection course in the injected eye.
- Potential for lens subluxation.
- In the controlled trials, the incidence of retinal detachment was 0.9% in the JETREA® group and 1.6% in the vehicle group, while the incidence of retinal tear (without detachment) was 1.1% in the JETREA® group and 2.7% in the vehicle group. Most of these events occurred during or after vitrectomy in both groups.
- Dyschromatopsia (generally described as yellowish vision) was reported in 2% of all patients injected with JETREA®. In approximately half of these dyschromatopsia cases, there were also electroretinographic (ERG) changes reported (a- and b-wave amplitude decrease).

Adverse Reactions

- The most commonly reported reactions (≥5%) in patients treated with JETREA® were vitreous floaters, conjunctival hemorrhage, eye pain, photopsia, blurred vision, macular hole, reduced visual acuity, visual impairment, and retinal edema.

Please see Brief Summary of full Prescribing Information on adjacent page.

VISIT JETREACARE.COM OR SCAN QR CODE FOR REIMBURSEMENT AND ORDERING INFORMATION

10/13 OCRVMA0133

JETREA.COM

JETREA™
(ocriplasmin)
Intravitreal Injection, 2.5 mg/mL

BRIEF SUMMARY OF FULL PRESCRIBING INFORMATION

Please see the JETREA® package insert for full Prescribing Information.

1 INDICATIONS AND USAGE
JETREA is a proteolytic enzyme indicated for the treatment of symptomatic vitreomacular adhesion.

2 DOSAGE AND ADMINISTRATION
2.1 General Dosing Information
Must be diluted before use. For single-use ophthalmic intravitreal injection only. JETREA must only be administered by a qualified physician.

2.2 Dosing
The recommended dose is 0.125 mg (0.1 mL of the diluted solution) administered by intravitreal injection to the affected eye once as a single dose.

2.3 Preparation for Administration
Remove the vial (2.5 mg/mL corresponding to 0.5 mg ocriplasmin) from the freezer and allow to thaw at room temperature (within a few minutes). Once completely thawed, remove the protective polypropylene flip-off cap from the vial. The top of the vial should be disinfected with an alcohol wipe. Using aseptic technique, add 0.2 mL of 0.9% w/v Sodium Chloride Injection, USP (sterile, preservative-free) into the JETREA vial and gently swirl the vial until the solutions are mixed.

Visually inspect the vial for particulate matter. Only a clear, colorless solution without visible particles should be used. Using aseptic technique, withdraw all of the diluted solution using a sterile #19 gauge needle (slightly tilt the vial to ease withdrawal) and discard the needle after withdrawal of the vial contents. Do not use this needle for the intravitreal injection.

Replace the needle with a sterile #30 gauge needle, carefully expel the air bubbles and excess drug from the syringe and adjust the dose to the 0.1 mL mark on the syringe (corresponding to 0.125 mg ocriplasmin). THE SOLUTION SHOULD BE USED IMMEDIATELY AS IT CONTAINS NO PRESERVATIVES. Discard the vial and any unused portion of the diluted solution after single use.

2.4 Administration and Monitoring
The intravitreal injection procedure should be carried out under controlled aseptic conditions, which include the use of sterile gloves, a sterile drape and a sterile eyelid speculum (or equivalent). Adequate anesthesia and a broad spectrum microbiocide should be administered according to standard medical practice.

The injection needle should be inserted 3.5 - 4.0 mm posterior to the limbus aiming towards the center of the vitreous cavity, avoiding the horizontal meridian. The injection volume of 0.1 mL is then delivered into the mid-vitreous.

Immediately following the intravitreal injection, patients should be monitored for elevation in intraocular pressure. Appropriate monitoring may consist of a check for perfusion of the optic nerve head or tonometry. If required, a sterile paracentesis needle should be available.

Following intravitreal injection, patients should be instructed to report any symptoms suggestive of endophthalmitis or retinal detachment (e.g., eye pain, redness of the eye, photophobia, blurred or decreased vision) without delay *[see Patient Counseling Information]*.

Each vial should only be used to provide a single injection for the treatment of a single eye. If the contralateral eye requires treatment, a new vial should be used and the sterile field, syringe, gloves, drapes, eyelid speculum, and injection needles should be changed before JETREA is administered to the other eye, however, treatment with JETREA in the other eye is not recommended within 7 days of the initial injection in order to monitor the post-injection course including the potential for decreased vision in the injected eye.

Repeated administration of JETREA in the same eye is not recommended *[see Nonclinical Toxicology]*.

After injection, any unused product must be discarded.

No special dosage modification is required for any of the populations that have been studied (e.g. gender, elderly).

3 DOSAGE FORMS AND STRENGTHS
Single-use glass vial containing JETREA 0.5 mg in 0.2 mL solution for intravitreal injection (2.5 mg/mL).

4 CONTRAINDICATIONS
None

5 WARNINGS AND PRECAUTIONS
5.1 Decreased Vision
A decrease of ≥ 3 line of best corrected visual acuity (BCVA) was experienced by 5.6% of patients treated with JETREA and 3.2% of patients treated with vehicle in the controlled trials *[see Clinical Studies]*.

The majority of these decreases in vision were due to progression of the condition with traction and many required surgical intervention. Patients should be monitored appropriately *[see Dosage and Administration]*.

5.2 Intravitreal Injection Procedure Associated Effects
Intravitreal injections are associated with intraocular inflammation / infection, intraocular hemorrhage and increased intraocular pressure (IOP). In the controlled trials, intraocular inflammation occurred in 7.1% of patients injected with JETREA vs. 3.7% of patients injected with vehicle. Most of the post-injection intraocular inflammation events were mild and transient. Intraocular hemorrhage occurred in 2.4% vs. 3.7% of patients injected with JETREA vs. vehicle, respectively. Increased intraocular pressure occurred in 4.1% vs. 5.3% of patients injected with JETREA vs. vehicle, respectively.

5.3 Potential for Lens Subluxation
One case of lens subluxation was reported in a patient who received an intravitreal injection of 0.175 mg (1.4 times higher than the recommended dose). Lens subluxation was observed in three animal species (monkey, rabbit, minipig) following a single intravitreal injection that achieved vitreous concentrations of ocriplasmin 1.4 times higher than achieved with the recommended treatment dose. Administration of a second intravitreal dose in monkeys, 28 days apart, produced lens subluxation in 100% of the treated eyes *[see Nonclinical Toxicology]*.

5.4 Retinal Breaks
In the controlled trials, the incidence of retinal detachment was 0.9% in the JETREA group and 1.6% in the vehicle group, while the incidence of retinal tear (without detachment) was 1.1% in the JETREA group and 2.7% in the vehicle group. Most of these events occurred during or after vitrectomy in both groups. The incidence of retinal detachment that occurred pre-vitrectomy was 0.4% in the JETREA group and none in the vehicle group, while the incidence of retinal tear (without detachment) that occurred pre-vitrectomy was none in the JETREA group and 0.5% in the vehicle group.

5.5 Dyschromatopsia
Dyschromatopsia (generally described as yellowish vision) was reported in 2% of all patients injected with JETREA. In approximately half of these dyschromatopsia cases there were also electroretinographic (ERG) changes reported (a- and b-wave amplitude decrease).

6 ADVERSE REACTIONS
The following adverse reactions are described below and elsewhere in the labeling:

- Decreased Vision *[see Warnings and Precautions]*
- Intravitreal Injection Procedure Associated Effects *[see Warnings and Precautions and Dosage and Administration]*
- Potential for Lens Subluxation *[see Warnings and Precautions]*
- Retinal Breaks *[see Warnings and Precautions and Dosage and Administration]*

6.1 Clinical Trials Experience
Because clinical trials are conducted under widely varying conditions, adverse reaction rates in one clinical trial of a drug cannot be directly compared with rates in the clinical trials of the same or another drug and may not reflect the rates observed in practice.

Approximately 800 patients have been treated with an intravitreal injection of JETREA. Of these, 465 patients received an intravitreal injection of ocriplasmin 0.125 mg (187 patients received vehicle) in the 2 vehicle-controlled studies (Study 1 and Study 2).

The most common adverse reactions (incidence 5% - 20%) listed in descending order of frequency) in the vehicle-controlled clinical studies were: vitreous floaters, conjunctival hemorrhage, eye pain, photopsia, blurred vision, macular hole, reduced visual acuity, visual impairment, and retinal edema.

Less common adverse reactions observed in the studies at a frequency of 2% - < 5% in patients treated with JETREA included macular edema, increased intraocular pressure, anterior chamber cell, photophobia, vitreous detachment, ocular discomfort, iritis, cataract, dry eye, metamorphopsia, conjunctival hyperemia, and retinal degeneration.

