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Retina Today
JANUARY/FEBRUARY 2020 VOL. 15, NO. 1 | RETINATODAY.COM

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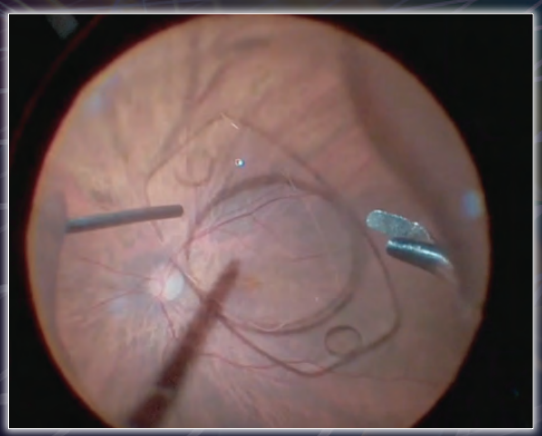
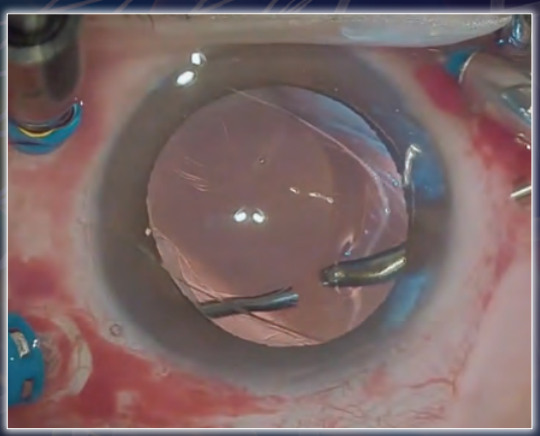
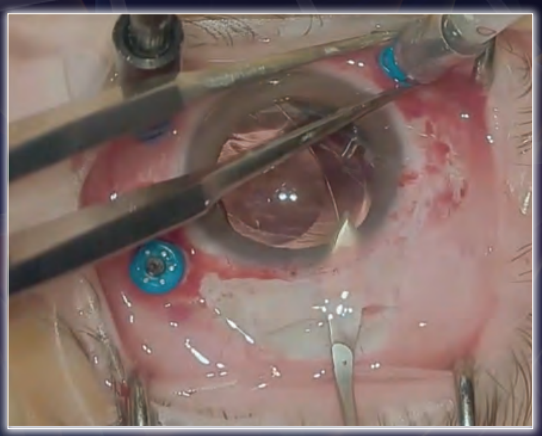
Techniques and Technologies







An update on new tools and tactics in the OR

CLOSING A MACULAR HOLE WITH DROPS INSTEAD OF SURGERY | CAN OCTA REDUCE THE NEED FOR FACEDOWN POSITIONING? | WHAT'S NEW FOR BILLING AND CODING IN 2020?

THIS IS PRECISION

This is

FINESSE™ SHARKSKIN™ ILM Forceps

Laser-ablated micro-surface is designed to support atraumatic ILM peel initiation[1]

Optimized grasping platform and angled tip closure to help mitigate membrane shredding[2]

GRIESHABER® DSP IMPORTANT PRODUCT INFORMATION

Caution: Federal (USA) law restricts this device to sale by, or on the order of, a physician. **Indications for Use:** GRIESHABER® DSP instruments are a line of single-use vitreoretinal microinstruments which are used in ophthalmic surgery, for cases either in the anterior or the posterior segment. The GRIESHABER® Advanced Backflush Handles DSP are a family of instruments for fluid and gas handling in vitreoretinal surgery. **Warnings and Precautions:** • Potential risk from reuse or reprocessing GRIESHABER® DSP instruments include: foreign particle introduction to the eye; reduced cutting or grasping performance; path leaks or obstruction resulting in reduced fluidics performance. • Verify correct tip attachment, function and tip actuation before placing it into the eye for surgery. • For light fiber instruments: Minimize light intensity and duration of exposure to the retina to reduce risk of retinal photic injury. The light fiber instruments are designed for use with an ALCON® illumination source. • Good clinical practice dictates the testing for adequate irrigation and aspiration flow prior to entering the eye. If stream of fluid is weak or absent, good fluidics response will be jeopardized. • Use appropriate pressure supply to ensure a stable IOP. • If unwanted tissue gets engaged to the aspiration port, it should be released by interrupting aspiration before moving the instrument. **Attention:** Please refer to the product labeling for a complete listing of indications, warnings, and precautions.

Reference: 1. Data on File. Alcon Laboratories Inc; May 2018. **2.** Data on File. Alcon Laboratories Inc; September 2017.

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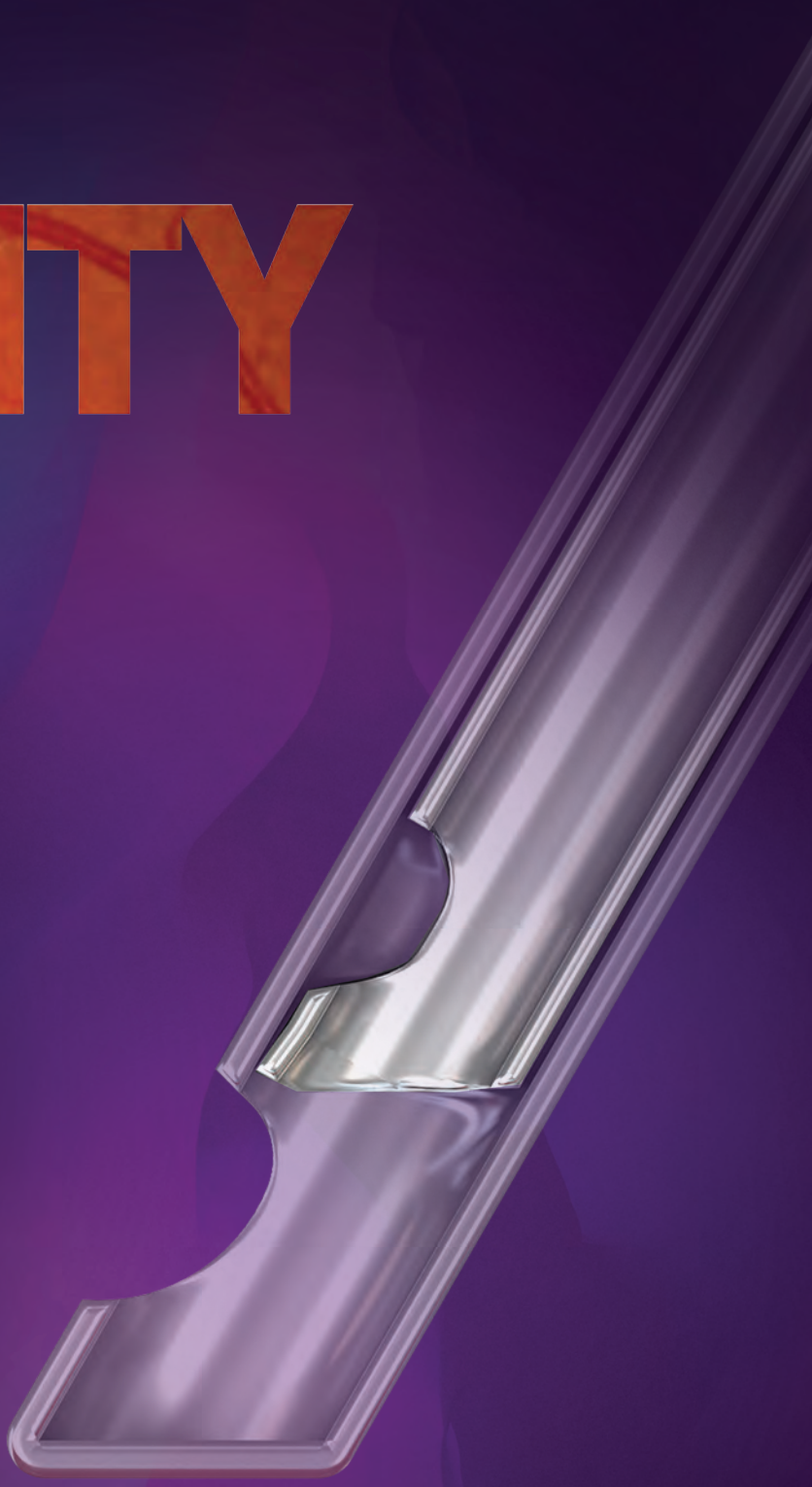
THIS IS STABILITY

This is HYPERVIT™

DUAL BLADE VITRECTOMY PROBE



Designed to:

- Enhance stability with a continuously open port and CONSTELLATION® Vision System's IOP compensation[1]
- Reduce pulsatile traction with **20 000 cuts per minute** using 25+® and 27+® gauge probes*, [2,3]
- Improve vitreous flow[4]
- Enable closer access to tissue plane with beveled tip[5]

*At similar single-blade flow rates

MIVS IMPORTANT PRODUCT INFORMATION

Caution: Federal law restricts this device to sale by, or on the order of, a physician. Indications for Use: The CONSTELLATION® Vision System is an ophthalmic microsurgical system that is indicated for both anterior segment (i.e., phacoemulsification and removal of cataracts) and posterior segment (i.e., vitreoretinal) ophthalmic surgery. The ULTRAVIT® Vitrectomy Probe is indicated for vitreous cutting and aspiration, membrane cutting and aspiration, dissection of tissue and lens removal. The valved entry system is indicated for scleral incision, canulae for posterior instrument access and venting of valved cannulae. The infusion cannula is indicated for posterior segment infusion of liquid or gas. **Warnings and Precautions:** • The infusion cannula is contraindicated for use of oil infusion. • Attach only Alcon supplied products to console and cassette luer fittings. Improper usage or assembly could result in a potentially hazardous condition for the patient. Mismatch of surgical components and use of settings not specifically adjusted for a particular combination of surgical components may affect system performance and create a patient hazard. Do not connect surgical components to the patient's intravenous connections. • Each surgical equipment/component combination may require specific surgical setting adjustments. Ensure that appropriate system settings are used with each product combination. Prior to initial use, contact your Alcon sales representative for in-service information. • Care should be taken when inserting sharp instruments through the valve of the Valved Trocar Cannula. Cutting instrument such as vitreous cutters should not be actuated during insertion or removal to avoid cutting the valve membrane. Use the Valved Cannula Vent to vent fluids or gases as needed during injection of viscous oils or heavy liquids. • Visually confirm that adequate air and liquid infusion flow occurs prior to attachment of infusion cannula to the eye. • Ensure proper placement of trocar cannulas to prevent sub-retinal infusion. • Leaking sclerotomies may lead to post operative hypotony. • Vitreous traction has been known to create retinal tears and retinal detachments. • Minimize light intensity and duration of exposure to the retina to reduce the risk of retinal photic injury. **ATTENTION:** Please refer to the CONSTELLATION® Vision System Operators Manual for a complete listing of indications, warnings and precautions.

References: 1. Irannejad A, Tambat S, Abulon DJK. Retropulsion and mass flow of 27-gauge vitrectomy probes: comparison of dual-blade/flat-tipped probes and single-blade/beveled probes. Poster presented at: 18th Congress of the European Society of Retina Specialists; September 20–23, 2018; Vienna, Austria. **2.** Alcon data on file. Alcon Laboratories, Inc; June 2018. **3.** Alcon data on file. Alcon Laboratories, Inc; June 2018. **4.** Alcon data on file. Alcon Laboratories, Inc; June 2018. **5.** Alcon data on file. Alcon Laboratories, Inc; May 2017.

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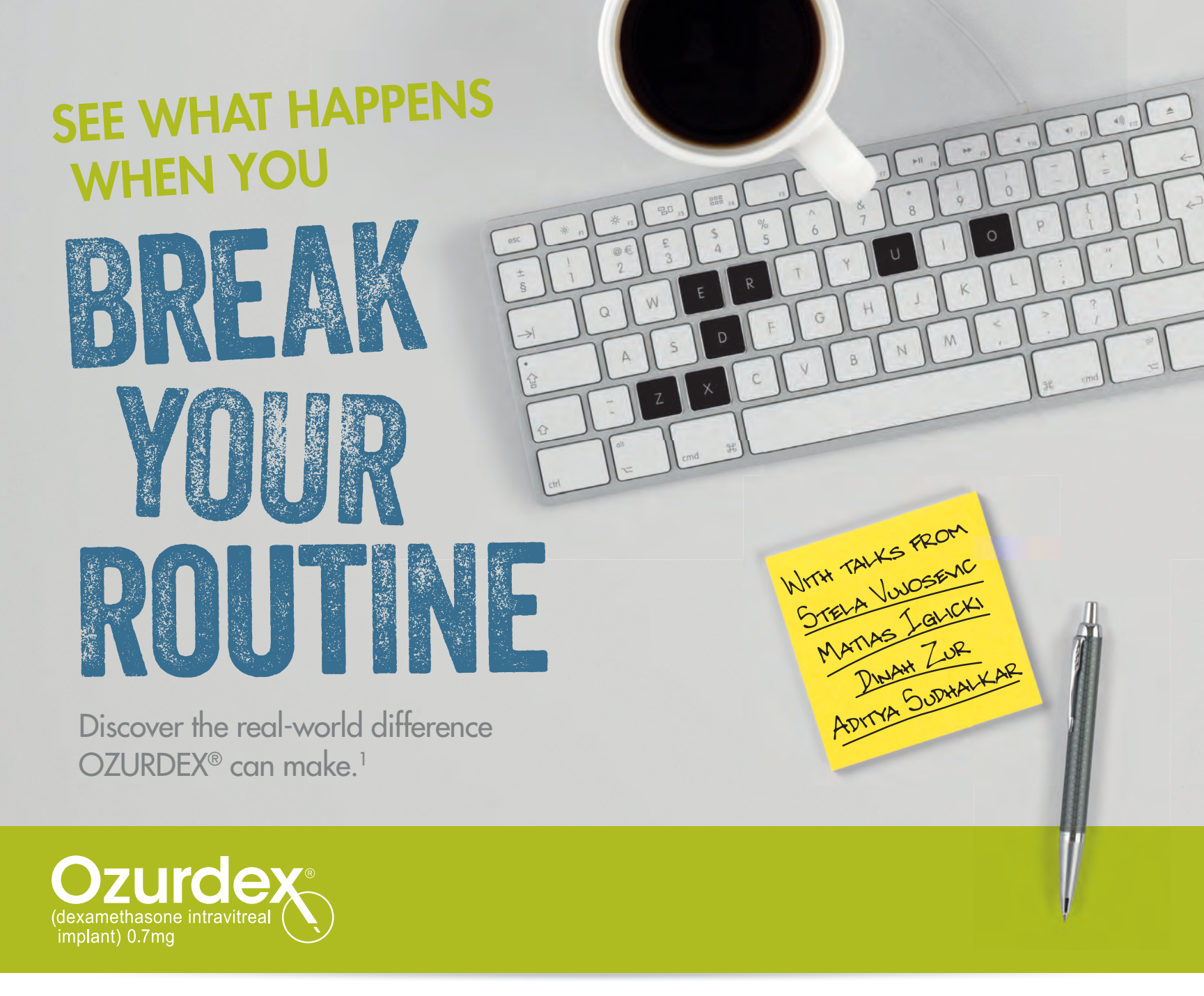

Discover the real-world difference OZURDEX® can make.[1]

Ozurdex®
(dexamethasone intravitreal implant) 0.7mg

OZURDEX® (Dexamethasone 700 micrograms intravitreal implant in applicator) Abbreviated Prescribing Information
Presentation: Intravitreal implant in applicator. One implant contains 700 micrograms of dexamethasone. Disposable injection device, containing a rod-shaped implant which is not visible. The implant is approximately 0.46 mm in diameter and 6 mm in length. **Indications:** Treatment of adult patients: with macular oedema following either Branch Retinal Vein Occlusion (BRVO) or Central Retinal Vein Occlusion (CRVO), inflammation of the posterior segment of the eye presenting as non-infectious uveitis and visual impairment due to diabetic macular oedema (DME) who are pseudophakic or who are considered insufficiently responsive to, or unsuitable for non-corticosteroid therapy. **Dosage and Administration:** Please refer to the Summary of Product Characteristics before prescribing for full information. OZURDEX must be administered by a qualified ophthalmologist experienced in intravitreal injections. The recommended dose is one OZURDEX implant to be administered intra-vitreally to the affected eye. Administration to both eyes concurrently is not recommended. Repeat doses should be considered when a patient experiences a response to treatment followed subsequently by a loss in visual acuity and in the physician's opinion may benefit from retreatment without being exposed to significant risk. Patients who experience and retain improved vision should not be retreated. Patients who experience a deterioration in vision, which is not slowed by OZURDEX, should not be retreated. In RVO and uveitis there is only very limited information on repeat dosing intervals less than 6 months. There is currently no experience of repeat administrations in posterior segment non-infectious uveitis or beyond 2 implants in Retinal Vein Occlusion. In DME there is no experience of repeat administration beyond 7 implants. Patients should be monitored following the injection to permit early treatment if an infection or increased intraocular pressure occurs. Single-use intravitreal implant in applicator for intravitreal use only. The intravitreal injection procedure should be carried out under controlled aseptic conditions as described in the Summary of Product Characteristics. The patient should be instructed to self-administer broad spectrum antimicrobial drops daily for 3 days before and after each injection. **Contraindications:** Hypersensitivity to the active substance or to any of the excipients. Active or suspected ocular or periocular infection including most viral diseases of the cornea and conjunctiva, including active epithelial herpes simplex keratitis (dendritic keratitis), vaccinia, varicella, mycobacterial infections, and fungal diseases. Advanced glaucoma which cannot be adequately controlled by medicinal products alone. Aphakic eyes with ruptured posterior lens capsule. Eyes with Anterior Chamber Intraocular Lens (ACIOL), iris or transscleral fixated intraocular lens and ruptured posterior lens capsule. **Warnings/Precautions:** Intravitreous injections, including OZURDEX can be associated with endophthalmitis, intraocular inflammation, increased intraocular pressure and retinal detachment. Proper aseptic injection techniques must always be used. Patients should be monitored following the injection to permit early treatment if an infection or increased intraocular pressure occurs. Monitoring may consist of a check for perfusion of the optic nerve head immediately after the injection, tonometry within 30 minutes following the injection, and biomicroscopy between two and seven days following the injection. Patients must be instructed to report any symptoms suggestive of endophthalmitis or any of the above mentioned events without delay. All patients with posterior capsule tear, such as those with a posterior lens (e.g. due to cataract surgery), and/or those who have an iris opening to the vitreous cavity (e.g. due to iridectomy) with or without a history of vitrectomy, are at risk of implant migration into the anterior chamber. Implant migration to the anterior chamber may lead to corneal oedema. Persistent severe corneal oedema could progress to the need for corneal transplantation. Other than those patients contraindicated where OZURDEX should not be used, OZURDEX should be used with caution and only following a careful risk benefit assessment. These patients should be closely monitored to allow for early diagnosis and management of device migration. Use of corticosteroids, including OZURDEX, may induce cataracts (including posterior subcapsular cataracts), increased IOP, steroid induced glaucoma and may result in secondary ocular infections. The rise in IOP is normally manageable with IOP lowering medication. Corticosteroids should be used cautiously in patients with a history of *ocular herpes simplex* and not be used in active *ocular herpes simplex*. OZURDEX is not recommended in patients with macular oedema secondary to RVO with significant retinal ischemia. OZURDEX should be used with caution in patients taking anti-coagulant or anti-platelet medicinal products. OZURDEX administration to both eyes concurrently is not recommended. Visual disturbance may be reported with systemic and topical corticosteroid use. If a patient presents with symptoms such as blurred vision or other visual disturbances, consider evaluating for possible causes which may include cataract, glaucoma or rare diseases such as central serous chorioretinopathy (CSCR) which have been reported after use of systemic and topical corticosteroids. **Interactions:** No interaction studies have been performed. Systemic absorption is minimal and no interactions are anticipated. **Pregnancy:** There are no adequate data from the use of intravitreally administered dexamethasone in pregnant women. OZURDEX is not recommended during pregnancy unless the potential benefit justifies the potential risk to the foetus. **Lactation:** Dexamethasone is excreted in breast milk. No effects on the child are anticipated due to the route of administration and the resulting systemic levels. However OZURDEX is not recommended during breast-feeding unless clearly necessary. **Driving/Use of Machines:** Patients may experience temporarily reduced vision after receiving OZURDEX by intravitreal injection. They should not drive or use machines until this has resolved. **Adverse Effects:** In clinical trials the most frequently reported adverse events were increased intraocular pressure (IOP), cataract and conjunctival haemorrhage*. Increased IOP with OZURDEX peaked at day 60 and returned to baseline levels by day 180. The majority of elevations of IOP either did not require treatment or were managed with the temporary use of topical IOP-lowering medicinal products. 1% of patients (4/347 in DME and 3/421 in RVO) had surgical procedures in the study eye for the treatment of IOP elevation. The following adverse events were reported: Very Common (≥ 1/10): IOP increased, cataract, conjunctival haemorrhage*. Common (≥1/100 to <1/10): headache, ocular hypertension, cataract subcapsular, vitreous haemorrhage*, visual acuity reduced*, visual impairment/disturbance, vitreous detachment*, vitreous floaters*, vitreous opacities*, blepharitis, eye pain*, photopsia*, conjunctival oedema*, conjunctival hyperaemia. Uncommon (≥1/1,000 to <1/100): migraine, necrotizing retinitis, endophthalmitis*, glaucoma, retinal detachment*, retinal tear*, hypotony of the eye*, anterior chamber inflammation*, anterior chamber cells/flares*, abnormal sensation in eye*, eyelids pruritus, scleral hyperaemia*, device dislocation* (migration of implant) with or without corneal oedema , complication of device insertion resulting in ocular tissue injury* (implant misplacement). (*Adverse reactions considered to be related to the intravitreous injection procedure rather than the dexamethasone implant). Please refer to Summary of Product Characteristics for full information on side effects. **Basic NHS Price:** £870 (ex VAT) per pack containing 1 implant. **Marketing Authorisation Number:** EU/1/10/638/001. **Marketing Authorisation Holder:** Allergan Pharmaceuticals Ireland, Castlebar Road, Westport, Co. Mayo, Ireland. **Legal Category:** POM. **Date of Preparation:** May 2019. UK/0288/2019

Adverse events should be reported. Reporting forms and information can be found at https://yellowcard.mhra.gov.uk/ Adverse events should also be reported to Allergan Ltd. UK_Medinfo@allergan.com or 01628 494026

Reference: 1. Kodjikian L *et al.* Biomed Res Int 2018:8289253.
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Date of preparation: July 2019
INT-OZU-1950010

Allergan

TRICKS OF THE TRADE


In *Retina Today*'s 5Q column, found on the final page of each issue, we often ask retina surgeons what drew them to the specialty. Read enough of those interviews and a pattern emerges. Synonyms for *elegance* appear. The word *puzzle* is used. Passionate phrases such as *fell in love with* and *was mesmerized by* emerge in drafts.

We understand where they're coming from: there's a romance to surgery. A marriage of engineering, medical science, and talent converge in the OR and buttress each other. New tools allow gifted surgeons to become more precise with their movements. Advances in anatomic understanding fuel the need for better equipment. Superior training in fellowship motivates surgeons to collaborate with industry to craft more advanced instruments.

This issue of *Retina Today* explores how our field thinks about surgery, both inside and outside the OR.

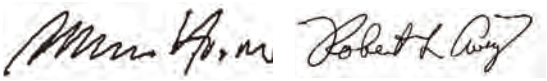
Michael A. Klufas, MD, highlights some of the latest videos on Eyetube, the online depot of surgical videos that even the best surgeons use to keep track of the field's trends. Ashley M. Crane, MD; and David A. Eichenbaum, MD, share pearls for Dutch Ophthalmic's EVA surgical platform, shedding light on how this growing technology has improved their OR. In a review of their favorite tools, Peter A. Karth, MD, MBA; and Rahul K. Reddy, MD, MHS, review Alcon's HyperVit Dual Blade Vitrectomy Probe and Bausch + Lomb's Bi-Blade Cutter, respectively.

As retina surgeons, we're often managing cases that involve IOLs. John W. Kitchens, MD, shares a technique for removing dropped IOLs that minimizes the risk of creating iatrogenic injury. Second-year Wills Eye Hospital fellows Thomas L. Jenkins, MD; Ravi R. Pandit, MD, MPH; and David Xu, MD, provide an introduction to secondary IOLs that is a great place to start for anyone who needs a survey of the latest technology.

Some of the topics in this issue take place outside of the OR. Ragui W. Sedeek, MD, makes the case for why laser therapy ought to play a large role in the management of patients with diabetic eye disease. Michael C. Renfroe, BSA; Gowtham Jonna, MD; Yong Ren, MMS; Saradha Chexal, MD; and Chirag D. Jhaveri, MD, explore how use of OCT angiography could affect the duration of facedown positioning for patients who underwent macular hole surgery.

And what about avoiding the OR altogether? Madeleine Webb, BA, BS; and Brian C. Joondeph, MD, MPS, profile a case in which surgery for a macular hole was obviated by a course of topical NSAID drops. By relying on outside-the-box thinking, the risks of surgery were avoided.

This issue is our gift to retina surgeons. We hope you find it useful. ■



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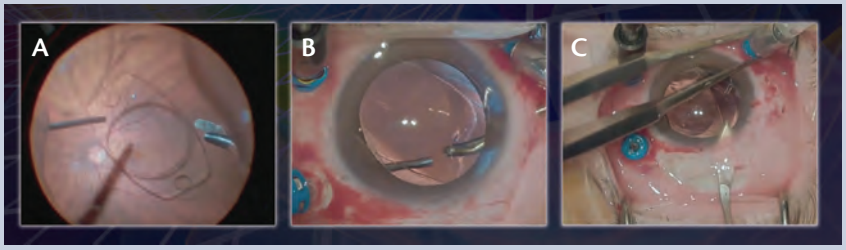
From the Cover



John W. Kitchens, MD, wrote an article in this issue about a technique for removing dropped plate haptic IOLs. By using a soft-tip cannula for removal of the IOL, he mitigates the risk of iatrogenic injury (A). Dr. Kitchens describes moving the IOL to the middle of the vitreous cavity, where safe manipulation is possible (B). The large incision required to remove the IOL doubles as an entry point for an anterior chamber IOL or other large IOL (C).

Want to know how Donald J. D'Amico, MD; María H. Berrocal, MD; and Timothy G. Murray, MD, MBA, reacted to the technique shared by Dr. Kitchens? Read his article in this issue's cover focus to find out.

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IN THE BACK

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SIX-MONTH DATA REPORTED FROM ONGOING PHASE 1/2 CLINICAL TRIAL IN X-LINKED RETINITIS PIGMENTOSA

Gene therapy company Applied Genetic Technologies Corporation (also called AGTC) reported positive interim 6-month data from its ongoing phase 1/2 clinical program in X-linked retinitis pigmentosa (XLRP). Patients treated centrally with the product candidate demonstrated durable improvement in visual function 6 months after dosing. These data reinforce the promising efficacy and safety results reported in September 2019 and will help investigators to design an XLRP pivotal trial that the company plans to initiate by the end of 2020, according to a company news release.

Data from 17 of the 25 patients were reported in September and suggested a favorable safety profile. Of the 17 patients, eight peripherally treated patients had stable visual function through 6 months, and nine centrally treated patients experienced an improvement in visual function as measured by microperimetry and/or BCVA through 3 months.

At the 6-month time point for those nine centrally dosed patients, measurable improvements were observed in visual sensitivity for four of the evaluable eight patients. All nine patients demonstrated stable or improved visual acuity, with 78% experiencing an improvement of at least 5 letters. ■

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NEWS BRIEFS

Read Eyewire's latest retina news at Eyewire.news/interests/retina.

> US FDA APPROVES FIRST TREATMENT FOR THYROID EYE DISEASE

The US FDA approved teprotumumab-trbw (Tepezza, Horizon Therapeutics) for the treatment of adults with thyroid eye disease, a rare condition in which the muscles and fatty tissues behind the eye become inflamed, pushing the eye forward and causing it to bulge outwards. This is the first drug approved for the treatment of thyroid eye disease.

Teprotumumab is a fully human monoclonal antibody and a targeted inhibitor of the insulin-like growth factor-1 receptor. It is administered to patients once every 3 weeks for a total of eight infusions.

>> PHASE 3 TRIAL OF THE PORT DELIVERY SYSTEM FOR DIABETIC MACULAR EDEMA BEGINS

Genentech and Roche have initiated a new phase 3 clinical trial of the Port Delivery System (PDS) with ranibizumab (Lucentis, Genentech) in patients with diabetic macular edema (DME). The PDS is an investigational, first-of-its-kind, refillable implant designed to continuously release a customized formulation of ranibizumab into the eye over a period of months.

The Pagoda trial is a phase 3, multicenter, randomized, active-comparator, noninferiority study that will evaluate the efficacy, safety, and pharmacokinetics of the PDS for the treatment of DME. Nearly 550 patients with DME will be randomly assigned to receive either the PDS 100 mg/mL refilled at fixed 6-month intervals or monthly intravitreal injections of ranibizumab 0.5 mg. The primary endpoint of the Pagoda trial is the change in BCVA from baseline averaged over weeks 48 and 50.

>>> OERTLI LAUNCHES THE VIPER ILLUMINATED SCLERAL INDENTOR FOR RETINAL SURGERY

Oertli Instrumente announced the launch of the ViPer illuminated scleral indentor for retinal surgery. The ViPer facilitates work in the periphery of the posterior segment thanks to its ability to indent and illuminate transsclerally at the same time, according to the company.

The tool is semitransparent and therefore an antiglare and backscatter-free instrument. The consistent illumination of the indented tissue improves the user's view of the retinal periphery, while the rounded 360° tip ensures its easy application and excellent mobility, according to the company.

WIDEFIELD FLUORESCEIN ANGIOGRAPHY IN COATS DISEASE

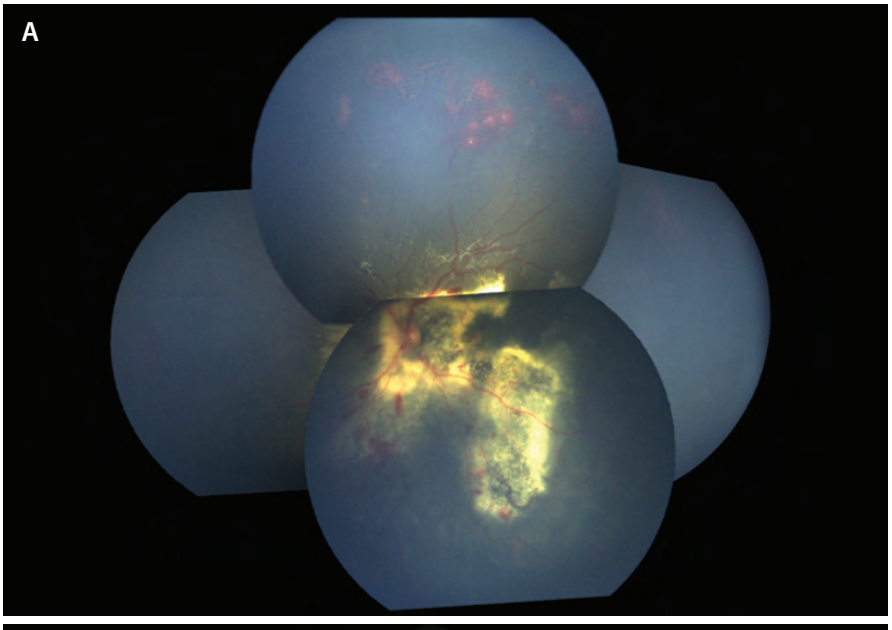

Imaging was essential in guiding the treatment for this pediatric patient.

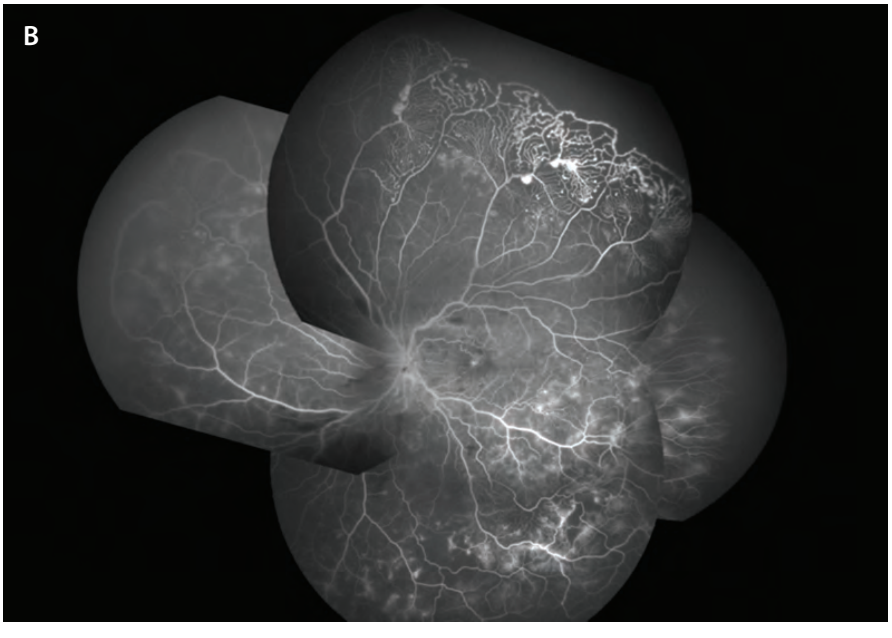
BY BOONTIP TIPSURIYAPORN, MD; AND YOSHIHIRO YONEKAWA, MD

A 3-year-old girl presented with leukocoria in the left eye. The anterior segment in each eye was normal. Fundus examination of the left eye showed extensive exudates in the posterior pole, subretinal fluid from arcade to arcade, retinal hemorrhages, and extensive telangiectatic vessels throughout the periphery with aneurysmal lesions superiorly (Image A). No mass lesions were observed. Widefield fluorescein angiography (WFA; RetCam 3, Natus) demonstrated diffuse vascular leakage, telangiectasia, aneurysms in the periphery, and large areas of capillary dropout and nonperfusion (Image B). The vascular findings on WFA were classic for Coats disease.