Dyschromatopsia was reported in 2% of patients injected with JETREA, with the majority of cases reported from two uncontrolled clinical studies. In approximately half of these dyschromatopsia cases there were also electroretinographic (ERG) changes reported (a- and b-wave amplitude decrease).

6.2 Immunogenicity
As with all therapeutic proteins, there is potential for immunogenicity. Immunogenicity for this product has not been evaluated.

8 USE IN SPECIFIC POPULATIONS
8.1 Pregnancy: Teratogenic Effects
Pregnancy Category C. Animal reproduction studies have not been conducted with ocriplasmin. There are no adequate and well-controlled studies of ocriplasmin in pregnant women. It is not known whether ocriplasmin can cause fetal harm when administered to a pregnant woman or can affect reproduction capacity. The systemic exposure to ocriplasmin is expected to be low after intravitreal injection of a single 0.125 mg dose. Assuming 100% systemic absorption (and a plasma volume of 2700 mL), the estimated plasma concentration is 46 ng/mL. JETREA should be given to a pregnant woman only if clearly needed.

8.3 Nursing Mothers
It is not known whether ocriplasmin is excreted in human milk. Because many drugs are excreted in human milk, and because the potential for absorption and harm to infant growth and development exists, caution should be exercised when JETREA is administered to a nursing woman.

8.4 Pediatric Use
Safety and effectiveness in pediatric patients have not been established.

8.5 Geriatric Use
In the clinical studies, 384 and 145 patients were ≥ 65 years and of these 192 and 73 patients were ≥ 75 years in the JETREA and vehicle groups respectively. No significant differences in efficacy or safety were seen with increasing age in these studies.

10 OVERDOSAGE
The clinical data on the effects of JETREA overdose are limited. One case of accidental overdose of 0.250 mg ocriplasmin (twice the recommended dose) was reported to be associated with inflammation and a decrease in visual acuity.

13 NONCLINICAL TOXICOLOGY
13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility
No carcinogenicity, mutagenicity or reproductive and developmental toxicity studies were conducted with ocriplasmin.

13.2 Animal Toxicology and/or Pharmacology
The ocular toxicity of ocriplasmin after a single intravitreal dose has been evaluated in rabbits, monkeys and minipigs. Ocriplasmin induced an inflammatory response and transient ERG changes in rabbits and monkeys, which tended to resolve over time. Lens subluxation was observed in the 3 species at ocriplasmin concentrations in the vitreous at or above 41 mcg/mL, a concentration 1.4-fold above the intended clinical concentration in the vitreous of 29 mcg/mL. Intraocular hemorrhage was observed in rabbits and monkeys.

A second intravitreal administration of ocriplasmin (28 days apart) in monkeys at doses of 75 mcg/eye (41 mcg/mL vitreous) or 125 mcg/eye (68 mcg/mL vitreous) was associated with lens subluxation in all ocriplasmin treated eyes. Sustained increases in IOP occurred in two animals with lens subluxation. Microscopic findings in the eye included vitreous liquefaction, degeneration/disruption of the hyaloideo-capsular ligament (with loss of ciliary zonular fibers), lens degeneration, mononuclear cell infiltration of the vitreous, and vacuolation of the retinal inner nuclear cell layer. These doses are 1.4-fold and 2.3-fold the intended clinical concentration in the vitreous of 29 mcg/mL, respectively.

14 CLINICAL STUDIES
The efficacy and safety of JETREA was demonstrated in two multicenter, randomized, double masked, vehicle-controlled, 6 month studies in patients with symptomatic vitreomacular adhesion (VMA). A total of 652 patients (JETREA 464, vehicle 188) were randomized in these 2 studies. Randomization was 2:1 (JETREA:vehicle) in Study 1 and 3:1 in Study 2.

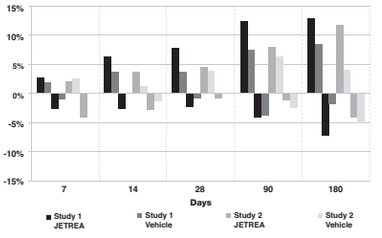
Patients were treated with a single injection of JETREA or vehicle. In both of the studies, the proportion of patients who achieved VMA resolution at Day 28 (i.e., achieved success on the primary endpoint) was significantly higher in the ocriplasmin group compared with the vehicle group through Month 6.

The number of patients with at least 3 lines increase in visual acuity was numerically higher in the ocriplasmin group compared to vehicle in both trials, however, the number of patients with at least a 3 lines decrease in visual acuity was also higher in the ocriplasmin group in one of the studies (Table 1 and Figure 1).

Table 1: Categorical Change from Baseline in BCVA at Month 6, Irrespective of Vitrectomy (Study 1 and Study 2)

Study 1			
	JETREA	Vehicle	Difference
	N=219	N=107	(95% CI)
≥ 3 line Improvement in BCVA			
Month 6	28 (12.8%)	9 (8.4%)	4.4 (-2.5, 11.2)
> 3 line Worsening in BCVA			
Month 6	16 (7.3%)	2 (1.9%)	5.4 (1.1, 9.7)
Study 2			
	JETREA	Vehicle	Difference
	N=245	N=81	(95% CI)
≥ 3 line Improvement in BCVA			
Month 6	29 (11.8%)	3 (3.8%)	8.1 (2.3, 13.9)
> 3 line Worsening in BCVA			
Month 6	10 (4.1%)	4 (5.0%)	-0.9 (-6.3, 4.5)

Figure 1: Percentage of Patients with Gain or Loss of ≥ 3 Lines of BCVA at Protocol-Specified Visits



16 HOW SUPPLIED/STORAGE AND HANDLING
Each vial of JETREA contains 0.5 mg ocriplasmin in 0.2 mL citric-buffered solution (2.5 mg/mL). JETREA is supplied in a 2 mL glass vial with a latex free rubber stopper. Vials are for single use only.

Storage
Store frozen at or below -4°F (-20°C). Protect the vials from light by storing in the original package until time of use.

17 PATIENT COUNSELING INFORMATION
In the days following JETREA administration, patients are at risk of developing intraocular inflammation/ infection. Advise patients to seek immediate care from an ophthalmologist if the eye becomes red, sensitive to light, painful, or develops a change in vision *[see Warnings and Precautions]*.

Patients may experience temporary visual impairment after receiving an intravitreal injection of JETREA *[see Warnings and Precautions]*. Advise patients to not drive or operate heavy machinery until this visual impairment has resolved. If visual impairment persists or decreases further, advise patients to seek care from an ophthalmologist.

Manufactured for:
ThromboGenics, Inc.
101 Wood Avenue South, 6th Floor
Iselin, NJ 08830

U.S. License Number: 1866

Version 1.0
Initial U.S. Approval: 2012
ThromboGenics U.S. patents: 7,445,775; 7,547,435; 7,914,783 and other pending patents.

05/13 OCRVMA0072 PI G

GLAUCOMA: SURGERY

Market adoption of MIGS growing

SLT continues to gain acceptance as first-line treatment as surgical options expand

By Cheryl Guttman Krader; *Reviewed by Robert D. Fechtner, MD, Malik Kahook, MD, and Joel S. Schuman, MD*

INTEREST IN NEW microinvasive glaucoma surgical (MIGS) procedures remained high in 2013.

Throughout the year, there was growing market adoption of the trabecular microbypass stent (iStent, Glaukos) as surgeons continued to wait for approval of two other investigational MIGS devices: the Schlemm's canal scaffold (Hydrus, Ivantis) and the supraciliary microstent (CyPass Micro-Stent, Transcend Medical).

Ophthalmology Times Editorial Advisory Board members Robert D. Fechtner, MD, Malik Kahook, MD, and Joel S. Schuman, MD, provided updates and insights on the status of glaucoma surgery.

The level of surgeon interest in performing trabecular microbypass stent implantation at the time of cataract surgery is noteworthy, Dr. Fechtner said, considering that in clinical trials, the proportion of patients achieving target IOP was only modestly higher among those who underwent the combined procedure compared with cataract surgery alone. According to recent literature, implanting more than one trabecular microbypass stent affords greater benefit, and Dr. Fechtner said he is looking forward to learning more about this approach from surgeons outside the United States.

Dr. Fechtner

"One of the business realities of device approval in the United States is that we are unlikely to see additional large scale studies that could provide greater insight about the indications and limitations of new modalities," said Dr. Fechtner, professor, Institute of Ophthalmology and Visual Science, and director, glaucoma division, Rutgers-New Jersey Medical School.