Laser photocoagulation, intravitreal bevacizumab (Avastin, Genentech), and sub-Tenon triamcinolone were administered. The laser was used to photocoagulate the nonperfused retina, to apply long duration laser burns to close the aneurysms, and to paint the incompetent vessels. The patient required three more treatment sessions before the vascular leakage resolved and there was substantial improvement of the exudation and resolution of the subretinal fluid.

Coats disease is a retinal vascular abnormality characterized by idiopathic retinal vascular telangiectasia and microvascular aneurysmal changes that can cause exudation and exudative retinal detachment.[1]





COATS DISEASE IS A RETINAL VASCULAR ABNORMALITY CHARACTERIZED BY IDIOPATHIC RETINAL VASCULAR TELANGIECTASIA AND MICROVASCULAR ANEURYSMAL CHANGES THAT CAN CAUSE EXUDATION AND EXUDATIVE RETINAL DETACHMENT.

The mainstay of management of Coats disease is photocoagulation to treat the nonperfused retina and to obliterate the aneurysms and leaking vessels.[1,2] Anti-VEGF injections and periocular steroids are not routinely administered but may be used as adjunctive treatments for severe disease.[3] Vitreoretinal surgery may be necessary for extensive retinal detachment; in that event, we recommend an external drainage approach.[4] WFA imaging is essential to identify all vascular pathology that must be lasered, and it can also provide data on when to stop treatment and be used for follow-up surveillance.[5] ■

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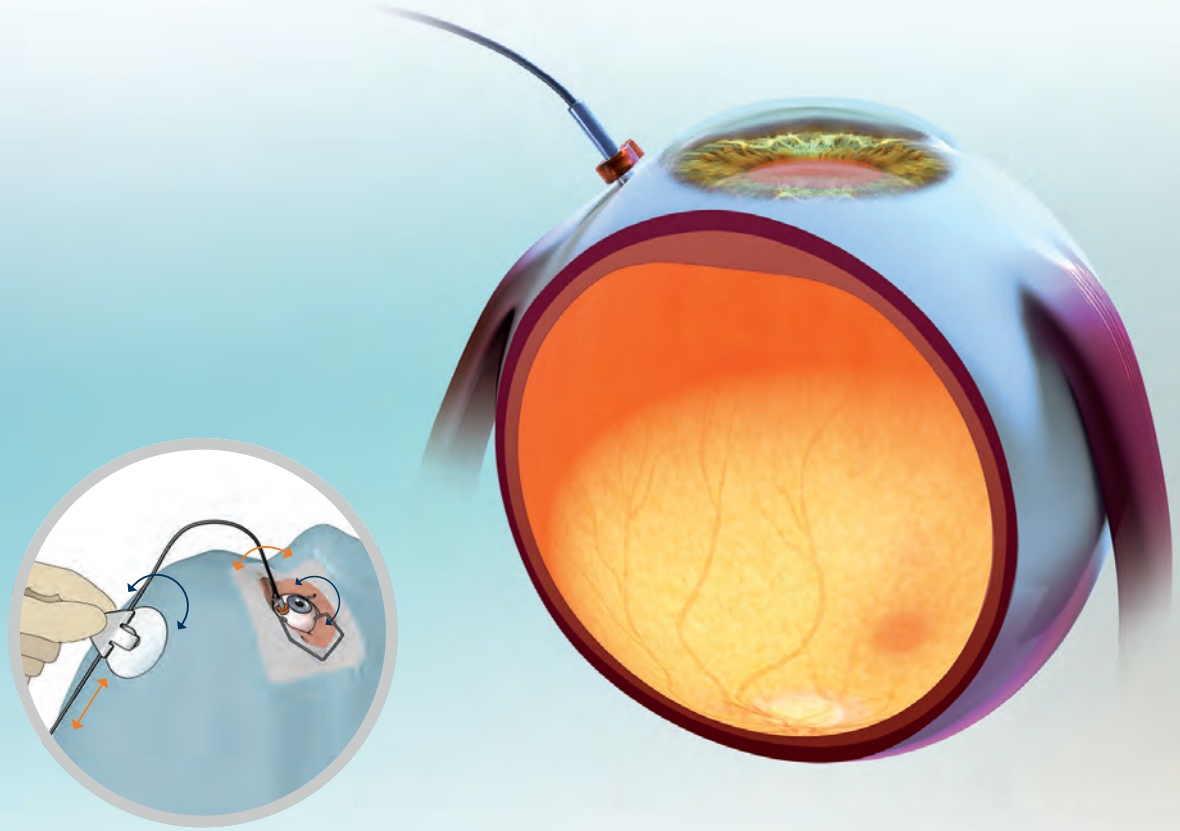
A Brighter Vision on Illumination

Enhanced Function and Directional Control



29G Spotlight Directional Chandelier

- Global endo-illumination and control
- Wide view fiber tip
- Straightforward insertion and fixation with 29G valved entry system

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OPHTHALMIC MANIFESTATIONS OF NEUROSYPHILIS: A CASE REPORT


Highlighting the characteristics of this condition that is experiencing a resurgence in some parts of the world.

BY SUKUMARAN RAMANATHAN, MB, BS, FRCSED, DO; AND AGATA NIZANKOWSKA, MB, BS

Several recent reports have indicated a resurgence of the prevalence of syphilis in some regions of the world.[1-4] Reported ophthalmic manifestations of syphilis include interstitial keratitis, uveitis, chorioretinitis, acute retinitis, retinal vasculitis, and cranial nerve and optic neuropathies,[5] as well as rare manifestations such as gumma of the superior orbital muscle bundle and anterior nodular scleritis.[6,7] These disorders can occur due to other etiologies, so a high index of clinical suspicion is required to identify *Treponema pallidum* as the causative agent.

In this article we report a case of acute placoid retinal pigment epitheliopathy secondary to tertiary syphilis, with acute loss of vision as the presenting complaint. Treatment and clinical outcome are discussed.

Figure 1. An all-over erythematous rash that was present for more than 7 weeks before onset of visual deterioration.

CASE REPORT

A 49-year-old white woman presented with rapid deterioration of vision in both eyes of 3 days' duration. Occasional photpsia was also reported. The patient reported painless, non-itchy, rough, reddish-brown rash over her upper and lower limbs and torso present for several weeks (Figure 1). She also had mouth ulcers and hoarseness of voice. Her medical history included treatment for hypertension, previous total abdominal hysterectomy, and bilateral salpingo-oophorectomy. Her medications included ramipril, omeprazole, and conjugated estrogens for hormone replacement therapy.

On examination, BCVA was 0.70 logMAR in the right eye (OD) and 0.90 in the left eye (OS) logMAR. The anterior chamber was quiet in each eye. Fundus examination showed circumscribed placoid areas of subtle retinal edema in the macular region in each eye (Figures 2 and 3).

Spectral-domain OCT showed irregularity and thickening of the retinal pigment epithelium (RPE) layer, hyperreflectivity of the outer nuclear layer, and obliteration of the outer limiting membrane in the macular region of each eye. The macula OD also showed evidence of subretinal fluid (SRF) at the fovea (Figures 4 and 5).

Fluorescein angiography (FA) showed fluorescent mottling of the macular region OS followed by leakage in the late frames, involving fairly circumscribed areas superior and inferior to the fovea. The fundus OD showed an area of diffuse hyperfluorescence in the late frames on FA, localized superior to the fovea and involving an area of about 2 disc diameters (Figures 6 and 7).

Relevant investigation results on presentation:

- Syphilis screen: Tryponemal screen (enzyme immunoassay) → Positive
- *Tryponema pallidum* haemagglutination test (TPHA) → Positive (Ref.Lab.) >1:10240
- *Tryponema pallidum* IgM → Positive
- Venereal disease research laboratory/rapid plasma

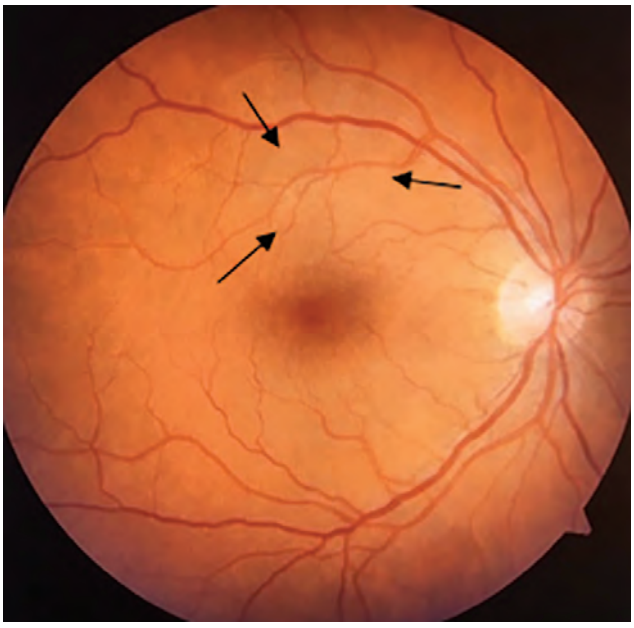

Figure 2. Color photo of the fundus OD showing an area of subtle retinal elevation superior to the fovea (arrows), due to chorioretinitis.

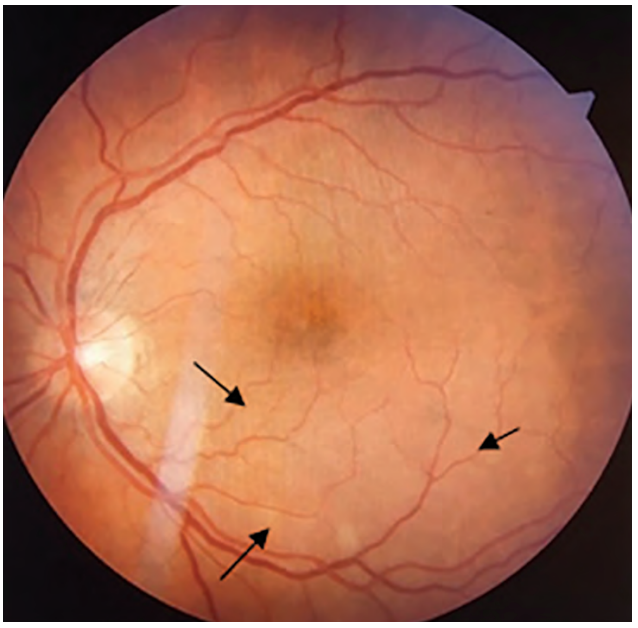

Figure 3. Color photo of the fundus OS showing area of subtle retinal elevation superior to the fovea (arrows), due to chorioretinitis.

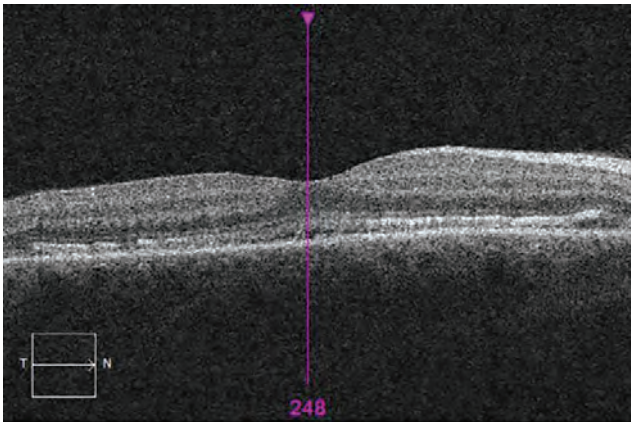

Figure 4. OCT showing irregularity and thickening of the RPE and obliteration of the outer limiting membrane in the macular region OD. The macula showed evidence of subfoveal fluid.

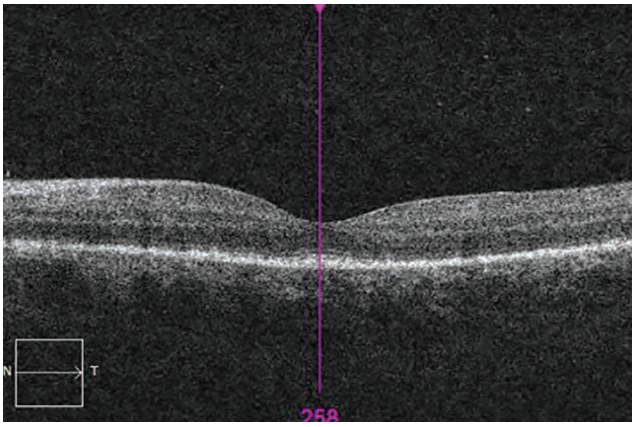

Figure 5. OCT showing irregularity and thickening of the RPE and obliteration of outer limiting membrane in the macular region OS.

reagin (VDRL/RPR) → Positive titre 1:32
- Cerebrospinal fluid polymerase chain reaction (PCR) → Positive for *Treponema pallidum*
- HIV → Negative

Treatment was initiated with a 14-day course of benzylpenicillin (2.4 g intravenous six times daily), along with oral prednisolone 20.0 mg for 4 days, 15.0 mg for 7 days, 10.0 mg for 7 days, and 5.0 mg for 7 days. The patient's partner tested positive for syphilis and was also treated appropriately. Oral thrush was treated with nystatin (100,000 units/mL) 1 mL orally for 7 days and benzydamine HCl 0.15% w/v (Difflam, Difflam) oral rinse four times daily for 4 weeks.

After the course of penicillin, the patient's vision recovered and the rashes resolved. BCVA was 0.00 logMAR OD and 0.06 logMAR OS. Fundus examination showed no significant abnormality in either eye. OCT showed reduced irregularity and thickening of the RPE layer and a well-defined outer limiting membrane in each eye. There was complete resolution of SRF OD (Figures 8 and 9).

DISCUSSION

The British Ocular Syphilis Study reported findings in 63 eyes of 41 patients during a 2-year surveillance.[8] Bilateral involvement was noted in 56% of patients. After treatment, mean VA improved, with 92.1% of eyes achieving VA of 0.3 logMAR or better. Average duration of symptoms was 1 month. Moradi et al, in a study including 61 eyes of 35 patients seen at a referral center, reported stable visual outcomes with treatment

Figure 6. FA showing diffuse leakage OD, localized superior to the fovea.

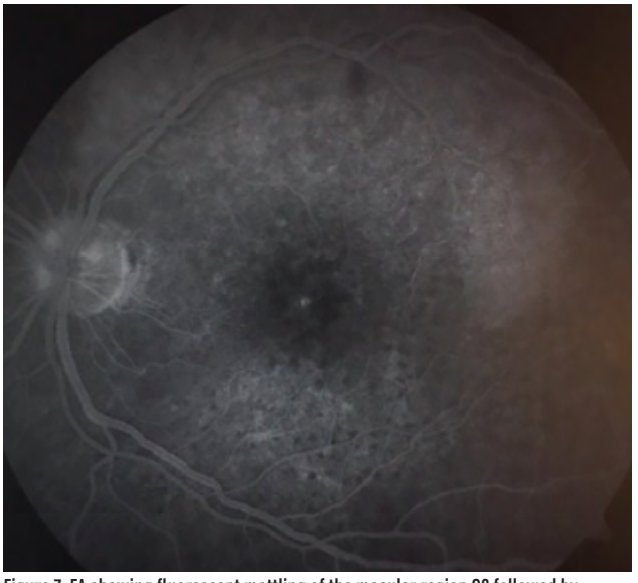

Figure 7. FA showing fluorescent mottling of the macular region OS followed by diffuse leakage in the late frames, involving fairly circumscribed areas superior and inferior to the fovea.

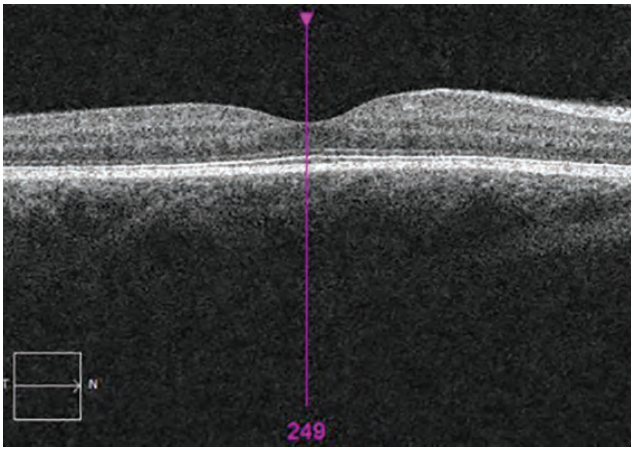

Figure 8. OCT showing reduced irregularity and thickening of the RPE layer and a well-defined outer limiting membrane OD. There was complete resolution of SRF.

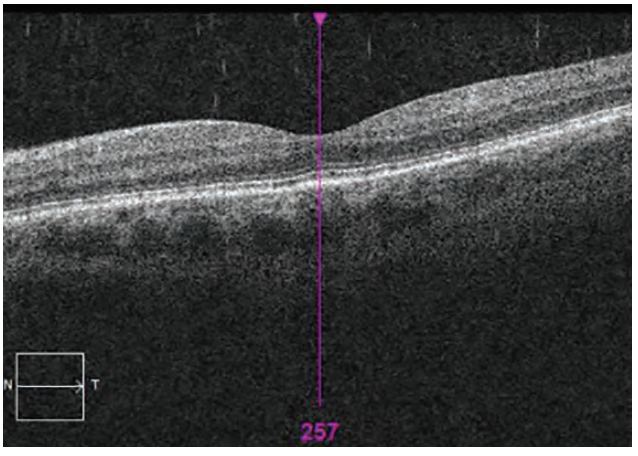

Figure 9. OCT showing reduced irregularity and thickening of the RPE layer and well-defined outer limiting membrane OS.

in 33.3% of eyes and deterioration of vision in 13% of eyes.[9]

In the case reported here, the patient presented within 3 days of onset of visual deterioration, and features of placoid retinal pigment epitheliopathy prompted a comprehensive set of investigations, resulting in rapid diagnosis and treatment. Prompt initiation of treatment may have played a role in the impressive visual recovery in this patient. ■

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UVEAL EFFUSION SECONDARY TO HYPERVISCOSITY FROM CHRONIC LYMPHOCYTIC LEUKEMIA

Partial spontaneous resolution was documented over 30 months in this case report.

BY SUNIDHI RAMESH, BS; MIN KIM, MD; AND CAROL L. SHIELDS, MD

Chronic lymphocytic leukemia (CLL) is a B-cell malignancy characterized by an accumulation of functionally incompetent monoclonal lymphocytes in the bone marrow, blood, and lymph nodes. This condition is known for its slow rate of cell division and disease progression, and, for this reason, CLL is often followed conservatively.[1]

A sequela of CLL is hyperviscosity syndrome. This occurs when the blood becomes hyperviscous secondary to an increase in immunoglobulins or the hyperproliferation of blood components.[2] Ultimately, hyperviscosity may lead to a series of hematologic, cardiovascular, neurologic, and renal complications, as well as bleeding from mucous membranes.[3]

Ophthalmic manifestations associated with hyperviscosity syndrome are not common but can manifest as venous distention or tortuosity, local areas of beading and dilatation of retinal vessels creating a string-of-sausage appearance, and flame-shaped hemorrhages.[3] Uveal effusion as a manifestation of hyperviscosity is quite uncommon. In this article we describe a case of uveal effusion secondary to hyperviscosity from CLL.

CASE REPORT

A 67-year-old white woman with a 2-month history of a blind spot in the left eye (OS) was referred to the Ocular Oncology Service at Wills Eye Hospital for evaluation of a possible intraocular mass. She had previously been seen by several retina specialists who had suspected a retinal detachment, posterior scleritis, or tumor.

Ocular history included LASIK in each eye 17 years before her presentation to us and cataract surgery in each eye. Medical history included several previous cancers, including a basal cell carcinoma of the right brow, which was surgically excised; thyroid cancer, treated with thyroidectomy and radioactive iodine; squamous cell carcinoma of the right arm, which was surgically excised; and CLL diagnosed 11 years before presentation and followed with observation. At the time of presentation, the patient reported no metastatic disease and noted long-standing hypertension.

VA was 20/25 in the right eye (OD) and 20/40 OS on examination. Tortuosity of the retinal veins was observed OD, but there was no sign of intraretinal, subretinal, or choroidal fluid or mass. The macula OD was intact. Similar retinal venous tortuosity was noted OS, but with shallow subretinal fluid and a smooth, brown, peripheral choroidal area that may have been presumed to be a mass in all

AT A GLANCE

- Hyperviscosity syndrome, in which blood becomes hyperviscous, is a common sequela of chronic lymphocytic leukemia.
- In this case study, hyperviscosity led to uveal effusion. The patient was followed for 30 months.

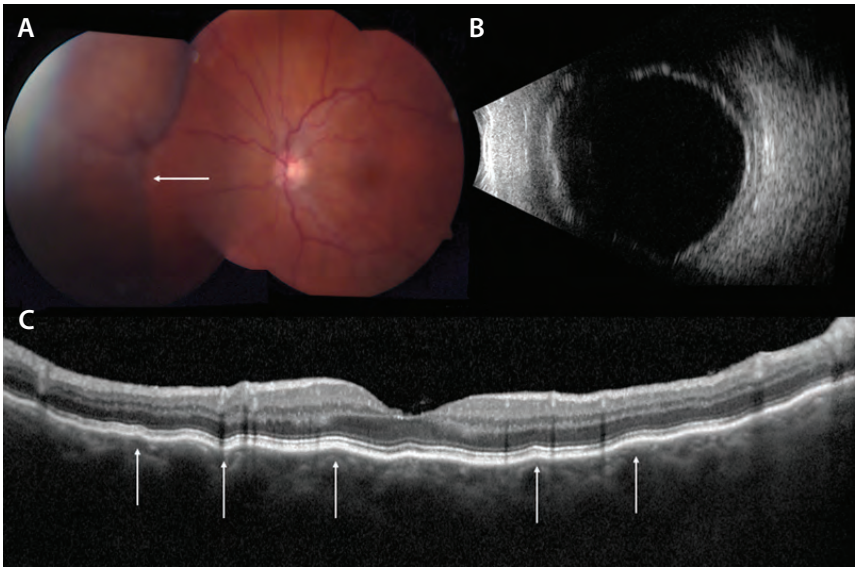

Figure 1. This is a case of choroidal effusion in a 67-year-old woman with CLL. At presentation, the left eye demonstrated dilated tortuous retinal veins and a large orange-brown "mass" in the nasal quadrant (A, arrow). Ultrasonography documented choroidal detachment with 4.75 mm elevation (B). OCT showed shallow choroidal undulations (C, arrows).

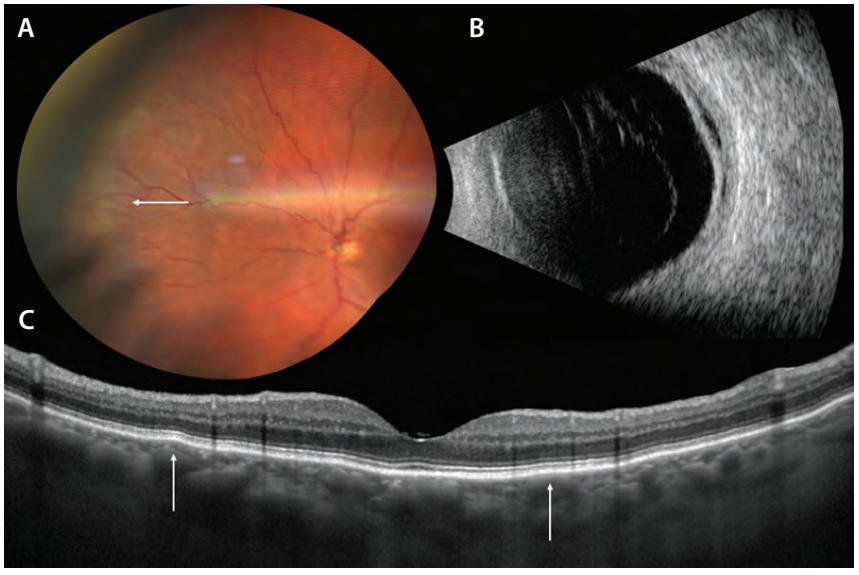

Figure 2. At 30 months, a marked reduction in the choroidal effusion was observed OS (A, arrow). Choroidal detachment was measured at 3.28 mm elevation on ultrasound (B). OCT imaging showed fewer, minimally perceptible choroidal undulations (C, arrows).

four quadrants but was most notable nasally (Figure 1A).

Ultrasonography confirmed the suspected mass to be choroidal detachment (effusion) measuring 4.8 mm in height. Axial length (23.4 mm OD and 23.2 mm OS) was within normal limits (Figure 1B).

OCT imaging showed shallow undulation of the choroidal surface without subretinal fluid or macular edema OS. The macula OS was otherwise intact (Figure 1C).

At this point, a diagnosis of choroidal effusion was suspected, but, given the patient's history of malignancy, an MRI was performed. This test confirmed choroidal detachment and the presence of suprachoroidal fluid. The cause of uveal effusion was suspected to be related to hyperviscosity secondary to CLL, as the patient's white blood cell count (22.9 x 10^3/µL) was moderately elevated (normal 4.5 x 10^3 to 10.5 x 10^3/µL). Given the underlying conditions and intact macula, a period of observation was advised.

At 30 months, the eye demonstrated nearly complete spontaneous resolution of effusion. Fundoscopy OD was normal and showed persistent retinal vascular tortuosity. Fundoscopy OS showed dramatic resolution of the effusion with minimal residual choroidal elevation and diffuse retinal pigment epitheliopathy temporally. The choroidal thickness had decreased to 3.3 mm on ultrasonography with trace choroidal undulation on OCT imaging (Figure 2). There was no subretinal fluid and no macular edema. VA was 20/40 OD and had improved to 20/25 OS.

DISCUSSION

Choroidal effusion represents an accumulation of fluid in the suprachoroidal space. There are various etiologies, most notably including scleropathies (congenital or acquired), hydrodynamic factors (through either ocular hypotony or elevated uveal venous pressure), inflammatory factors, and neoplastic conditions.[4]

The most important scleropathy is nanophthalmos. Nanophthalmos is defined by an axial length of 20 mm or less and can often be complicated by angle-closure glaucoma and exudative retinal detachment.[4] In the patient described in this article, the axial length was 23.2 mm, ruling out nanophthalmos.

Hydrodynamic factors that can lead to ocular hypotony include wound leak, ocular trauma or surgery, ciliary body dysfunction, and rhegmatogenous retinal detachment. Hydrodynamic factors that can lead to elevated uveal venous pressure include Sturge-Weber syndrome and globe

OUR STRATEGY IS TYPICALLY TO OBSERVE MILD CASES AND TRIAL ALL OTHERS ON ORAL OR PERIOCULAR CORTICOSTEROIDS. PATIENTS WHO DO NOT RESPOND TO CORTICOSTEROIDS ARE THEN ADVISED TO UNDERGO SCLEROTOMY, IF NECESSARY.

compression from orbital mass or hemorrhage. In our patient, we speculate that the effusion was related to a hydrodynamic process of hyperviscosity from her elevated white blood cell count, leading to sludging of vascular flow and raised venous pressure.

The treatment of uveal effusion typically involves corticosteroid (oral, periocular, or intraocular) therapy or surgical sclerotomy (either partial or full-thickness scleral resection). In 2017, Shields et al reviewed 104 eyes with non-nanophthalmic uveal effusion treated with corticosteroids and found that control was achieved in 95% of eyes, and scleral window surgery was required in only 5% of cases.[5]

Sclerotomy is a technique designed to create a scleral window to allow drainage of suprachoroidal and supraciliary fluid. Mansour et al published a case series in which uveal effusion was treated in eight nanophthalmic eyes of five patients using sclerotomy. In that series, all effusions resolved within an average of 14 days.[6] Our strategy is typically to observe mild cases and trial all others on oral or periocular corticosteroids. Patients who do not respond to corticosteroids are then advised to undergo sclerotomy, if necessary.

Leukemia can affect the eye in several ways.[7-9] Koshy et al described ophthalmic manifestations of acute and chronic leukemias in 96 patients and found direct leukemic infiltration of the eye in eight patients (8.3%) and indirect involvement of the eye from anemia, thrombocytopenia, hyperviscosity, total body irradiation, and immunosuppression in 42 patients (43.8%).[10] The other patients in the series showed no evidence of ocular changes due to leukemia. The authors noted that ocular involvement was more often found in patients with acute and myeloid leukemia and was relatively uncommon in cases of chronic and lymphocytic leukemia.

CONCLUSION

This article described a patient with uveal effusion as a rare manifestation of hyperviscosity syndrome from CLL. In this patient, partial spontaneous resolution was documented over 30 months. ■

Support provided in part by the Eye Tumor Research Foundation, Philadelphia, PA (CLS). The funders had no role in the design and conduct of the study, in the collection, analysis and interpretation of the data, and in the preparation, review or approval of the manuscript. Carol L. Shields, MD, has had full access to all the data in the study and takes responsibility for the integrity of the data.

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VBS AT MEDITERRANEAN RETINA

Debates were frequent at the VBS panel at the Mediterranean Retina 2019 meeting.

BY R. ROSS LAKHANPAL, MD, FACS

As president of the Vit-Buckle Society (VBS), I was honored to attend and moderate a symposium at the Mediterranean Retina 2019 meeting in Dubrovnik, Croatia. Several societies were represented at the meeting, including the European Vitreoretinal Society and the Vitreoretinal Society of India. I was humbled and honored that the VBS was included in this group of distinguished societies.

I moderated a panel on surgical challenges that included Joseph Coney, MD; Matteo Forlini, MD; Hugo Quiroz-Mercado, MD; and Ratko Lazic, MD. Each panelist presented a case that, in the spirit of the VBS Annual Meeting, sparked debate and welcomed new ideas. Here, I summarize those cases.

CASE No. 1: JOSEPH CONEY, MD (UNITED STATES)

Dr. Coney presented a case of a 65-year-old aphakic man with a hyphema who received a pars plana vitrectomy (PPV) and a scleral-fixed IOL following a complicated cataract procedure. After hyphema evacuation, the surgeon identified a 4-clock-hour iridodialysis, retained lens material, and an inferior retinal detachment (RD). Anterior and posterior vitrectomy was performed, lens fragments were removed, RD repair was performed, and a modified sewing machine technique was used to repair the iridodialysis. Dr. Coney showed a video demonstrating how the sewing machine technique reattached the iris root to the sclera.

He planned to suture an Akreos IOL (Bausch + Lomb) to the sulcus during a second procedure, at which time he would perform reconstruction of the pupil. Dr. Coney shared a video demonstrating multiple techniques for dealing with a traumatic iridodialysis and repair of an RD and then later placing a secondary lens to maximize visual potential. The panelists debated whether, based on the complexity of the first procedure, a scleral-fixated IOL would have been a better choice than an anterior chamber IOL. They pointed out that, in general, scleral-fixated IOLs have potentially fewer long-term complications (such as uveitis-glaucoma-hyphema syndrome), and noted that recent advances in anterior chamber IOL technology have decreased the risk of complication.

CASE No. 2: HUGO QUIROZ-MERCADO, MD (MEXICO)

Dr. Quiroz-Mercado shared a case involving a patient with a diabetic tractional RD who had undergone PPV, membrane peel, and silicone oil placement. After surgery, traction remained on the central macula, and the patient reported metamorphopsia.

In this situation, some surgeons may opt for silicone oil removal, secondary PPV, membrane peel, and replacement of the silicone oil. Dr. Quiroz-Mercado, however, decided to perform a membrane peel under silicone oil with the vitreous cutter and did not place infusion in the eye. He used 25-gauge instrumentation.

The panelists debated the merits of 27-gauge instrumentation in this case. During this debate, I pointed out that 27-gauge instrumentation would allow a surgeon to intervene between the tractional membranes in this case more effectively than 23- or 25-gauge instrumentation.

The panel also discussed the importance of silicone oil removal for this patient and the potential complications related to hemostasis.

CASE No. 3: MATTEO FORLINI, MD (ITALY)

Dr. Forlini began his presentation on ocular trauma surgery by pointing out that, in such cases, many vitreoretinal surgeons face the challenge of performing PPV through an opacified cornea, making visualization of the fundus difficult. Media opacities may be due

AT A GLANCE

- The VBS hosted a panel at the Mediterranean Retina 2019 meeting in Dubrovnik, Croatia, that sparked discussion about surgical techniques.
- The international VBS panel discussed cases involving complicated vitrectomy, trauma, and chronic RRD.