Dr. Kahook observed that currently, any patient who undergoes iStent implantation with two devices would need to pay out-of-pocket for the second device, which is significantly costly. Thus, there is interest in determining variables for predicting which patients might benefit most from the single implantation and in identifying ways to maximize the IOP-lowering effect achieved with a single device.

take-home

- **Experts discuss the growing market of MIGS, as well as their benefits and possible concerns, while examining alternative non-invasive intervention methods.**

Image-guided placement is one possibility, and Dr. Kahook mentioned the work being done by Dr. Schuman and colleagues in this area.

"We know that the stent ideally should be implanted next to the collector channels, but currently there are no techniques to confirm proper localization," said Dr. Kahook, The Slater Family Endowed Chair in Ophthalmology and professor of ophthalmology, University of Colorado, Denver. "Software for anterior segment OCT under development by Dr. Schuman and colleagues shows promise for imaging the collector channels preoperatively in order to guide a 'smart' implantation."

According to Dr. Kahook, one of the most exciting developments in the realm of MIGS is the undertaking by Ivantis of a head-to-head-

Continues on page 14 : ***Surgery***

DIAGNOSIS

(Continued from page 10)

and director, glaucoma division, Rutgers-New Jersey Medical School, Newark.

IMAGING BEYOND STRUCTURE

Malik Kahook, MD, and colleagues at the University of Colorado are among groups of researchers developing multi-photon microscopy as a new imaging modality for ophthalmology.

The laser-based technique images tissue structure, but with subcellular resolution, and it is also able to assess tissue function.

Dr. Kahook

"Multi-photon microscopy is still at an early stage of investigation," said Dr. Kahook, The Slater Family Endowed Chair in Ophthalmology and professor of ophthalmology, University of Colorado, Denver. "However, there has been encouraging progress during the year and we are very excited about its potential."

He explained that the technology could potentially allow clinicians to assess the function of cells in the outflow system, as well as investigate the oxidative stress effects in the cornea and retina.

Future goals include gathering structure and function information simultaneously with the same device and creating software that will allow for faster acquisition of larger datasets.

"Multi-photon microscopy can also image lipid in and around cells and might help elucidate information about metabolic function that is poorly understood today," he said. "We are also using this platform for drug discovery and have teamed up with industry partners to augment their research and development enterprise." ■

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Dr. Kahook is a consultant to Alcon Laboratories, Allergan, ClarVista Medical, Aerie Pharmaceuticals, and FDA. He has intellectual property interests with Abbott Medical Optics, ClarVista Medical, Glaukos, New World Medical, Oasis, and Prospex Medical. He is an inventor of DWT and the University of Colorado owns the patent under his name.

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Dr. Schuman receives royalties for intellectual property licensed by Massachusetts Institute of Technology and Massachusetts Eye and Ear Infirmary to Carl Zeiss Meditec.

SURGERY

(Continued from page 13)

trial comparing its Hydrus device against dual iStent implantation.

"This kind of evidence-based research will give us an idea about the relative efficacy of these new options and perhaps start us on a path to tailored surgical therapy by potentially providing information that will help guide patient selection," Dr. Kahook said. "Whereas not that long ago, our choices for surgical intervention were trabeculectomy or a drainage device, the options are expanding, and in the future we may be able to optimize care by individualizing our surgical decisions."

Dr. Kahook

However, there seem to be mixed reports on outcomes from surgeons who have been performing ab interno trabeculectomy using the Trabectome device (NeoMedix), noted Dr. Schuman, Eye and Ear Foundation professor and chairman of ophthalmology, University of Pittsburgh School of Medicine (UPMC), and director, UPMC Eye Center.

The conflicting results may be more technique-related than representing some limitation intrinsic to the procedure itself, and glaucoma surgeons should be watching for more information on this story, he said.

NOVEL, NON-INVASIVE INTERVENTION

As an alternative to compete with the Trabectome procedure and laser trabeculoplasty approaches, Dr. Kahook and colleagues have created Deep Wave Trabeculoplasty (DWT, Ocutherix), which is designed to enhance aqueous outflow through the trabecular meshwork without causing tissue damage. The noninvasive procedure is now being developed by Ocutherix, which obtained rights to the technology from the University of Colorado.

DWT involves external application of mechanical energy to cause focal stretching and relaxation of the trabecular meshwork that induces an IOP-reducing stress response in the trabecular meshwork cells modulated by a change in the local protein environment. The changes are not associated with heat or tissue damage.

"Several years ago, Dr, Schuman reported laboratory evidence that the mechanism by which cataract surgery reduces IOP involves ultrasound activation of an ELAM-1/IL-1/NF-κB response in trabecular meshwork cells," Dr. Kahook said. "Deep wave trabeculoplasty was developed to work using similar principles."

The efficacy of DWT was first demonstrated in preclinical testing and showed ~30% IOP lowering. Results of an initial human trial in 30 patients found DWT treatment resulted in a 26% decrease in IOP with no complications. A second clinical trial that is randomized with comparison to selective laser trabeculoplasty is now underway in the Philippines with data expected to be reported in the next 6 months.

The second human trial is also exploring efficacy of repeated treatments.

"Our goal is to make DWT available as a more cost effective option compared to use of topical drops," Dr. Kahook said. "We also believe this approach will negate any concerns regarding adherence to topical therapy, which is currently very poor in glaucoma patients."

ALTERNATIVE METHODS EXPANDED

Discussion about cataract surgery for lowering IOP also continued throughout this past year.

Dr. Kahook commented that he still considers this approach appropriate only for patients with visually significant cataract.

Alternative enhances aqueous outflow

Deep Wave Trabeculoplasty, in development by Ocutherix, uses this device to enhance aqueous outflow through the trabecular meshwork without causing tissue damage. *(Image courtesy of Malik Kahook, MD)*

OT INDUSTRY YEAR IN REVIEW

OIS @AAO 5TH ANNUAL OPHTHALMOLOGY INNOVATION SUMMIT

OIS DELIVERS YEAR IN REVIEW FOR OPHTHALMIC MARKET

EMMETT CUNNINGHAM, MD, PhD, MPH, Gil Kliman, MD, and Bill Link, PhD, co-chairmen of Ophthalmology Innovation Summit (OIS), presented the "2013 - Year in Review" at the 5th Annual OIS meeting, held before the American Academy of Ophthalmology meeting in New Orleans last month.

The Year in Review covered FDA approvals for pharmaceuticals and devices, total global ophthalmic procedures, mobile technology, venture capital and National Eye Institute funding, merger and acquisitions, initial public offerings,

For the complete recap of the OIS Year in Review, go to: http://bit.ly/18JxbNE - Password: OISAAO2013

"More discussion and more data is needed before clear lens removal should enter the mainstream of surgical glaucoma management," Dr. Kahook said.

With its benefits for overcoming the drawbacks of medical therapy for glaucoma—including cost, adherence, and ocular surface issues—SLT continues to gain acceptance as a first-line treatment for open angle glaucoma.

Since SLT was first approved by the FDA in 2001, lasers for performing the procedure were available from only a single manufacturer—Lumenis—as a patent prevented other manufacturers from selling their SLT equipment in the United States. Competition came to the U.S. marketplace in 2013 with introduction of SLT lasers by Ellex and Quantel.

Ellex first commercialized the SLT technology for Coherent (now Lumenis) in 2001, and its proprietary SLT technology has been sold outside of the United States for almost 10 years.

Quantel has been providing SLT technology outside the United States since 2007.

FACING THE NEW FRONTIER

Looking ahead, Dr. Schuman noted that the sweeping changes in medicine being brought on by the Affordable Care Act will cause practitioners to make difficult choices in patient management, recognizing that the quality of their care delivery is being judged in part by its cost.

"When glaucoma surgeons choose to use new devices, they will need to consider the cost versus the benefit compared with trabeculectomy or some other procedure," Dr. Schuman said. "Now is the time to decide how we can prepare for these changes."

Also commenting on the changing healthcare marketplace, Dr. Fechtner noted that only time will tell how ophthalmology fits into the accountable care organizations or what the implications of the newly insured population will be in terms of demand on ophthalmology services and resources.


Dr. Schuman

However, it seems certain that practitioners can expect to face another cycle of adaptation.

"It is reasonable to expect there will be continued downward pressure on reimbursement, and I believe this will continue to stimulate interest in some of the components of our care that fall outside of strict insurance payment limits," Dr. Fechtner said. "Therefore, the 'cataract-plus' procedures are going to continue to be of interest for our otherwise healthy glaucoma patients." ■

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Ophthalmology, optometry groups to join forces

SAN FRANCISCO AND ORLANDO :: **THE AMERICAN ACADEMY** of Ophthalmology and the American Academy of Optometry have announced a joint initiative to work together to prepare and better support their members in delivering the highest quality eye care.