MANY SURGEONS FROM EUROPE STATED THAT PHACOVITRECTOMY AND PLACEMENT OF A POSTERIOR CHAMBER IOL IS THE STANDARD OF CARE, WHEREAS SURGEONS FROM THE UNITED STATES NOTED THAT PPV AND FLUID-GAS EXCHANGE IS THE STANDARD OF CARE.

to corneal wounds secondary to the ocular trauma itself.

In his video, Dr. Forlini demonstrated some tips and tricks for PPV in these difficult scenarios. He performs surgery without removing the clouded cornea, thereby avoiding corneal transplantation at the time of PPV. The panel's debate during and after the video concerned whether it would have been better to combine PPV with penetrating keratoplasty (PK) instead of performing PPV alone. The majority of the audience thought that the visualization through the hazy cornea was adequate to perform PPV. Some audience members noted that a PK would be necessary after PPV anyway, and that perhaps a PK before or at the time of PPV would have been a better choice. The patient did well after the PPV, according to Dr. Forlini.

CASE No. 4: RATKO LAZIC, MD (CROATIA)

Dr. Lazic presented a case of a macula-on rhegmatogenous RD (RRD) with a nuclear sclerotic cataract. He performed PPV with an endolaser and fluid-gas exchange. Dr. Lazic pointed out that phacoemulsification is often performed during PPV. The positives and negatives of combined surgery were the subject of a lively debate. On the positive side, a single surgical session is optimal, especially if the desired outcome is achieved. However, depending on the complexity of the RD, some believe that it is better to address the RD and then do a staged procedure for the cataract extraction. To complete a combined surgery, the surgeon must be proficient at both procedures. It should be noted that many retina surgeons do not routinely perform cataract surgery.

International differences in the management of cases in which visualization through the cataract is possible became clear. Many surgeons from Europe stated that phacovitrectomy and placement of a posterior chamber IOL is the standard of care, whereas surgeons from the United States noted that PPV and fluid-gas exchange is the standard of care.

CASE No. 5: MANISH NAGPAL, MS, DO, FRCS(EDIN) (INDIA)

I had the honor of presenting a case submitted by Manish Nagpal, MS, DO, FRCS(Edin).

Dr. Nagpal's case concerned a chronic total RRD in a patient with proliferative vitreoretinopathy and subretinal silicone oil 360° that was present after an unsuccessful attempt at total RRD repair.

First, he initiated silicone oil removal from the vitreous cavity via a silicone oil–fluid exchange. After the exchange, the entire retina remained detached, and he observed that the peripheral retina was chronically detached and ischemic. He placed PFO on the surface of the retina out to the periphery and then performed a 270° retinectomy to flatten the retina centrally. He could remove the remaining subretinal silicone oil only after PFO installation. Dr. Nagpal performed endocautery at the edge of the ischemic retina, again injected PFO, and performed a PPV using scissors mode to remove the peripheral retinal tissue necessary to flatten the retina. He then performed endolaser photocoagulation for 360° at the edges of the retinectomy.

A complete fluid-air exchange was initiated while PFO kept the central macula flat. This was followed by removal of the PFO, more endolaser photocoagulation, and reapplication of silicone oil to address the chronic RRD.

The panel had many opinions about the steps necessary to flatten the retina in this case of chronic RRD with subretinal silicone oil. Some attendees wondered whether fluid-air exchange and subretinal silicone oil removal could be a better solution than PFO application. In this case, Dr. Nagpal used PFO because he did not want any residual subretinal silicone oil or residual subretinal fluid during the repair, as these would ultimately have affected the patient's postoperative recovery and visual prognosis.

MORE INTERNATIONAL VBS PANELS?

The VBS–Mediterranean Retina symposium sparked the type of discussion that the VBS is known for. I was honored to represent the VBS at this meeting, and the VBS team looks forward to collaboration with international societies in the coming years. ■

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Eyetube Retina Channel Update

A number of videos recently uploaded to Eyetube show innovative, cutting-edge techniques.

BY MICHAEL A. KLUFAS, MD

As the Retina Chief for Eyetube, I am on the lookout for videos that show innovative procedures from surgical pioneers and outside-the-box thinkers. For this issue's cover focus on surgical techniques and technologies, I selected five videos that I think illustrate the field's ingenuity and creativity in the OR, and here I offer comments on some of the questions these procedures raise.

Case No. 1: Endolaser-Assisted Scleral Buckle

From David Xu, MD; and Jason Hsu, MD: We perform a scleral buckle for a patient with a retinal detachment. The patient also has extensive lattice in four quadrants, which we treat with a lighted endolaser probe. This provides widefield microscope visualization during the application of the laser and cryotherapy.

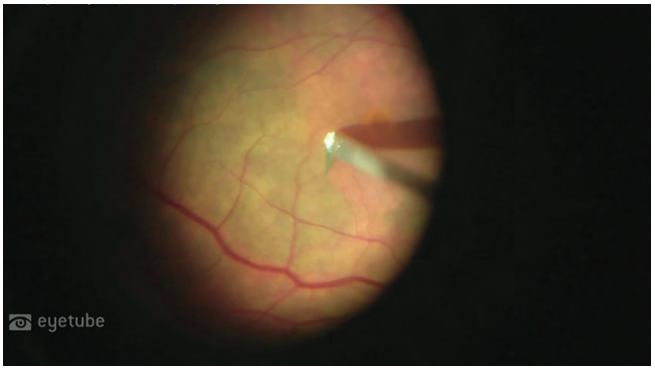
Commentary from Dr. Klufas: Scleral buckling is still an important procedure, and this is a nifty little trick to avoid cryotherapy and further modification of the chandelier-assisted scleral buckle. A case such as this one raises a compelling question worthy of study: Does endolaser provide better clinical outcomes than cryotherapy in cases of retinal detachment?

VIEW AT: BIT.LY/HSU0120

Case No. 2: Internal Limiting Membrane Peeling for Macular Hole With the Awh Micro Vacuum Pick

From Carl C. Awh, MD: This is one of the first macular hole cases I performed using the micro vacuum pick (Awh MVP; Katalyst Surgical). I make a firm stroke to incise the ILM at the start of surgery. After I have an edge, I lift it with a spatula.

Commentary from Dr. Klufas: New surgical devices continue to push our field forward. Clinical series have reported visual field defects and scotomas resulting from pinch-and-peel techniques. Could the Awh MVP help lead the way to an era of less traumatic ILM peeling?



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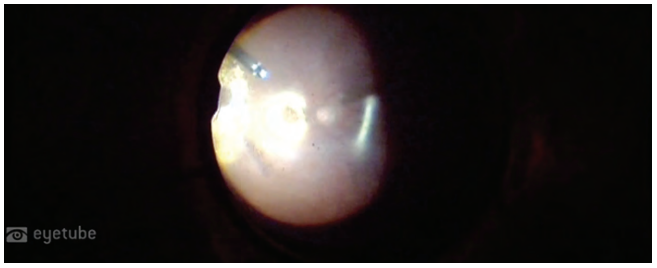
Case No. 3: Dexamethasone Intravitreal Implant 0.7 mg Under the Retina

From Federic Aissani, MD: A 70-year-old patient presented with a dexamethasone intravitreal implant 0.7 mg (Ozurdex, Allergan) under the retina. The patient's surgical history included two surgeries for

retinal detachment in the left eye and one surgery for retinal detachment in the right eye. I operated on the patient because the retina was detached; had the retina been attached, I would not have operated.

Commentary from Dr. Klufas: We have heard of steroid implant migration to the anterior segment in aphakic patients, but this one takes the cake. Consider the choices Dr. Aissani makes, including the decision to leave the implant in the eye.

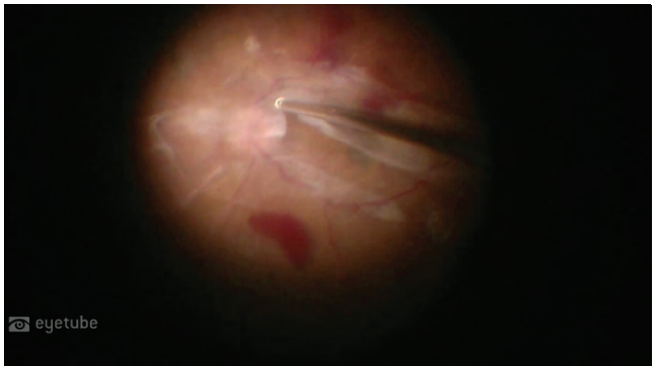


VIEW AT: BIT.LY/AISSANI0120

Case No. 4: Unimanual 27-Gauge Vitrectomy for Tractional Retinal Detachment

From Gurkan Erdogan, MD: This video presents unimanual (one-handed) 27-gauge vitrectomy for tractional retinal detachment surgery. This surgical technique minimizes the forces applied on the retinal surface, eliminates the need for chandelier illumination, and reduces the number of instrument exchanges during surgery.

Commentary from Dr. Klufas: Is a 27-gauge cutter all you need for diabetic tractional retinal detachment surgery? This instrument can be like a magic eraser for removing tightly adherent membranes. Because of its small sphere of influence and limited flow, it reduces the chance of iatrogenic breaks (even in cases of bullous detached retina).

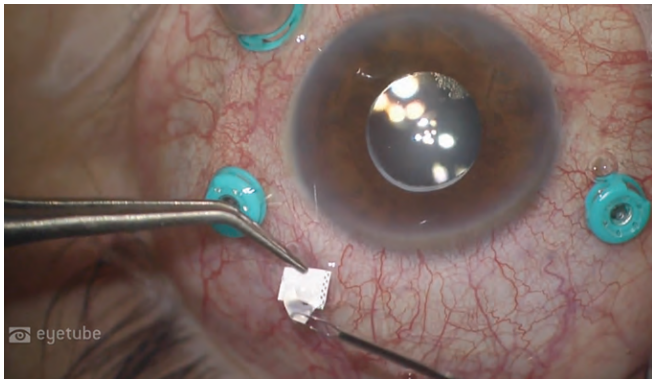


VIEW AT: BIT.LY/ERDOGAN0120

Case No. 5: Repair of a Chronic Macular Hole

From Diana V. Do, MD; and Peter H. Tang, MD, PhD: We present a case of a 62-year-old pseudophakic woman with counting fingers vision and stable diabetic retinopathy who presented for treatment of a large, persistent macular hole in her right eye. There had been three attempts at repair prior to her presentation. Autologous serum and amniotic membranes were used to close the macular hole.

Commentary from Dr. Klufas: Should we try to close holes with retinal grafts? With autologous serum and amniotic membrane? If so, is one preferred over the other? Some argue that retinal grafting is more effective. Others note that application of autologous serum and amniotic membrane is easier to perform. ■



VIEW AT: BIT.LY/TANG0120

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Surgical Pearls for the EVA Platform


Improved fluidics and illumination are features of this vitrectomy system.

BY ASHLEY M. CRANE, MD; AND DAVID A. EICHENBAUM, MD

The Enhancing Visual Acuity (EVA) vitrectomy system (Dutch Ophthalmic) can be used for vitreoretinal surgery, cataract surgery, and combined anterior-posterior segment surgery. The system has gained widespread use due to its safety and efficiency and its lower price point compared with other similar systems.

The EVA incorporates an innovative fluidics system and a twin duty cycle cutter, and it works with a variety of peripheral accessories. This article describes three posterior segment surgical pearls relating to the EVA system.

PEARL No. 1: FLUIDICS

The EVA system's most distinctive feature is its VacuFlow Valve Timing Intelligence (VTi) vacuum control system. In traditional venturi pump systems, a flow of air is used to create a vacuum. The surgeon controls the vacuum, and the flow depends on several factors, including the amount of vacuum, the gauge of instrumentation, and the viscosity of fluid or tissue. In a peristaltic system, a rotary wheel compresses the tubing system to displace fluid. The surgeon controls the flow, and vacuum can also be controlled independently.

The EVA system's VTi system pump can be used in vacuum or in flow mode. Core vitrectomy is typically performed in vacuum mode, as it allows quick and efficient removal of core vitreous. When the surgeon is working closer to the retina, however, it is advantageous to switch to flow mode. In vacuum mode, the vacuum rate is constant but flow fluctuates depending on the viscosity of the fluid. When working closer to the retina, this may cause inadvertent contact by the cutter, resulting in iatrogenic breaks. Transient hypotony may also occur.

When flow mode is activated, the flow at the tip of the cutter (or other instrument) is kept constant with the assistance of VTi, often resulting in safer and more effective shaving, especially over detached retina or during a posterior membrane peel.

Furthermore, the surgeon can toggle among customized preset flows using the footpedal, based on the mobility of the retina or the desired proximity of the cutter to the retinal surface. A common setting for peripheral vitrectomy, for example, is to use flow mode with a low-vacuum *shave* setting.

PEARL No. 2: ILLUMINATION

The EVA system also incorporates LEDStar Illumination LED technology. These LED bulbs are known for their long life, minimizing the frequency of bulb changes. The technology includes updated LED light fibers that provide better visualization in 27-gauge surgery. The color of the light can be varied from white to yellow or amber. Some surgeons like to use the yellow or amber light while working under air or during long cases.

The EVA's light pipe incorporates a directional light, minimizing glare and allowing the surgeon to efficiently visualize the vitreous and retina. Of note, it may take a couple of surgeries for the user to get accustomed to directing this light pipe posteriorly when it is introduced through the trocar.

Light pipes in all gauges also come with a clear cap that can be fitted over the light pipe so that it can be used as an illuminated scleral depressor. This

AT A GLANCE

- The EVA system's VTi system pump can be used in vacuum or in flow mode, depending on the surgical scenario.
- The LED illumination system offers improved visualization with 27-gauge instrumentation.
- A high-flow infusion system can provide high infusion pressure in small-gauge surgeries.

LIGHT PIPES IN ALL GAUGES ALSO COME WITH A CLEAR CAP THAT CAN BE FITTED OVER THE LIGHT PIPE SO THAT IT CAN BE USED AS AN ILLUMINATED SCLERAL DEPRESSOR. THIS FEATURE IS BEST USED ON LIGHTLY PIGMENTED EYES AND MAY NOT PROVIDE SUFFICIENT TRANSSCLERAL ILLUMINATION IN SOME CASES.

feature is best used on lightly pigmented eyes and may not provide sufficient transscleral illumination in some cases.

PEARL No. 3: CANNULAS AND INFUSION

The trocars and cannulas of the EVA system have both pluses and minuses. The trocars are fitted with transparent, removable, silicone valved cannulas that provide a watertight seal. The funnel-shaped metal trocar makes insertion of rigid instruments easy. However, care must be taken when choosing soft tip instruments, as some soft silicone soft tips will adhere to the silicone valves, impeding their entry into the cannulas. This is a common problem across platforms with silicone valves. Some widely used soft tip cannulas may be difficult to introduce into the EVA's trocar-cannulas. Stabilizing the cannula with forceps can often solve this difficulty. In our experience, the soft tip cannula manufactured by Vortex Surgical, with its slightly shorter and more rigid silicone tip, is significantly easier to introduce into the EVA trocar-cannula than other soft tip cannulas. Vortex also offers 23- and 25-gauge retractable soft tip cannulas, which basically eliminate this issue.

The removable valved cannula also allows the EVA system to be used with an alternative high-flow infusion system, which is optional in 23- and 25-gauge systems and is used in all 27-gauge systems. For use of this system, the translucent valved cannula is removed, and the infusion is changed from one that is fitted inside the trocar cannula to one that fits around the trocar. This allows full use of the entire lumen of the trocar for infusion, and therefore lower infusion pressures.

When the high-flow infusion system is used, the surgeon must be mindful to decrease the upper limit of the automatic infusion control in order to avoid excessively high infusion pressures in comparison with those of standard infusion systems.

Conversely, when standard infusion is used, the surgeon must be careful not to overpower the infusion with excessive vacuum, which can result in hypotony. Getting used to one's own individual infusion, flow, and vacuum settings is easy and intuitive on the EVA system, but each surgeon should work with his or her company representative to customize the machine's setup.

CONCLUSION

The EVA system offers significant advantages over traditional systems, especially with regard to its innovative fluidics system. We recommend the use of flow mode when the cutter is coming into close contact with mobile retina or when preretinal membranes are being removed with the vitreous cutter. The EVA illumination system allows greater customization and broader use of 27-gauge instrumentation than other lighting systems. It is important for surgeons to familiarize themselves with the accessories most compatible with the EVA trocars in order to maximize their surgical efficiency. ■

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Introduction to Secondary IOLs

Scleral fixation of a lens with two eyelets requires precise sclerotomy placement and suture management to avoid rotation.

BY THOMAS L. JENKINS, MD; RAVI R. PANDIT, MD, MPH; AND DAVID XU, MD

There are multiple options for secondary IOL implantation in aphakic eyes, including the use of anterior chamber IOLs, iris-fixated IOLs, or scleral-fixated IOLs.[1] In young patients or patients with insufficient iris support, narrow anterior chambers, corneal endothelial disease, or other anterior segment pathology, scleral fixation of a posterior chamber IOL should be considered.