The two organizations will be engaging with each other in an effort to foster a mutual approach to serving a growing population of patients in the United States who are expected to require eye health services in the near future.

This effort marks the first-ever large-scale, organized effort within the optometry and ophthalmology professions in support of joint educational initiatives, according to both organizations.

By working together, the two organizations anticipate being better positioned to assist their respective members in being able to manage the rapidly growing demand for eye care efficiently due to many chronic eye disease increasing in prevalence in the United States related to the aging Baby Boomer population. ■

GLAUCOMA: DRUG THERAPY

Drug OKs advance glaucoma therapy

The year also brought medication challenges, no investigational drug breakthroughs

By Cheryl Guttman Krader; *Reviewed by Robert D. Fechtner, MD, Malik Kahook, MD, and Joel S. Schuman, MD*

IN 2013, GLAUCOMA specialists obtained access to the first beta blocker-free, fixed combination IOP-lowering medication [brinzolamide 1% plus brimonidine 0.2% (Simbrinza Suspension, Alcon Laboratories)], faced growing challenges related to generic medications, and continued to wait for novel agents to make their way out of the investigational drug pipeline and into the clinic.

Ophthalmology Times Editorial Advisory Board members Robert D. Fechtner, MD, Malik Kahook, MD, and Joel S. Schuman, MD, spoke about these and other issues pertaining to medications for glaucoma care.

Dr. Schuman noted the new fixed combination product enables dual treatment with two IOP-lowering medications of different classes without worry about the systemic side effects associated with beta-blockers.

"Safety of topical beta-blockers is a concern in the glaucoma population because a significant number of older patients are on an oral beta blocker for management of systemic disease," said Dr. Schuman, Eye and Ear Foundation professor and chairman of ophthalmology, University of Pittsburgh School of Medicine (UPMC), and director, UPMC Eye Center. "A fixed combination therapy that does not compound beta-blocker risk is a nice option for those patients as well as for those with contraindications to a beta blocker.

Dr. Schuman

"Since there is decreased return from topical beta blocker treatment in patients already on an oral beta blocker, these patients may also benefit with greater IOP-lowering efficacy when treated with the new combination versus a fixed combination containing a beta blocker," he added.

Dr. Kahook agreed that the fixed combination has advantages when combination treatment with an alpha agonist and carbonic anhydrase inhibitor is indicated. Whether or not patients will be able to obtain the product when it is prescribed is another issue, as the new fixed combination is not appearing on the formulary of many insurance plans.

"However, there are signs that this new combination medication is appearing on more formularies, and this is a welcomed change that will benefit my patients," said Dr. Kahook, The Slater Family Endowed Chair in Ophthalmology and professor of ophthalmology, University of Colorado, Denver. "This is a clear example of the effect health care economics has on our ability to best manage patients. When it comes to choosing medications, the insurer's formulary has a large role in determining what we can use.

"I have noticed that many patients that receive a branded fixed combination prescription from me eventually go on the individual generic components due to pressure from insurance companies or other factors," he continued. "This will not be possible with Simbrinza since there is currently no generic option for brinzolamide on the market. It will be interesting to see how this plays out over the next few months."

take-home

- **New products and medications for glaucoma became available in 2013, while much focus remained on the cost of generics.**

Dr. Fechtner

Dr. Fechtner—professor, Institute of Ophthalmology and Visual Science, and director, Glaucoma Division, Rutgers-New Jersey Medical School, Newark—also commented on the issue of formulary restrictions.

"There is tremendous coercion of patients based on cost, and it is wearing my colleagues down that their educated choices on medications for patients are taking a backseat to formulary decisions," he said

Development of novel glaucoma medications continued in 2013 without major news, however, there was growing industry interest in injectable glaucoma medications. Dr. Kahook noted that trials are now beginning with intraocular extended-release products that would eliminate the need for daily topical drops.

EYE ON GENERICS

With a generic version of travoprost becoming available in 2013, the number of glaucoma patients using a generic medication for IOP-lowering is growing. Dr. Kahook said that the overwhelming majority of patients are well managed on a generic version of the brand medications.

A new beta blocker-free, fixed-combination therapy (Simbrinza) for glaucoma patients combines brinzolamide 1% and brimonidine tartrate 0.2% into one multidose bottle.
(Photo courtesy of Alcon Laboratories)

However, ophthalmologists should remain aware that there is a small subset of individuals who do not appear to do as well after being switched from the brand name to a generic.

"We need to keep this possibility on our radar and watch out for patients in whom a generic is not a good substitute," Dr. Kahook said.

Both Dr. Schuman and Dr. Fechtner pointed out that generic does not always equate to low cost, as the price of some generic medications has risen dramatically in 2013.

"There is tremendous pressure being brought to bear to switch patients to generics, but in our marketplace we have seen substantial increases in the prices of many generics," Dr. Fechtner said.

"A high price for generic versions of even some older medications is making it difficult for patients and frustrating for physicians," Dr. Schuman said. "In some instances, generic medications that previously were available at just $4 to $5 for a month's supply may now

> 'A high price for generic versions of even some older medications is making it difficult for patients and frustrating for physicians.'
>
> —*Joel S. Schuman, MD*

cost upwards of 10 times that amount. The same legislators who are determining the payments physicians get from health care need to be directing their attention to the rising cost of medications."

MEDICATION FOR SURGERY

An FDA-approved formulation of mitomycin-C for use in glaucoma surgery (Mitosol, Mobius Therapeutics) became available during 2013. The mitomycin-C kit can be stored in the operating room with a long shelf-life and reconstituted when needed.

Dr. Fechtner noted this is a convenient option that eliminates storage and transportation concerns associated with obtaining mitomycin-C from the in-house or compounding pharmacy, but it is more expensive. The manufacturer, however, was proactive and pursued and obtained a reimbursement code for the product so the institution should be able to recover this cost, Dr. Fechtner said.

Dr. Kahook noted adoption of the new mitomycin-C has been poor because it is so much more expensive than the compounded mitomycin-C that has been widely used for many years by glaucoma surgeons.

"While one might think that we would see a lot of glaucoma specialists gravitate to use of this first ever FDA-approved antifibrotic agent, in my opinion, adoption has been poor due to cost," Dr. Kahook explained. "Our center still uses compounded mitomycin-C and our costs are a fraction of Mitosol.

"Mitosol might find a role in outpatient centers that find it difficult to obtain compounded products," he continued. "The status of the reimbursement code over the next 2 years will be a driving factor for adoption and persistence of this new product." ■

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RETINA DRUGS

(Continued from page 1)

"Before the availability of this drug, the only option was observation of the patients to evaluate for progression which might prompt the need for surgical intervention," Dr. Hahn said. "Ocriplasmin can induce vitreomacular separation without surgery in some cases."

RETINAL PROTECTION

The AREDS2 Study found that the new supplement formulation that was proposed was not superior to the previous AREDS1 formulation.

However, the investigators did identify a benefit of the supplement among a subgroup of patients who received the AREDS2 formulation: removing beta-carotene and adding lutein and zeaxanthin resulted in an additional 18% decrease in the risk of progression to advanced AMD, Dr. Hahn noted.

"This vitamin formulation is probably helpful to some degree," Dr. Hahn said. "The optimal formulation still remains to be determined. In the AREDS2 study, supplementing the formulation with the additional components did not result in any significant benefit."

Pravin U. Dugel, MD, found the clinical interpretation of the AREDS2 study challenging.

"This was a fantastic study and very difficult to perform," said Dr. Dugel, clinical associate professor of ophthalmology, Keck School of Medicine, University of Southern California, Los Angeles.

"This study showed that when considering the entire self-selected study population, the components of the formulation—such as the antioxidants and fish oil that were thought to be helpful—were not helpful," Dr. Dugel said.


Dr. Dugel

Patients who are apt to enroll in such a study are those who are motivated to take better care of themselves.

One concern, Dr. Dugel noted, is generalizing the results from that subset of motivated patients to the entire population of patients that ophthalmologists see on a daily basis.

"The AREDS results should be taken in perspective," he said. "They may apply to that group of people seen in the study, but may not be generalizable."

Dr. Dugel also commented on an interesting study performed by Carl Awh, MD, and colleagues showing that—depending on individual genetic factors—certain nutrients might be more beneficial or harmful to patients. The investigators published their findings in *Ophthalmology* (2013;11:2317-2323).