This article describes considerations pertinent to suture type, lens selection, and surgical technique when implanting a scleral-fixated IOL. We also describe the technique used at our institution for scleral fixation with one particular combination of IOL and suture material.

SUTURE TYPES

Multiple authors have demonstrated excellent IOL positioning and stability with sutured scleral-fixated lenses using a variety of suture types, including 10-0 polypropylene, 9-0 polypropylene, and polytetrafluoroethylene (PTFE; Gore-Tex, W.L. Gore & Associates) suture materials.[2-5]

PTFE is a nonabsorbable monofilament suture with high tensile strength. It is an attractive option for scleral fixation of IOLs due to its durability and low rate of suture-related complications. In 2018, Khan et al, at our institution, reported favorable outcomes of combined pars plana vitrectomy and ab externo scleral fixation of posterior chamber IOLs with PTFE suture after a minimum of 1-year follow-up with no documented instances of suture breakage or lens dislocation.[3]

LENS TYPES

Many models of foldable acrylic IOLs have been used for scleral suture fixation. The Akreos AO60 (Bausch + Lomb) is a one-piece, foldable hydrophilic acrylic IOL with four eyelets through which sutures can be passed. This lens is commonly used as a secondary IOL, but there have been well-documented reports of optic opacification with calcium salt deposition after air or gas fill due to its hydrophilic properties.[6-9] Given the frequent comorbid factors that place aphakic patients at high risk of requiring retinal surgery (eg, previous trauma, retinal damage from dislocated IOL, vitreous traction), the Akreos lens may be seen as inappropriate for use in some patients.

The enVista MX60 IOL (Bausch + Lomb) is a one-piece hydrophobic acrylic IOL with two eyelets. In contrast to the Akreos lens, no cases of opacification have been reported with this lens. It may, therefore, represent a more versatile option in a vitreoretinal surgical context in which intraocular air or gas tamponade is likely to be used. Despite the two-eyelet design of the MX60 IOL, with proper technique

AT A GLANCE

- Options for secondary IOL implantation in aphakic eyes include the use of anterior chamber IOLs, iris-fixated IOLs, or scleral-fixated IOLs.
- Polytetrafluoroethylene (PTFE) suture, also known as Gore-Tex suture, is an attractive option for scleral IOL fixation because of its durability and low rate of suture-related complications.
- A one-piece foldable hydrophobic acrylic IOL may be preferred for patients in whom intraocular air or gas tamponade is likely to be needed.

and suture placement it has been shown to result in surgically induced astigmatism similar to that of other IOL models.[10]

The CZ70BD (Alcon) is a one-piece PMMA lens with two eyelets that are suitable for suture fixation. However, this lens requires a larger scleral tunnel incision, as the optic is not foldable.

At our institution, we have had the most experience with the Akreos and the enVista.

OUR TECHNIQUE

Surgical placement of a PTFE scleral-fixated IOL can be challenging due to the need for precise sclerotomy placement and suture management to avoid rotation of the lens during intraocular insertion. The steps used for this surgery at our institution are described below.

A toric lens marker is used to mark the cornea at two points 180° apart. Marking the 3 and 9 clock positions is the most common, but some surgeons choose 10 and 4 clock positioning to avoid the nasal bridge.

Sectoral peritomies 3 clock hours in size are performed centered on the corneal marks, and hemostasis is maintained through the use of wet-field cautery. Calipers are used to mark 3 mm posterior to the limbus and 2.5 mm above and below the posterior mark, such that the markings are 3 to 5 mm apart on each side (Figure 1). The surgeon may adapt the precise posterior and intersclerotomy measurements based on his or her own surgical results.

Depending on surgeon preference, a 23-, 25-, or 27-gauge needle is used to make sclerotomies at the inferior marks, and sclerotomy ports of the corresponding gauge are inserted at the superior scleral marks (Figure 2). An inferotemporal transconjunctival infusion cannula is inserted, and a standard three-port pars plana vitrectomy is performed.

The infusion is clamped, and the anterior chamber is maintained with

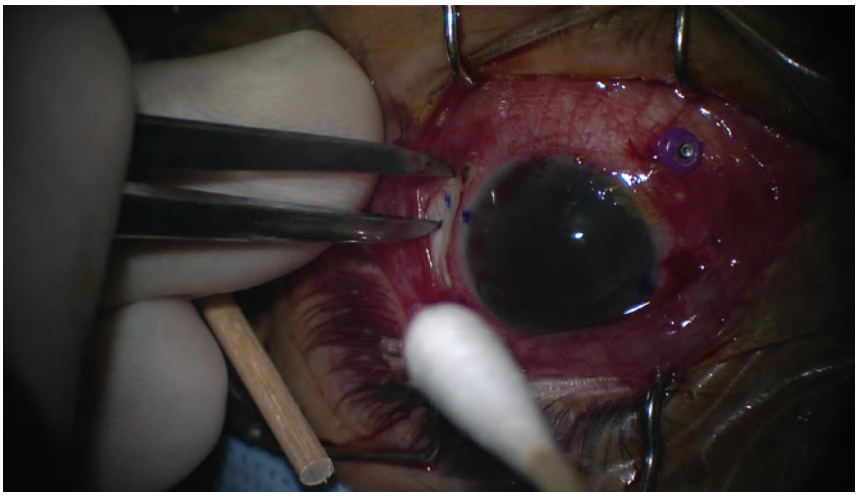


Figure 1. Calipers are used to mark 3 mm posterior to the limbus and 2.5 mm above and below the posterior mark.

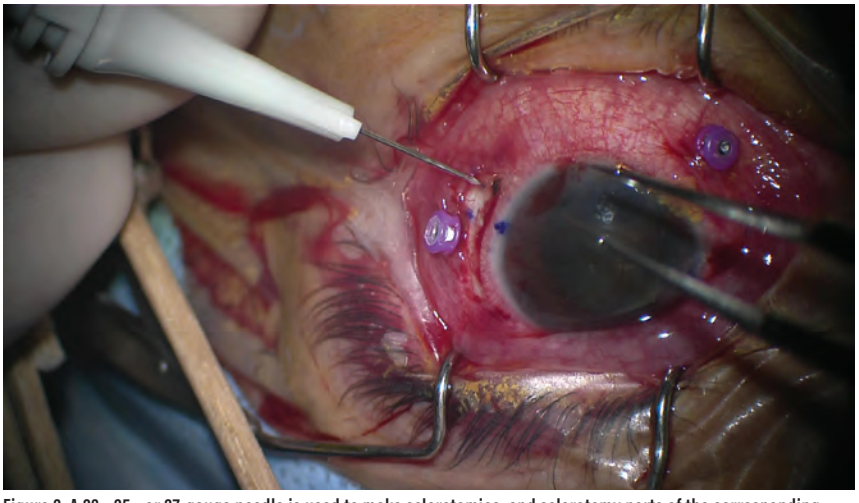


Figure 2. A 23-, 25-, or 27-gauge needle is used to make sclerotomies, and sclerotomy ports of the corresponding gauge are inserted at the superior scleral marks.

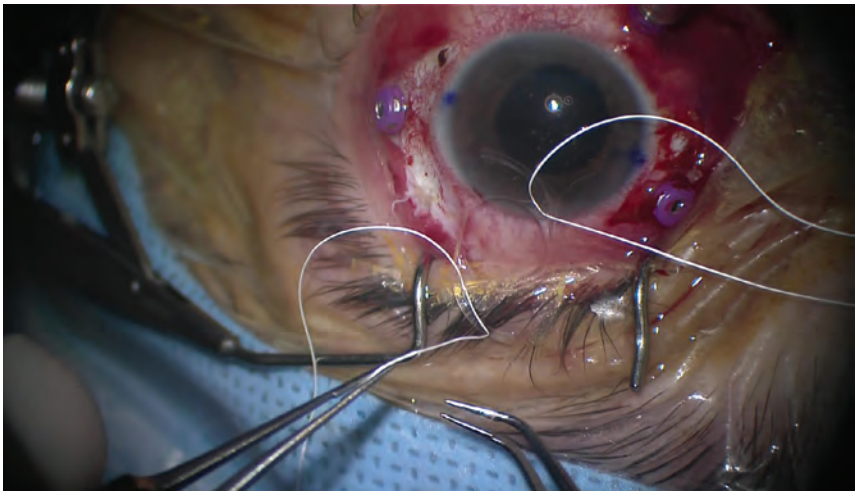


Figure 3. One half of an 8-0 PTFE suture with the needle removed is threaded through each eyelet of an MX60 IOL, with both ends of the suture going over the haptic.

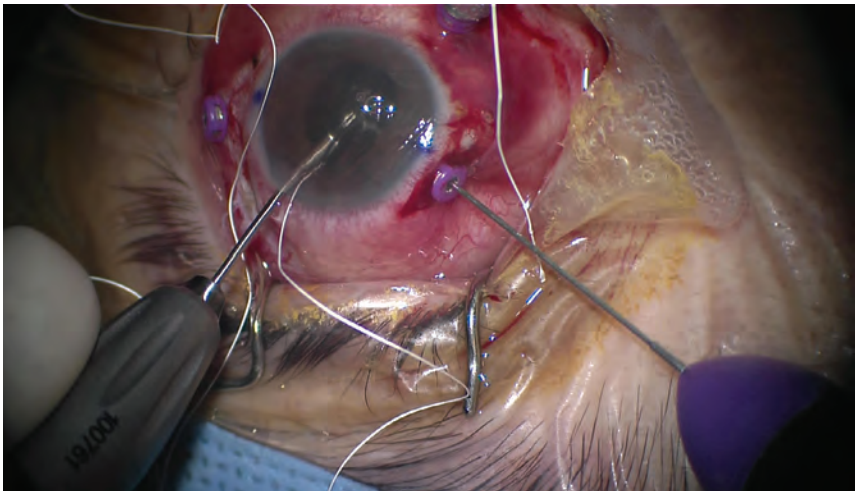


Figure 4. Each end of the suture from the leading haptic of the IOL is passed into the anterior chamber and retrieved from the corresponding sclerotomy using 27-gauge forceps.

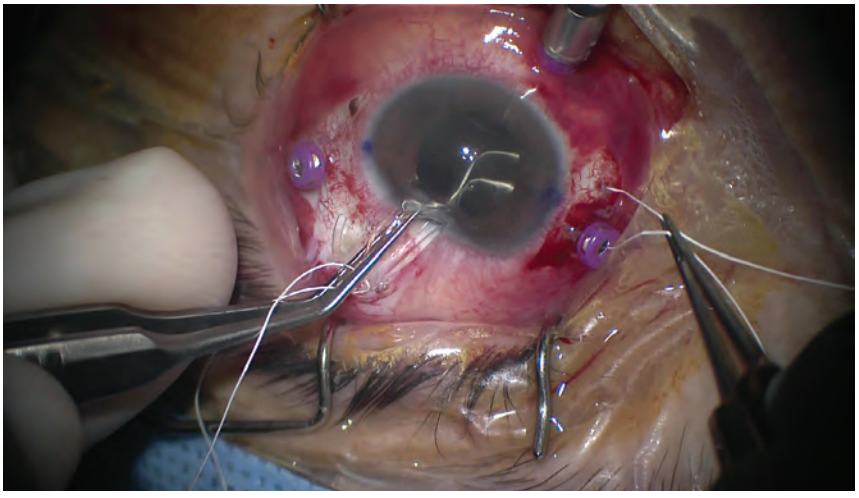


Figure 5. The IOL optic is folded in half, the haptics are tucked into the folded IOL using curved Kelman-McPherson forceps, and the IOL is introduced into the anterior chamber.

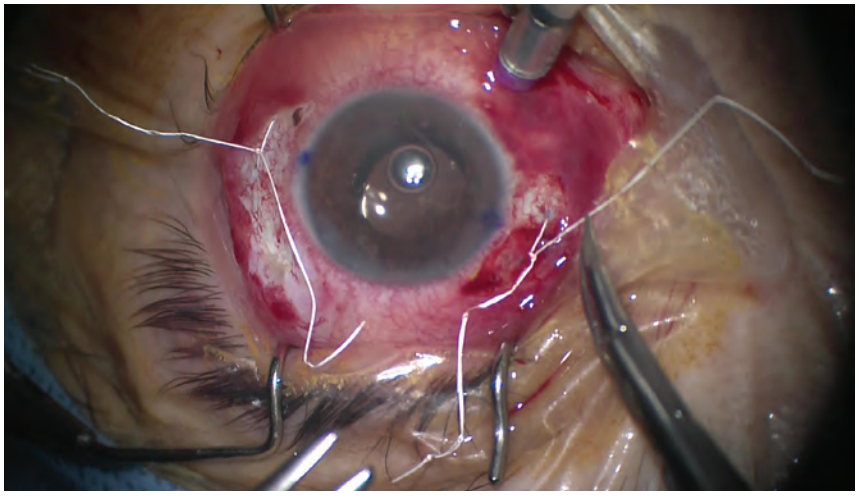


Figure 6. With appropriate tension placed and lens centration confirmed, the sutures are tied.

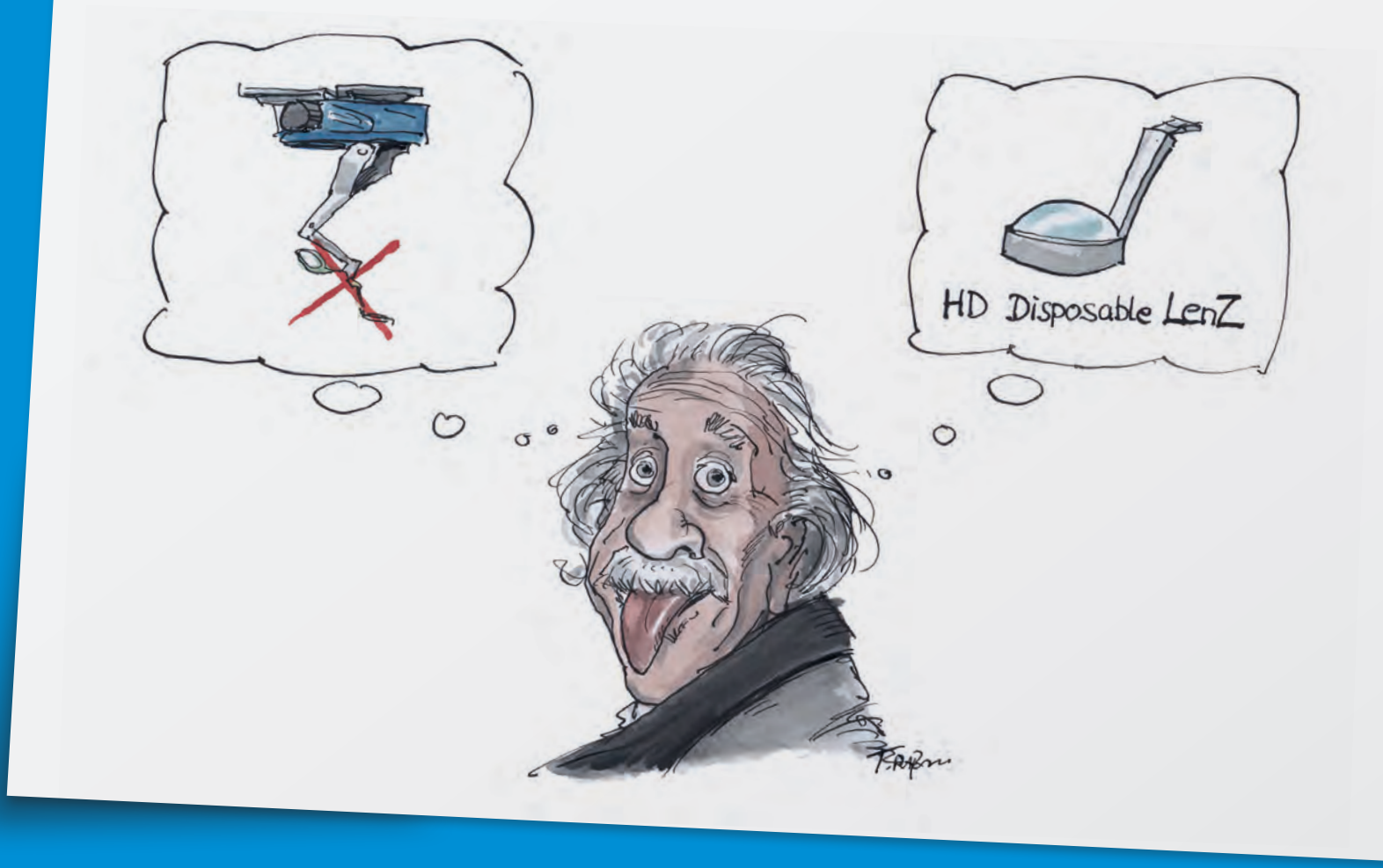
MULTIPLE AUTHORS HAVE DEMONSTRATED EXCELLENT IOL POSITIONING AND STABILITY WITH SUTURED SCLERAL-FIXATED LENSES USING A VARIETY OF SUTURE TYPES.

use of an OVD. A 2.75-mm keratome is used to create a clear corneal incision at the superior limbus. Some surgeons prefer instead to create a corneoscleral tunnel using an angled crescent knife before entering the anterior chamber with the keratome.