"This is highly controversial and a great deal more study needs to be done," he said. "However, this is the first time that we have the possibility of individualized nutritional medicine."

This study was not definitive, but is an exciting concept to consider, Dr. Dugel added.

take-home

- **Pharmacologic treatments for retina diseases continued to made headlines in 2013, including the release of ocriplasmin and the AREDS2 Study.**

WET, DRY AMD AND RVO

Generally, there is a bigger disconnect between clinical trials and real patient experience in AMD, DME and BVO, in the opinion of Dr. Dugel.

"Many of the trial protocols simply are not sustainable," he said. "We are also seeing that the number of treatments [which] patients actually receive are less than what they should have been receiving. Therefore, the outcomes must be much worse than those that are expected in randomized clinical trials."

Sustained as well as effective therapy may be attainable with the introduction of combination therapies, which seems to be the future trend.

> 'Combination therapy may be the logical evolutionary strategy when treating wet AMD.'
>
> — *Pravin U. Dugel, MD*

"As good as anti-vascular endothelial growth factor [VEGF] treatment is, . . . we may have reached a ceiling with anti-VEGF monotherapy," Dr. Dugel said. "Combination therapy may be the logical evolutionary strategy when treating wet AMD."

A novel anti-platelet-derived growth factor combination agent (Fovista, Ophthotech) may be the next important therapy for wet AMD, he continued. Clinical trials are currently under way.

"This will be the most exciting combination treatment," he said.

For the treatment of diabetes and RVO, Dr. Dugel sees a strong role for steroid delivery devices, two in particular: dexamethasone (Ozurdex, Allergan) and fluocinolone acetonide (Iluvien, Alimera Sciences).

The steroid devices have different pharmacokinetic profiles from each other, he said.

Dexamethasone provides an initially high-dose increase and a slow decrease and can last 3 to 5 months, whereas fluocinolone acetonide has a near zero-order kinetics with release that may last for 3 years, Dr. Dugel explained.

The choice is not one or the other. We need both to achieve the best treatment, Dr. Dugel said.

"We also will see a trend toward combination treatment in DME and RVO," he said.

Progress for dry AMD also continues to beRamesh made in clinical trials.

For instance, a study involving an oral visual cycle modulator, emixustat hydrochloride (Acucela), is currently under way.

"The drug slows the visual cycle and decreases toxic by product accumulation," Dr. Dugel said. "It has the potential to be an effective and sustainable strategy to decrease progression to dry AMD."

Anti-factor D (Genentech) is an injectable drug recently studied in a phase II trial for the treatment of geography atrophy (GA).

In patients with complement factor I, results show a 44% reduction in the progression to geographic atrophy with monthly injections. This is the first study to demonstrate a positive treatment effect with a complement inhibitor in GA, he noted.

"All of these drugs are exciting," Dr. Dugel said. "Even within the same drug category, these drugs can complement each other.

"The goal is to individualize therapy," he added. "Therefore, the more drugs we have at our disposal, the better . . . for our patients."

DETECTION OF OPHTHALMIC TOXICITY

Guidelines for detecting ophthalmic toxicity in the form of retinal pigment epithelial and retinal injury in patients receiving hydroxychloroquine (Plaquenil, Sanofi-Synthelabo) have changed. The American Academy of Ophthalmology recently updated guidelines for detecting toxicity resulting from the drug using newer imaging technologies.

Hydroxychloroquine is used to treat inflammatory diseases, such as rheumatoid arthritis and lupus. However, the drug is associated with corneal changes and irreversible retinal

Continues on page 20 : ***Toxicity***

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RETINA: CLINICAL DIAGNOSIS

OCT, angiography make retinal strides

Void still exists for clinical diagnostic technologies that combine structure and function

By Lynda Charters; *Reviewed by Pravin U. Dugel, MD, and Paul Hahn, MD, PhD*

OPTICAL COHERENCE tomography (OCT) has seen important clinical diagnostic advances during the year and wide-field angiography is promising for the future as well.

However, ophthalmologists note a gap in the ability to see the relationship between retinal structure and function with the available technologies.

OCT FOR IMAGING

"From my perspective, we will have better resolution of structure," said Pravin U. Dugel, MD, clinical associate professor of ophthalmology, Keck School of Medicine, University of Southern California, Los Angeles. "The OCT machines have been improved. Swept-source OCT provides better resolution."

The improved tissue penetration of swept-source OCT will likely be particularly useful for imaging of choroidal structures, according to Paul Hahn, MD, PhD, assistant professor of ophthalmology, Duke University School of Medicine, Durham, NC.

"We have begun to learn that variations in choroidal morphology are seen in many retinal conditions, such as age-related macular degeneration (AMD) and central serous chorioretinopathy," Dr. Hahn said.

These variations are currently an active area of investigation and have already proven to aid in diagnosis of certain conditions. As their possible role in disease pathogenesis is elucidated, novel treatment options may be identified that target the choroid, he said.

However, it seems that the best is yet to come.

Looking to the future, Dr. Dugel pointed out the pressing need for further advances in technology. The key in clinical diagnosis is going to be a method by which structure and function can be married.

"If we have a device that can combine structure and function, that ultimately would be very exciting," he said.

In the clinic, surgeons see patients with AMD and other diseases where the visual function is expected to be poor based on the condition of the ocular structures.

However, there is often a disconnect between the two. It would be optimal to have a technology that would allow surgeons to marry the two," Dr. Dugel said.

Annidis Corp. has developed a machine (RHA) that uses light scattering noninvasively to dissect the different layers of the retina. This machine is an "ocular pathology visualization system" that combines analytic software and multispectral imaging for early detection of glaucoma, AMD, and diabetic retinopathy, according to Dr. Dugel.

Due to its ability to inquire specific characteristic wavelengths, Dr. Dugel explained that it might offer the possibility of looking at certain photophores to determine the material that is being metabolized and the location at which the metabolism is taking place.

He currently is using this machine on an investigational basis.

"This technology may offer the opportunity to marry structure and function," he said. "The potential with this technology is extremely exciting."

take-home

- **Technologies that aid in the clinical diagnosis of retina diseases advanced in the areas of optical coherence tomography and wide-field angiography.**

WIDE-FIELD ANGIOGRAPHY

Technology behind wide-field angiography has received much attention this year. This area deserves more study, according to Dr. Dugel, because it is too soon to jump on the technology bandwagon with a dearth of data-driven evidence.

"For example, the wide-field angiography images may show areas of nonperfusion, leaving surgeons with the impression that those

Continues on page 22 : ***Angiography***

TOXICITY

(Continued from page 18)

toxicity, so early detection is advised. In the retina, bilateral pigmentary retinopathy can develop that manifests late in disease as a bull's eye maculopathy with paracentral and central scotomas.

Ultimately, extensive retinal and retinal pigment epithelial atrophy develops that affects the central and peripheral vision, which emphasizes the need for early screening to prevent profound visual loss, according to Sharon Fekrat, MD, associate professor of ophthalmology, Duke Eye Center, Duke University School of Medicine, Durham, NC, and chief of ophthalmology at the Durham Veterans Affairs Medical Center.

Dr. Fekrat

The recommended screening modalities for detecting hydroxychloroquine side effects include biomicroscopy, Humphrey visual field testing, spectral-domain optical coherence tomography (SD-OCT), fundus autofluorescence, or multifocal electroretinography.

When Dr. Fekrat performs screening, she prefers 10-2 Humphrey visual field white-on-white.

"We are standardizing our protocol at the Durham VA and have decided on this approach after collaborative discussion," she said. ■

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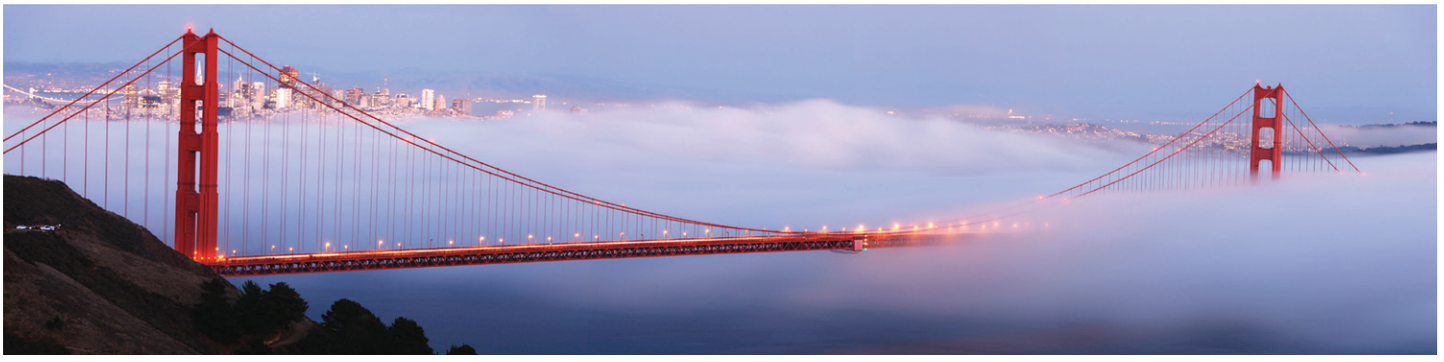

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ANGIOGRAPHY

(Continued from page 20)

areas should receive laser therapy," he said. "However, it may not be as simple as that."