One half of an 8-0 PTFE suture with the needle removed is threaded through each eyelet of an MX60 IOL, with both ends of the suture going over the haptic (Figure 3). Each end of the PTFE suture from the leading haptic is then passed into the anterior chamber and retrieved from the corresponding sclerotomy using 27-gauge intraocular forceps (Figure 4). The optic of the IOL is folded in half, and the haptics are tucked into the folded IOL using curved Kelman-McPherson forceps. The IOL is then introduced into the anterior chamber (Figure 5).

The PTFE suture is tied temporarily with a three-loop throw or a slipknot. The other ends of the suture are subsequently passed through the opposite sclerotomies in a similar manner. After appropriate tension has been placed and lens centration confirmed,

(Continued on page 30)



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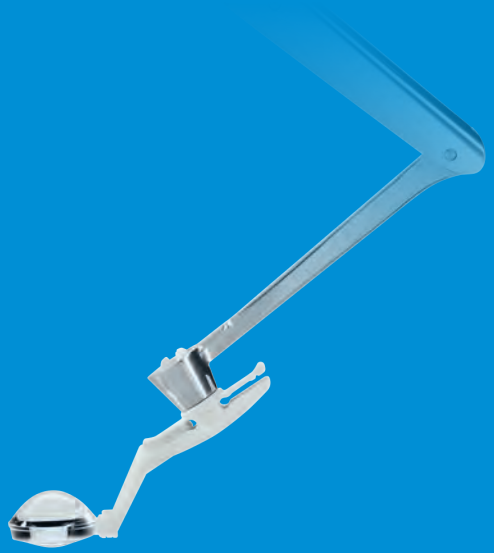

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The Case for Modern Lasers in Diabetic Eye Disease

New laser technology may lead to increased use in some patients.

BY RAGUI W. SEDEEK, MD

In the days before the anti-VEGF era, focal laser application in patients with diabetic macular edema (DME) was an effective therapeutic option that came with a price: The heavy burn created by the laser blanched tissue and left permanent scarring. After anti-VEGF agents were found to be effective in the treatment of DME, many clinicians abandoned focal laser in favor of pharmacotherapy for DME.

Patients with diabetic eye disease undergoing anti-VEGF therapy require frequent treatment. Young, phakic, working-age patients with bilateral disease are particularly affected by this treatment burden. The need for frequent injections can be disruptive to patients' lives and may lead to patients skipping treatments altogether. Some clinicians may choose to employ steroid therapy, but that strategy comes with a certainty of cataract formation in phakic patients and a risk of glaucoma development. Using steroids in working-age, phakic patients, then, seems counterproductive: The need for frequent anti-VEGF injections is eliminated but replaced by potential ocular complications.

Applications of subthreshold laser therapy (SLT) in young, phakic, working-age patients can, in my experience, lower the treatment burden for patients with

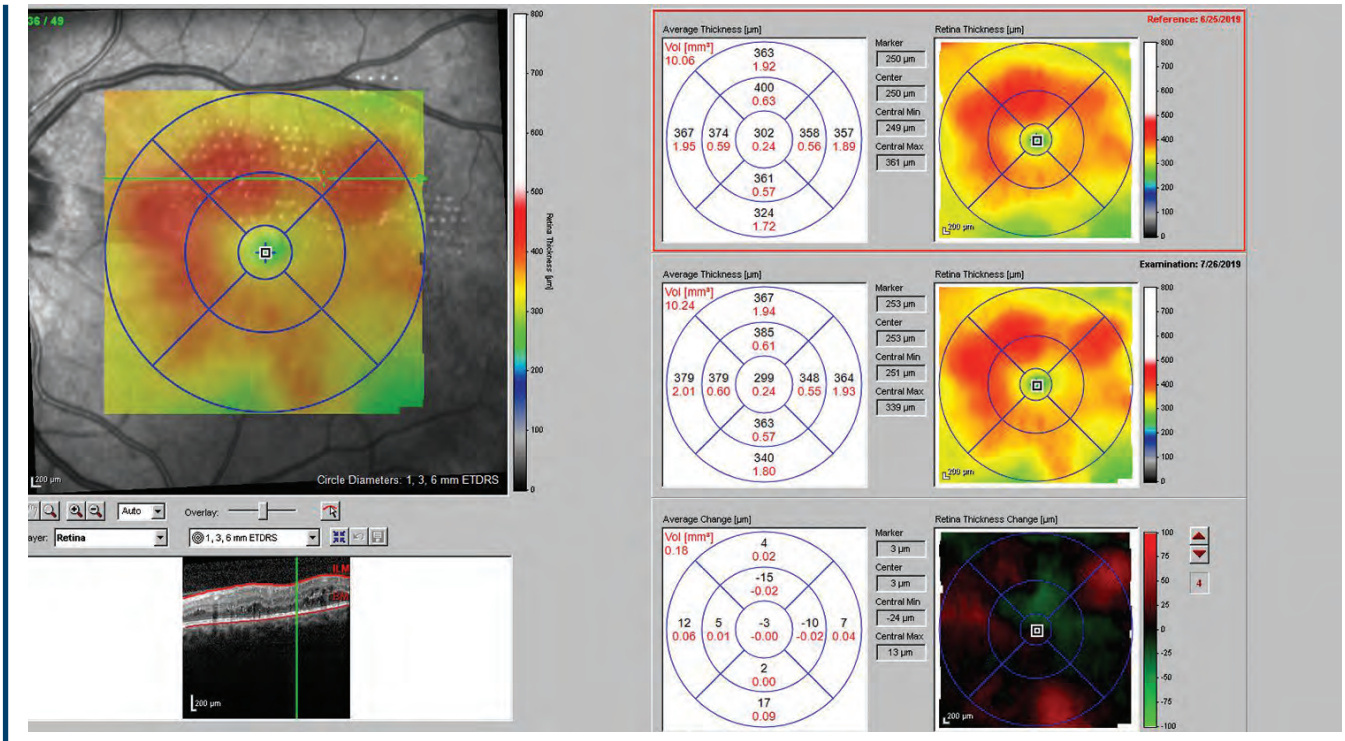

Figure 1. One month after subthreshold laser treatment in a diabetic patient with clinically significant macular edema, VA had improved from 20/30-2 to 20/25-2. Retinal thickness had decreased in areas treated with pattern subthreshold laser.

DME without sacrificing efficacy. This has been particularly true in patients who have non–center-involving DME.

SUBTHRESHOLD TECHNOLOGIES

The evolution of lasers for retina therapy has brought the field two subthreshold laser platforms: MicroPulse on the IQ 532 and IQ 577 lasers (Iridex) and Endpoint Management on the

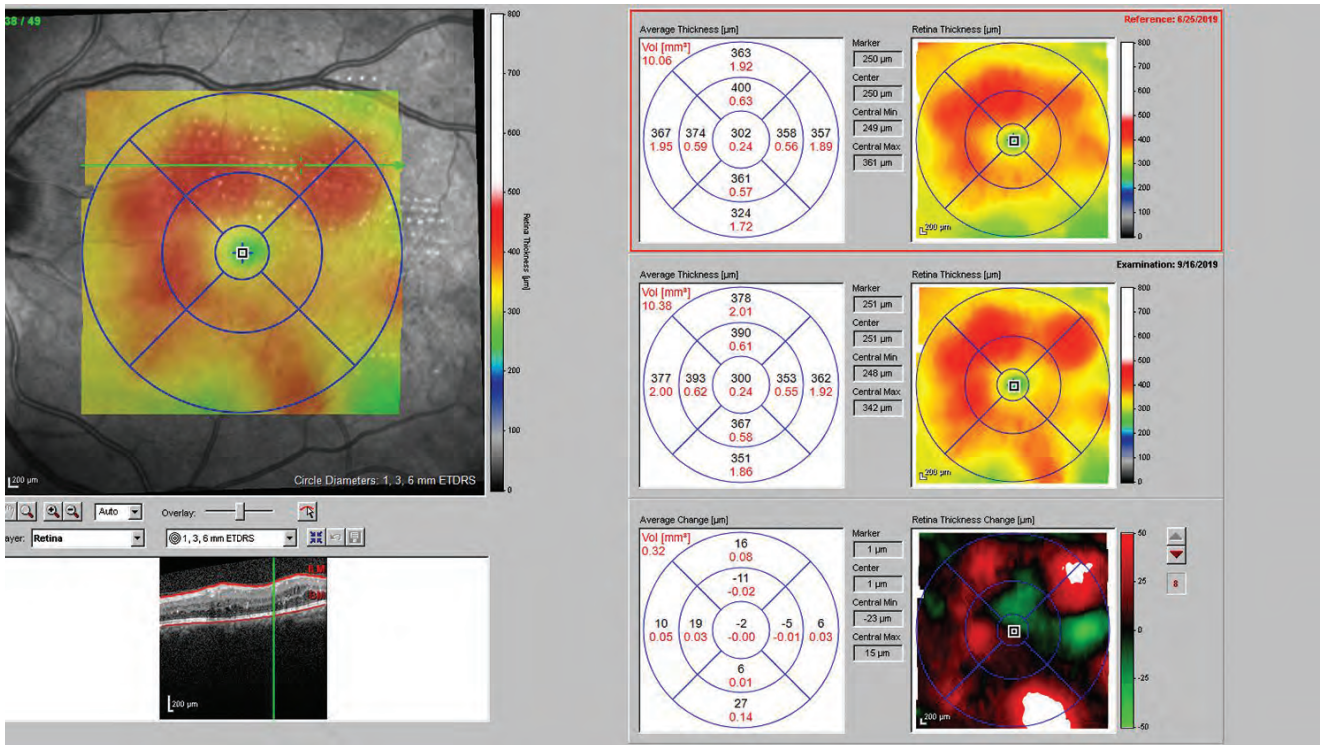

Figure 2. At 3 months, retinal thickening had decreased and the patient's VA had improved slightly, to 20/25.

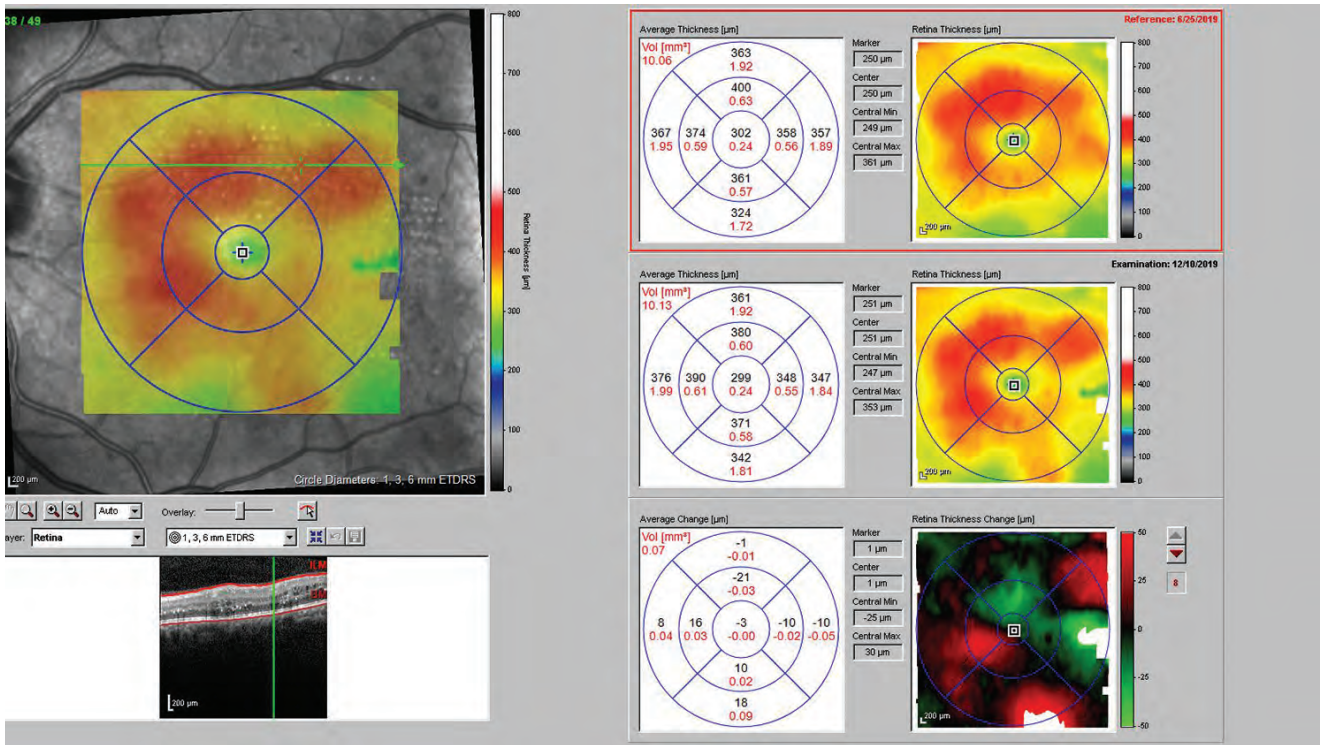

Figure 3. At 6 months, the patient's VA remained 20/25 and no recurring thickening was noted.

Pascal suite of lasers (Topcon). Subthreshold laser treatment has been shown to be effective in treating microaneurysms without causing permanent tissue damage.[1] SLT can also be reapplied in patients with recurring or new microaneurysms.

In my experience, a number of patients with DME who received SLT have not needed subsequent anti-VEGF injections or have reduced the burden of injections. I estimate that patients who require retreatment after SLT visit the office every 3 months.

When applying subthreshold laser with the Pascal platform, I test the laser intensity in an area outside the macula, usually nasal to the disc. If, after 10 seconds, there is no tissue blanching, I then initiate Endpoint Management, which reduces the laser's intensity by 50%. This allows the laser to treat microaneurysms without causing permanent tissue damage.

I target only microaneurysms found outside of the center, and I avoid application of subthreshold laser directly to the fovea. I do not target individual microaneurysms, but rather a region of microaneurysms with a pattern generated by the laser.

The patient is usually in the chair for about 5 minutes during a laser application session.

A RECENT CASE

A 48-year-old woman with an 8-year history of type 2 diabetes mellitus presented with clinically significant macular edema in her left eye. VA was 20/30-2. Juxtafoveal and perifoveal thickening was noted on examination, as were exudates and microaneurysms. Leakage was noted on fluorescein angiogram.

I treated the patient with subthreshold laser using the Endpoint Management system. At 1 month follow-up, the patient's VA had improved to 20/25-2 and retinal thickness had decreased in the treated areas (Figure 1). At her 3-month follow-up visit, the VA had improved to 20/25 and areas of resolution were noted in areas of thickening identified previously (Figure 2). At 6 months, VA remained 20/25 and no recurring thickening was seen (Figure 3).

DON'T RULE OUT LASER

For clinicians concerned that their working-age patients with DME may skip anti-VEGF therapy sessions due to treatment burden (or who are concerned about recent literature linking glaucoma development to frequent anti-VEGF injections for neovascular age-related macular degeneration[2]), I suggest considering SLT on the Iridex or Pascal platforms. ■

1. Scholz P, Altay L, Fauser S. A review of subthreshold micropulse laser for treatment of macular disorders. *Adv Ther*. 2017;34(7):1528-1555.
2. Wingard JB, Delzell DA, Houlihan NV, Lin J, Gieser JP. Incidence of glaucoma or ocular hypertension after repeated anti-vascular endothelial growth factor injections for macular degeneration. *Clin Ophthalmol*. 2019;13:2563-2572.

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■ Financial disclosure: None disclosed

(Continued from page 26)

the sutures are tied using a 3-1-1 or slipknot technique (Figure 6). The knots are trimmed and rotated into the sclerotomy using forceps.

The sclerotomy sites are closely inspected for leakage, and they may be closed with an 8-0 polyglactin suture if necessary, taking extraordinary care to avoid cutting the PTFE suture during the needle pass. After removal of any residual OVD, the clear corneal incision is closed with an interrupted 10-0 nylon suture and the conjunctival peritomies are closed.

CONCLUSION

There are multiple options for placing a secondary IOL in aphakia. In the appropriate clinical context, a scleral-fixated posterior chamber IOL with PTFE suture can offer a stable option with good refractive outcomes. ■

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OCT Angiography to Confirm Macular Hole Closure and Reduce Facedown Positioning

This noninvasive, high-speed imaging technique can improve macular hole closure visualization and minimize discomfort for patients.