In support of this, Dr. Dugel cited a study by Richard Spaide, MD, et al. The investigators published their findings from 10 patients (*Retina* 2013;33:1315-1324). Specifically, there was no decrease in the number of injections or improvement in the visual acuity based on the application of laser to areas of retinal nonperfusion.

Dr. Dugel

"Here again, the question of structure and function arises: What is the disconnect regarding application of laser to these areas of nonperfusion?" he asked. "We do not know what nonperfusion or perfusion means."

Nonperfusion could actually mean dead retinal tissue that is not capable of producing vascular endothelial growth factor (VEGF), he explained.

"We may simply be applying laser with no effect at all," Dr. Dugel said. "On the other hand, perfusion is what we see anatomically."

However, just because the tissue is perfused does not mean that there is enough metabolic support for the cells, which in actuality may be producing VEGF.

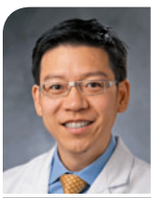
"This disconnect between structure and function is potentially consequential—leading to unnecessary retinal destruction or to necessary retinal non-destruction," Dr. Dugel explained.

The RHA instrument is a multispectral digital ophthalmoscope with a patented optical system that captures high-resolution image data through the retinal and subretinal layers.

(Images courtesy of Annidis)

In addition to wide-field angiography, wide-field autofluorescence and wide-field OCT have more recently become commercially available.

According to Dr. Hahn, "We have begun to learn that many retinal conditions, including ones traditionally thought to be localized to the posterior pole, have significant peripheral pathology.



Dr. Hahn

"These wide-field imaging modalities will likely improve our understanding of these conditions," he said. "As with wide-field angiography, however, the clinical significance remains to be seen and needs thorough investigation." ■

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Post-surgical diplopia poses risks

BALTIMORE ::

A CAREFUL HISTORY TAKING— with attention to risk factors—may aid ophthalmologists in the prevention of diplopia after surgical procedures, said Anya Trumler, MD.

"Diplopia is a disabling complication of any ocular surgery and should be included in the surgical consent, especially in those at risk," said Dr. Trumler, assistant professor of ophthalmology, division of pediatric ophthalmology and adult strabismus, The Krieger Children's Eye Center, Wilmer Eye Institute, Johns Hopkins University School of Medicine, Baltimore.

Causes of diplopia may be mechanical, neuromuscular, nerve related, disorder- or toxin-induced, and can include fixation switch, concurrent onset of systemic illness, and tilting of the IOL.

One of the possible causes of diplopia after surgery is the nerve block, Dr. Trumler said.

"All anesthetic agents directly injected into muscle are myotoxic," she said. "Bupivacaine is the most, and procaine the least."

Treatment includes observation, Fresnel and ground-in prisms, and strabismus surgery, she added.

Diplopia is also a well-known complication of scleral buckling for retinal detachment, Dr. Trumler said, and occurs after pars plana vitrectomy without scleral buckle.

Factors that predispose these patients include underlying strabismus, disinsertion of EOM with faulty repositioning, cryotherapy, and multiple reoperations. The types of diplopia that occur in these patients include hypertropia (58%), horizontal deviation (17%), and torsional (46%).

Aniseikonia from macular disease may cause a separation or compression of photoceptions, or rivalry between central and peripheral fusion. Dragged-fovea diplopia may result from rivalry between central and peripheral fusion as well.

"One treatment option is removal of the scleral buckle," she said. "(But) wait at least 6 months before doing so."

Exoplant removal, however, has minimal effects on improving strabismus, and the re-detachment rate ranges from 4% to 33% for various reasons, Dr. Trumler said.

In addition, there seems to have been an increase in the incidence of diplopia related to amniotic graft syndrome, she said. ■

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RETINA: SURGERY

Emerging advances in small-gauge retina surgery maximize outcomes

Integration of devices and instrumentation yields greater surgical efficiency

By Lynda Charters; *Reviewed by Pravin U. Dugel, MD, and Paul Hahn, MD, PhD*

AS RETINA SURGEONS review the surgical highlights of 2013, small-gauge instrumentation (27 gauge), a small vitrectomy machine, and a surgical microscope with optical coherence tomography (OCT) attracted much of their attention.

SMALLER-GAUGE VITRECTOMY SYSTEMS

Both the introduction of 27-gauge vitrectomy instrumentation and the ability to perform very efficient small-gauge surgery were among the highlights of the year for Pravin U. Dugel, MD.

Historically, the flow of substance into the port and removal of tissue have been problematic and were never efficient as a result of the inability to control duty cycle, which determines the length of time the cutter remains open.

Traditionally, the cutters were spring-based and did not permit control of the duty cycle with ultra-fast cut rates.

"Now, I use a cutter based on a dual-pneumatic system [Constellation Vision System, [Alcon Laboratories]," said Dr. Dugel, clinical associate professor of ophthalmology, Keck School of Medicine, University of Southern California, Los Angeles. "This allows faster cutting in smaller gauges with predictable flow control, which cannot happen with a spring-based cutter.

Dr. Dugel

"For the first time, our surgeries can be more efficient and facilitate more accurate dissection," he said.

Paul Hahn, MD, PhD, assistant professor of ophthalmology, Duke University School of Medicine, Durham, NC, also commented on the importance of the smaller-gauge systems.

"Traditionally, 20-gauge instrumentation was used that then progressed to 25- and 23-gauge," Dr. Hahn said. "Twenty-seven gauge instrumentation has recently become available, although . . . at this time is still limited."

Currently, he said, it remains to be determined how useful is the smallest gauge instrument. The smaller the instruments, the more flexible they become—which may be a hindrance during surgery.

"Regarding 27-gauge instruments, most surgeons will likely initially use them during surgical cases when that stiffness is not required," Dr. Hahn said. "With today's improved wide-angle visualization systems the stiffness of instrumentation is less critical, and I predict continued increased usage of small-gauge vitrectomy."

take-home

- **Advancements in retina surgery include small-gauge instrumentation, a small vitrectomy machine, and a surgical microscope with optical coherence tomography.**

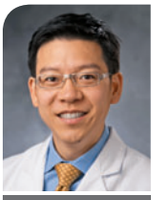
VITRECTOMY MACHINES

This past year saw the introduction of more vitrectomy systems (such as the VersaVIT, Synergetics USA).

"This is a very small vitrectomy machine that performs with 2,500 cuts per minute," Dr. Hahn said. "[This system] is easily portable with an attractive price point, and it will be interesting to see what role this unique machine plays in the operating room setting."

VALVED CANNULAS

Use of valved cannulas has increased over the past year. Valved cannulas were first placed into extensive commercial use by Alcon Laboratories. These cannulas have distinct advantages over non-valved cannulas. Most importantly, they maintain improved intraocular fluid dynamics and stability.



Dr. Hahn

"I now use valved cannulas exclusively," Dr. Hahn said. "These benefits are not just theoretical. To me, these fluidics benefits are a game-changer that significantly augment stability of the eye and thus safety during vitrectomy."

Recently, Bausch + Lomb developed valved cannulas with a removable valve that may be useful in circumstances where a valve is not needed.

OCT INTEGRATION

Dr. Hahn notes the advantages of OCT imaging integrated into the surgical microscope.

"This is becoming more and more of a hot topic because of its obvious benefits in surgery," he said. Dr. Hahn is working with Dr. Cynthia Toth, professor of ophthalmology and biomedical engineering at Duke University, in developing a prototype microscope-integrated OCT device.

"This is a rapid area of development, and we are continually incorporating additional technology into our device, including swept-source OCT and a real-time tracking system," Dr. Hahn said.

Two OCT systems for intraoperative use are commercially available:

- **One is a handheld system (Bioptigen) whose use was first reported at Duke, but requires halting surgery and moving the microscope out of the field to obtain images.**
- **Also, Haag-Streit this past year released for European sales an integrated OCT device into its surgical microscope.**

"This is an exciting device," Dr. Hahn said. "Current systems generally are limited to obtaining OCT images at pauses in surgery, and limitations in current technology make real-time acquisition and processing difficult.

"Our Duke prototype system is designed to obtain real-time images during surgical maneuvers and is continually being refined," he added. "This technology is not far from your operating room, and I predict it will soon change the way we perform surgery just as OCT has transformed the way we see patients." ■

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RETINA: TECHNOLOGY

Technology heralds retinal prosthesis

Year unfolds availability of advanced laser platforms; ushers new era of patient care

By Lynda Charters; *Reviewed by Pravin U. Dugel, MD, and Paul Hahn, MD, PhD*

THE APPROVAL OF a retinal prosthesis system and introduction of lasers that can selective treat structures in the retina were among the technologic highlights of 2013.

The Argus II Retinal Prosthesis System (Second Sight Medical Products)—colloquially referred to as the "bionic eye"—was approved by the FDA as a humanitarian use device in February 2013, after more than 20 years of research and development pioneered by Mark Humayun, MD, PhD, professor of ophthalmology, Biomedical Engineering, and Cell Neurobiology at the University of Southern California.

take-home

The advent of a retinal prosthesis system coupled with the latest generation of laser technology brings a new era of patient care in 2013.

This implant, which is surgically implanted in the eye, communicates wirelessly to an external camera, thereby providing artificial visual stimuli to improve vision that was once considered to be permanently lost in patients with retinal diseases, specifically retinitis pigmentosa, said Paul Hahn, MD, PhD, assistant professor of Ophthalmology, Duke University School of Medicine, Durham, NC.

"From a medical standpoint, the availability of this technology is revolutionary and heralds a new era of patient care in which rather than just slowing or stabilizing vision loss, we can restore vision that was once considered to be lost permanently," Dr. Hahn said.

Though the technology is approved, the device is not yet commercially available. It has not yet been implanted on an FDA-approved basis yet, but this should happen in the very near future, he explained.

"The other big event along with approval of the [device] is that Medicare has agreed to fund its implantation," Dr. Hahn said. "The lack of insurance coverage had been expected to be a big barrier to use of the device."

Implantation of the device currently is approved only for patients with retinitis pigmentosa with visual acuity of bare light perception or worse.

"These are profoundly blind patients," he said.

Investigations with the device for other blinding diseases are currently under way.

BENEFITS TO PATIENTS

The effect of the implantation can be substantial for some patients. Before implantation, these patients barely know if the brightest of lights are on or off, Dr. Hahn explained.

"After implantation, they may feel more socially connected through visual cues that allow them to function better in everyday living," he said. "For example, the patients can often identify straight lines in a crosswalk or identify a doorway, which helps them be more independent."

In simulated tests, some patients with the implant can read large letters on a computer screen, which he described as a profound improvement.

One patient who attended a music concert reported that she was able to see a reflection of the sequins on the performer's dress. Other patients have reported seeing fireworks. Dr. Hahn believes that they are seeing flashes of light that correspond to the location of the fireworks.

"The patients do not yet have true restoration of vision," he said. "They cannot read or see faces, but they get visual cues that may help them feel more connected." ■

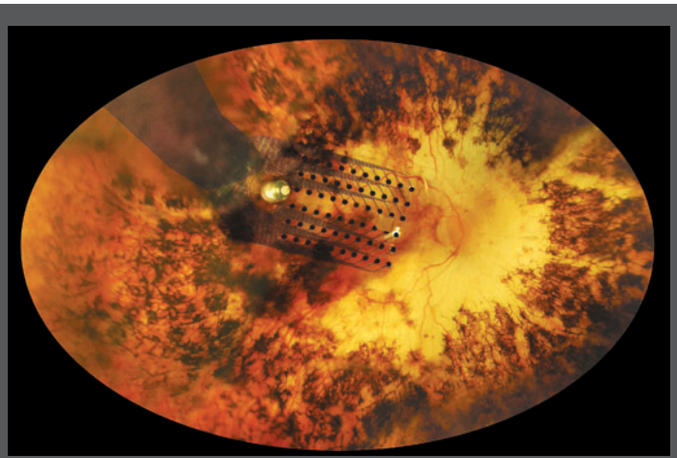
Advanced laser technology

THE LATEST GENERATION OF LASERS IS noteworthy, said Pravin U. Dugel, MD, who anticipates that laser photocoagulation will be reintroduced to treat retinal diseases. There will be a paradigm shift from traditional laser photocoagulation, he noted.

"The newer lasers are much more selective and can specifically target the retinal pigment epithelial (RPE) cells," said Dr. Dugel, clinical associate professor of ophthalmology, Keck School of Medicine, University of Southern California, Los Angeles.

The Topcon and Endpoint Management lasers will be beneficial, because rather than destroying all retinal tissue, they have the potential to target RPE cells selectively, he said.

"We will, I believe, be talking about laser photostimulation, rather than laser photocoagulation," he said. ■



Late-stage RP hope

The retinal prosthesis (Argus II) is designed to bypass the eye structure damaged by retinitis pigmentosa with electrical stimulation of the retina to induce visual perception in blind individuals. *(Image courtesy of Second Sight)*

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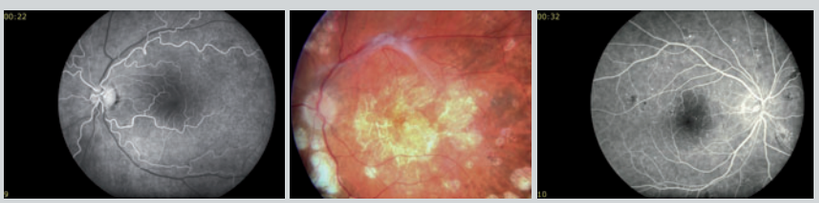

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Strategies for how to fit a round peg in a square hole

Hint: Recognize that differences and nonconformities do exist among staff in the clinic

Putting It In View *By Dianna E. Graves, COMT, BS Ed*

TAKE-HOME

- ***When managing staff, it is important to remember that employees are unique in their own way and want to be treated as individuals.***

Growing up, one of my favorite holiday television specials was "Rudolph the Red-Nosed Reindeer."

My mom would make sure all the baths were taken, line us up on the couch, and make cocoa with real marshmallows—and for 1 hour, we'd quietly be mesmerized by Hermey the Dentist and Rudolph. Once the Bumble emerged, my sister would spend the rest of the show watching from behind the couch—convinced the Bumble would enter the living room at any moment.

As I grew older, and still watched, the lessons began to emerge. Subtle at first, but then amazingly, more profound through the years.

Yukon Cornelius and Charlie in the Box began to focus on each of our non-conformities. Now, we politically correctly call them our differences.

I no longer looked at Rudolph as the savior of Christmas and the highly coveted toys he helped Santa bring. I looked more to Yukon Cornelius and how he gave hope to all the unwanted toys on the Island of Misfit Toys.

Each Christmas Eve there was hope that this would be the year Santa would come and take them—regardless of their nonconformities.

APPLYING TO REAL-LIFE SITUATIONS

As I became a manager, and tried to find my practice style, I spent a long time trying to figure out how I would/could become the type of leader people would want to work for—and to follow. How could I get staff to buy in to my program?

I bought books, took management classes, and quietly listened to conversations of managers and administrators who were more experienced. I took class after class showing how to manage staff using grids and flow charts, and then I would dutifully concoct my own charts to convince the staff that these charts would help to attain our mission statement. If we followed the grids and the flow charts, we, too, would succeed.

I called it drinking the Kool-Aid.

But, not everyone would. Some even had the audacity to question the end goal or recommend variations to it.

> 'Most staff members want . . . to be acknowledged for being themselves, not a peg that fits comfortably into a universal hole.' *– Dianna E. Graves, COMT, BS Ed*

REVELATIONS

In my younger days, I often frowned on this behavior—for they were not conforming or complying with the mantra. Begrudgingly, I would try to change the flavor of the Kool-Aid. But instead of everyone going along with my new end goal, new nonconformists arose.

So, out would come the hammer.

One way or another, I would prove that you could get a round peg in a square hole.

For a while, it worked to some degree.

Until the next holiday season, when I would watch the Island of Misfit Toys and realize that I wasn't allowing their nonconformities to help our practice. I was beating it out of them if they wanted to stay here and work. Then the new year would begin, and the lessons were lost again to the hubbub of keeping the staff moving in the same direction.

As the nieces and nephews arrived in my life, I became the auntie who went to the movies with them. I had libraries of movies for when they dropped in.

I began to realize that each movie afforded me an education that the $5 ticket price never intended—Kermit the Frog singing that it was okay to be green, Donkey and the love-struck dragon in Shrek, and Nemo realizing that he really didn't have it so badly before he was snatched by the Dentist.

It opened my eyes that staff members were these characters—each one in a different way—but uniquely different still the same. I was going to need to adapt to their uniqueness in order to get the best from them.

ADAPTING TO DIFFERENCES

Most staff members want to do a good job, but at the same time they want to be acknowledged for being themselves, not a peg that fits comfortably into a universal hole.

Staff members don't want to be a duplicate of a mold—they want and need to embrace who they are within the group.

Now as I get older, I am finding that the newer employees are highly individualistic, and what we worry about when hiring new staff is not a concern to them. They look at what they bring to the clinic with their skills and knowledge, not the vessel it arrives in.

Continues on page 30 : ***Differences***

DIFFERENCES

(Continued from page 29)

They seek new ways to express themselves individually. Just take a look around you: tattoos abound, piercings in more than the earlobes, and hairstyles. I remember the first time an employee in the operating room came to the clinic wearing a mohawk.

SEEKING A SOLUTION

Where do we—or better yet, should we—draw the line?

The answer lies within you.

Yes, I agree. We are in a professional field and patients don't want to see an employee covered with tattoos—I think.

Yet, come to think of it, no patient has ever complained to me about the technician's hairstyle, hair color, or that they had a brow piercing.

Of course we have a dress policy: If you have a tattoo, I don't want to see it. Facial piercings are also not allowed at work.

But I will admit that when I had recent surgery, it did not bother me at all when the ICU nurse answered my bell at 3 a.m. with her eyebrows pierced.

What I do remember was that she spent 20 minutes gently rubbing my back to help the spasms I was having, and kindly checking my vitals while apologizing for waking me up again.

Recently, I was asked by a hopeful new manager who the most influential person had been to me when I was developing my manager model.

I smiled broadly and said: "Yukon Cornelius [for] the Island of Misfit Toys."

Then I made a quick note to myself that when I got back to my office, I needed to remember to throw away my hammer—again—and then I needed to stop at the hardware store for some new sandpaper to help smooth the edges off of some of my pegs I have in the clinic, and maybe a few of my own. This way we would all fit comfortably into our round holes that we call clinic. ■

DIANNA E. GRAVES, COMT, BS ED, *is clinical services manager at St. Paul Eye Clinic PA, Woodbury, MN. Graves is a graduate of the School of Ophthalmic Medical Technology, St. Paul, MN, and has been a member of its teaching faculty since 1983. She can be reached at dgraves@stpauleye.com.*

AMA honors Dr. V.K. Raju

By Rose Schneider, *Content Specialist*

CHICAGO :: **THE AMERICAN MEDICAL ASSOCIATION (AMA)** Foundation has awarded its Dr. Nathan Davis International Award to V.K. Raju, MD, for his more than 34 years of experience working to combat avoidable blindness around the world.

Dr. Raju

The award honors physicians who represent the highest values of altruism, compassion, and dedication to patient care, as Dr. Raju was recognized as a person in medicine who offers tribute to individuals he has worked with through sight-saving procedures worldwide, according to the AMA.

After receiving the award, Dr. Raju expanded his missions to both the West Virginia diabetic initiative through the school of public health at West Virginia University, Morgantown, as well as through the Eye Foundation of America's (EFA) "100,000 Lives" eyesight-saving campaign in India.

The campaign's goal is to provide eye care to 100,000 people in rural India during 2014.

As the EFA's founder and medical director, Dr. Raju said the effort targets avoidable-blindness by identifying and helping people who suffer from diabetes and are at risk for, or may already be suffering from, diabetic retinopathy.

"Although we have reached an initial fundraising milestone, we still need to raise a lot more money to reach our goal of $1 million that will let us actually put everything into motion for this diabetic retinopathy initiative," Dr. Raju said. ■

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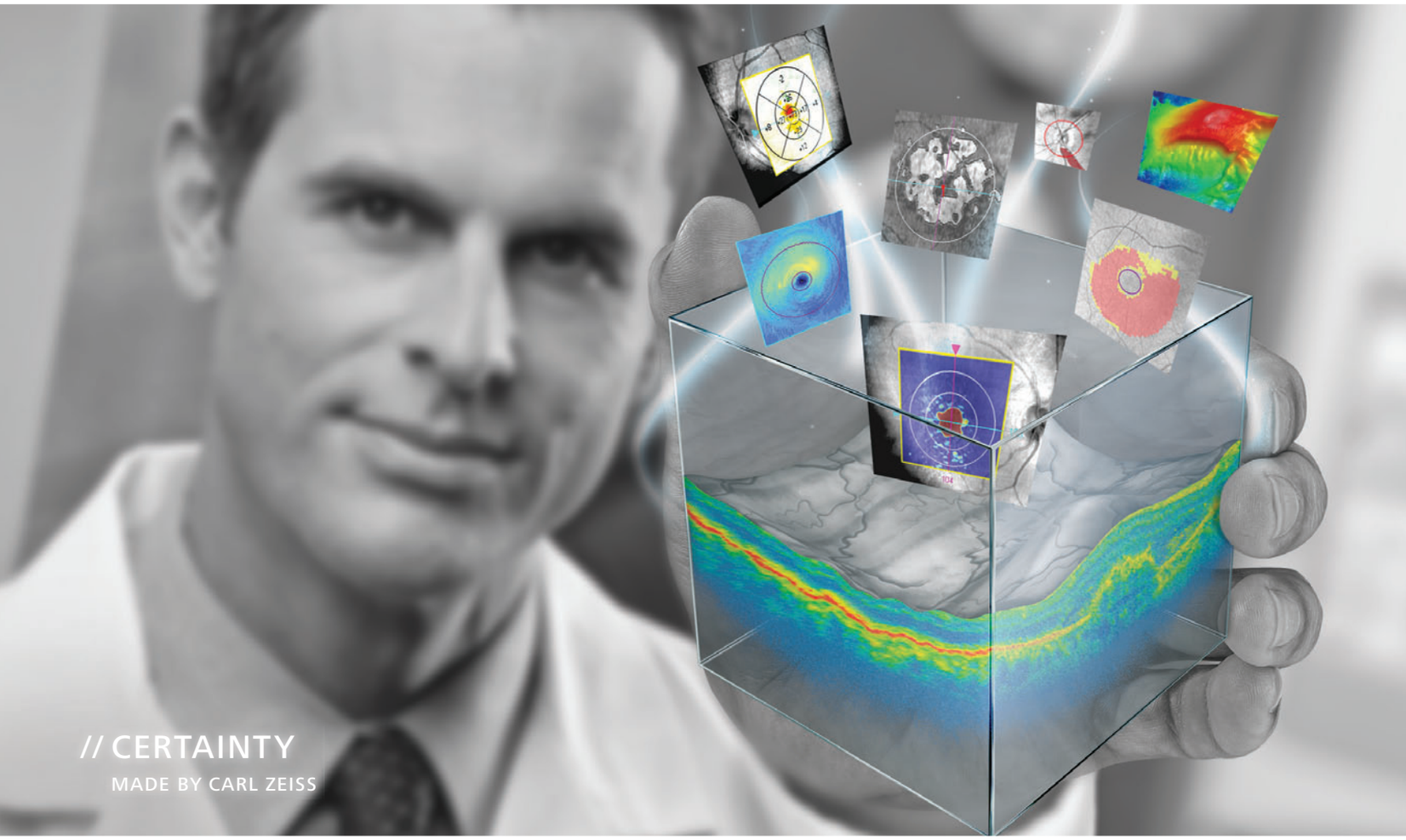

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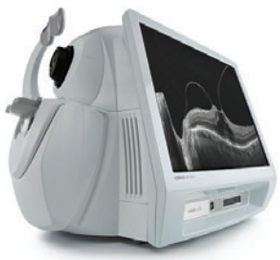

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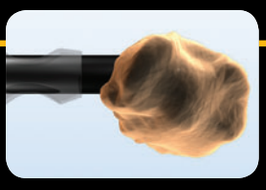

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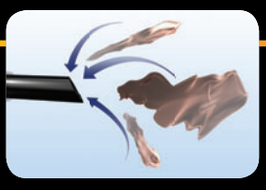

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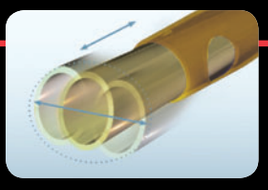

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