BY MICHAEL C. RENFROE, BSA; GOWTHAM JONNA, MD; YONG REN, MMS; SARADHA CHEXAL, MD; AND CHIRAG D. JHAVERI, MD

Intraocular gas tamponade creates a gas-fluid interface in the eye, which complicates adequate visualization of the fundus with spectral-domain OCT. With lack of visual confirmation of macular hole (MH) closure, clinicians have perpetuated excessive facedown positioning (FDP) regimens that can be arduous and may even be contraindicated in some patients with comorbidities.

The standard duration of FDP has gradually decreased from as much as 1 month to as little as 3 days.[1-3] A pilot study demonstrated an 85% closure rate (28 of 33 eyes) with no FDP,[4] challenging its necessity altogether. Since then, multiple studies have confirmed comparable efficacy of strict FDP and no-FDP regimens in MH closure.[5,6] Although the evidence remains inconclusive on the impact of postoperative FDP on the outcome of MH surgery,[7] two randomized, controlled trials have suggested a benefit of FDP with higher closure rate in holes larger than 400 µm.[8,9]

OCT angiography (OCTA) can effectively capture images in gas-filled eyes, with clear visualization of the fovea and closure status of MHs at postoperative day 1. We sought to evaluate the effectiveness of OCTA in ascertaining MH closure at postoperative day 1 in an attempt to minimize cumbersome FDP regimens for patients.

STUDY

Seven patients (three phakic, four pseudophakic) with idiopathic, unilateral MHs stages 2 to 4 were treated by two physicians following the same surgical protocol. Surgery included pars plana vitrectomy, internal limiting membrane (ILM) staining and peeling, and gas tamponade.

The AngioVue OCTA imaging system (Optovue) was used to perform the following OCTA and OCT scan protocols preoperatively and postoperatively, contingent on sufficient view: OCTA (6.0 mm), 3D widefield volume OCT (12.0 x 9 mm), and retina cross-line

AT A GLANCE

- Positioning regimens after surgery for MH closure can be distressing, highly uncomfortable, and even harmful for patients with comorbidities.
- OCT angiography can be used to assess gas-filled eyes and closure status of MHs on postoperative day 1.
- Capturing a clear image of MH closure can facilitate decrease or discontinuation of positioning time for patients while maintaining surgical and visual outcomes.

(10.0 mm) scan. All scans were performed by two experienced retinal photographers with the patient in an upright position.

Patients were instructed to maintain FDP after surgery until their postoperative day 1 visit. If the MH was observed to be closed on OCTA, the patient was allowed to discontinue FDP but was instructed to avoid faceup positioning until clearance of the gas bubble.

OCTA adequately visualized hole closure status in six of the seven patients. Four patients had apparent total closure of the MH, and for them FDP was discontinued. Details for two of those patients are illustrated in Figures 1 and 2. The other two patients had adequate visualization of the fovea by OCTA, but only near-total closure was noted. They were instructed to continue FDP, typically for a total of 3 days. OCTA could not adequately document MH closure status in one patient.

Mean visual gain from preoperative to postoperative was 27 (±7) letters. Two patients underwent cataract surgery with IOL implantation after the MH surgery. Two patients had visually significant cataracts at their most recent follow-up.

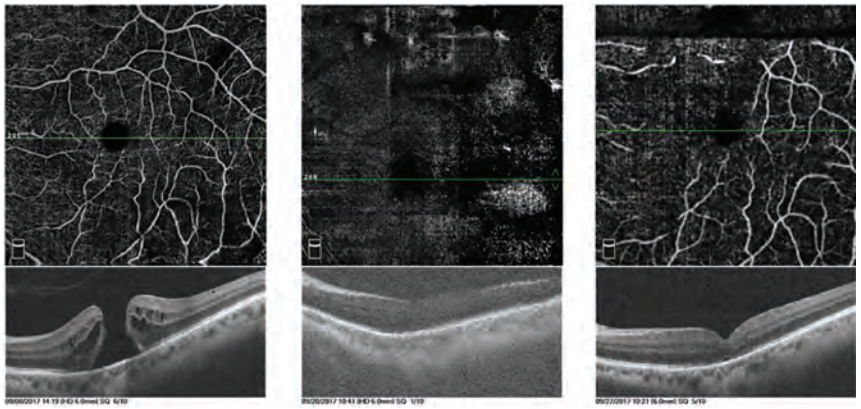

Figure 1. Superficial en face OCTA images of a 74-year-old pseudophakic woman before surgery (left column), at postoperative day 1 (middle column), and at postoperative week 1 (right column). The OCTA scan followed the course of the retinal vessels, localized the fovea, and obtained the best quality images with gas in place. Although resolution was limited in the postoperative day 1 image, MH closure was evident, and FDP was discontinued. BCVA improved from 20/200 before surgery to 20/40 at 6 months.

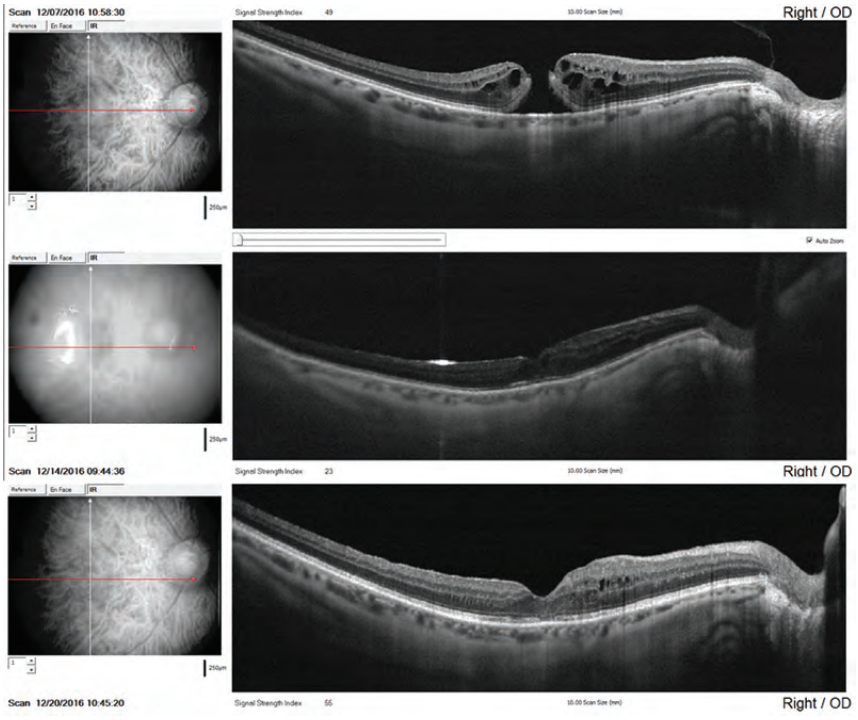

Figure 2. Infrared imaging combined with dense raster scans (including the optic nerve) was used to localize the fovea and confirm MH closure in a 70-year-old pseudophakic woman. The preoperative image (top row) illustrates a full-thickness MH with associated intraretinal cystoid changes. Using the optic disc as a reference, infrared imaging was used along with the OCT component of the OCTA platform to localize the fovea and demonstrate closure of the MH at postoperative day 1 (middle row) and postoperative week 1 (bottom row). BCVA improved from 20/100 before surgery to 20/25 at a postoperative visit 21.5 months later.

DISCUSSION

Until 1996, strict postoperative FDP was thought to be critical for successful MH closure. Long periods of FDP are uncomfortable, may be painful in those with cervical and lumbar pathology, and can deter patients from opting for surgery altogether. Furthermore, FDP has been linked to ulnar neuropathy,[10] decubitus ulcers,[11] and, rarely, venous thrombotic/thromboembolic disease.[12,13]

Given the numerous potential variables—including MH size, chronicity of MH, and surgeon-to-surgeon variability—the practice patterns for MH surgery significantly vary.[14] Despite reports of positive outcomes without strict FDP, 87% of US respondents to a 2018 American Society of Retina Specialists survey reported that they recommend postoperative FDP for patients.[15]

Fourier-domain OCT has been used to discern MH closure as early as 24 hours after surgery, providing guidance to the surgeon regarding FDP duration.[16-19] Microvascular features

and the potential for postoperative recovery due to neuronal and vascular plasticity have been elucidated using OCTA.[20-23] However, to the best of our knowledge, this is the first report of using features specific to OCTA to discern MH status in gas-filled eyes in the immediate postoperative period.

In our study, OCTA successfully visualized the fovea in six of the seven patients in our cohort (86%) on postoperative day 1. There was a 100% MH closure rate at postoperative week 1, despite discontinuation of FDP in four (57%) patients who had complete hole closure noted on postoperative day 1.

OCTA offers superior axial resolution (5 µm) and scanning speed (70,000 A-scans per second) compared to previous spectral-domain OCT technologies. Visualization of the fovea is more accurate because the vessels can be easily identified using the angiography portion of the OCTA scans.

For our study, at the day 1 postoperative visit the automatic follow-up option of the OptoVue device was disabled because the infrared view was significantly different compared with the preoperative scans and the software would not allow automatic registration. The infrared view was used to visualize the macula, and then the retinal vessels and optic nerve were used to assist in locating the fovea. To successfully acquire the best available OCTA image quality and position, the automatic adjustment function (a combination of auto Z, auto F, and auto P) was performed twice, followed by manual adjustment of the focus and scan position by the photographer. The 3D widefield volume OCT and cross-line scans were also obtained following these specified adjustments.

Image quality was found to be better in pseudophakic patients than in phakic patients overall. The presence of cataract may have prevented adequate visualization of the fundus in one patient.

CONCLUSION

With its superior axial resolution and high scanning speed, OCTA may assist in confirming MH closure status in gas-filled eyes in the immediate postoperative period. Visual confirmation of MH closure on OCTA may be used as evidence to discontinue or reduce patients' FDP regimens after MH surgery. Ultimately, this improves the patient experience and reduces morbidity while maintaining good surgical and visual outcomes. ■

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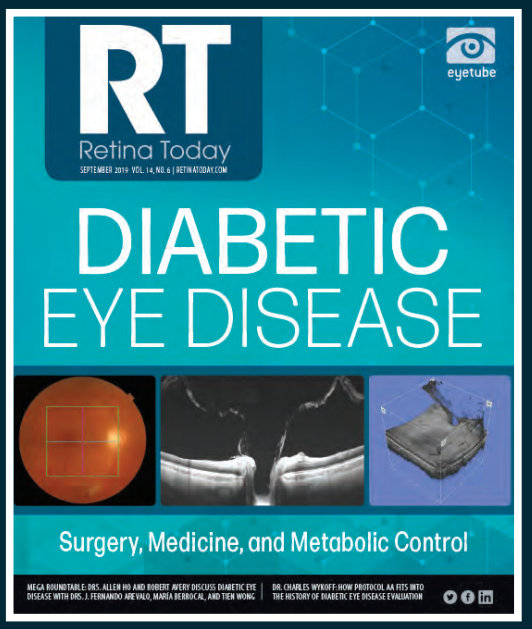

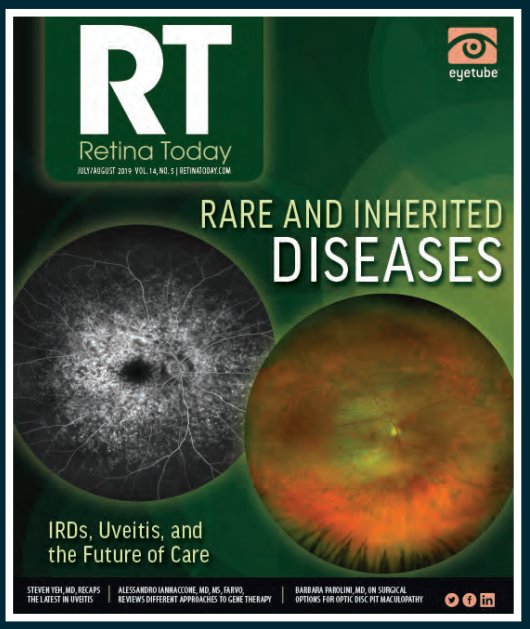

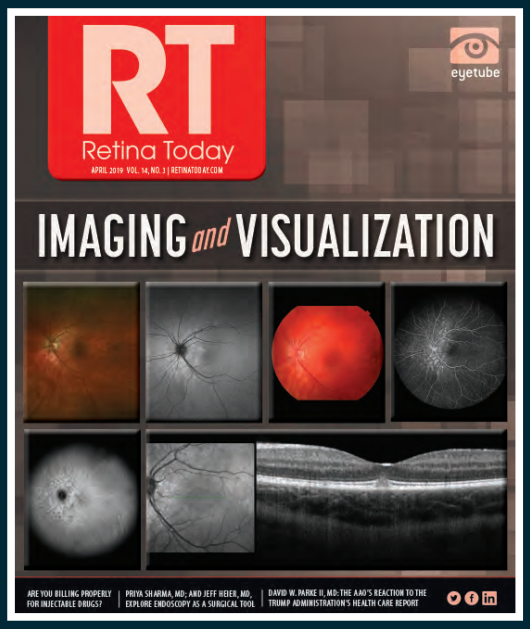

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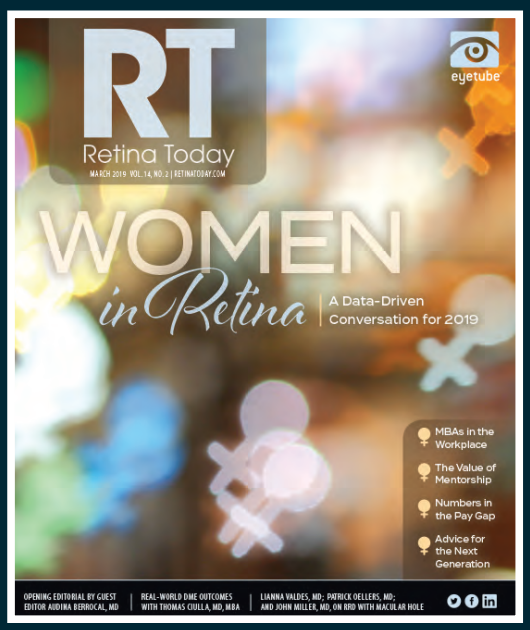

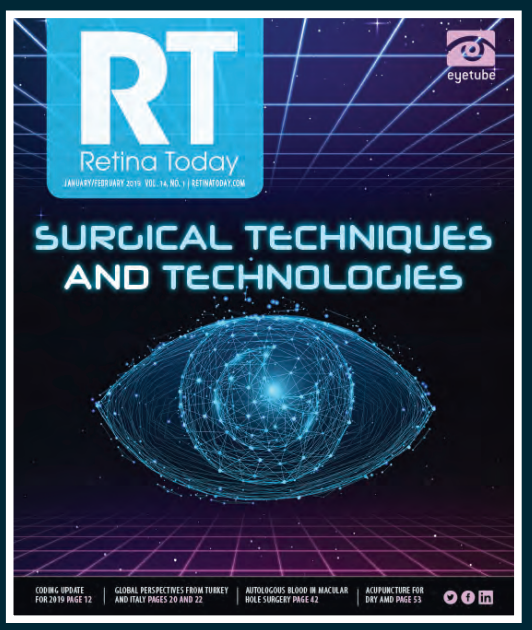

Avoiding Iatrogenic Injury During IOL Removal

A pearl for this not uncommon occurrence could reduce the risk of patient injury.

BY JOHN W. KITCHENS, MD

Secondary surgical removal of a dropped IOL from the posterior segment carries a risk of iatrogenic injury, and plate-haptic IOLs in particular elevate this risk. The silicone material of these IOLs makes them difficult to grasp, and forceps must come very close to the retinal tissue to grasp the IOL during removal, risking a retinal injury or tear. In addition, this technique allows wide-angle viewing to be used for the entire case, as opposed to switching from a high-magnification contact lens when grasping the IOL on the surface of the retina to a wide-angle lens when removing it from the eye. Over the years, I have found this technique to be particularly useful for safely and effectively removing these lenses from the posterior segment.

I start with 25-gauge chandelier lighting (Alcon) and perform a full vitrectomy, ensuring that a posterior vitreous detachment has occurred. Then, with a 25-gauge soft-tip aspiration cannula (Alcon), I use suction to engage the IOL on the optic surface. With suction applied and a vacuum created, I lift the IOL to the middle of the vitreous cavity (Figure 1). With the IOL safely away from the retina, I can then use either 20-gauge reusable IOL forceps or 25-gauge MaxGrip Forceps (Alcon) to grasp the IOL in my other hand and to maneuver it into the anterior chamber (Figure 2).

I do not cut the lens during this procedure, but rather remove the IOL from the eye intact. This requires creating a large incision (Figure 3), which some surgeons wish to avoid. However, because I usually implant a replacement IOL that requires a large incision such as an anterior chamber IOL or a large rigid PMMA IOL such as the CZ70BD (Alcon), the large incision is needed to insert the new IOL.

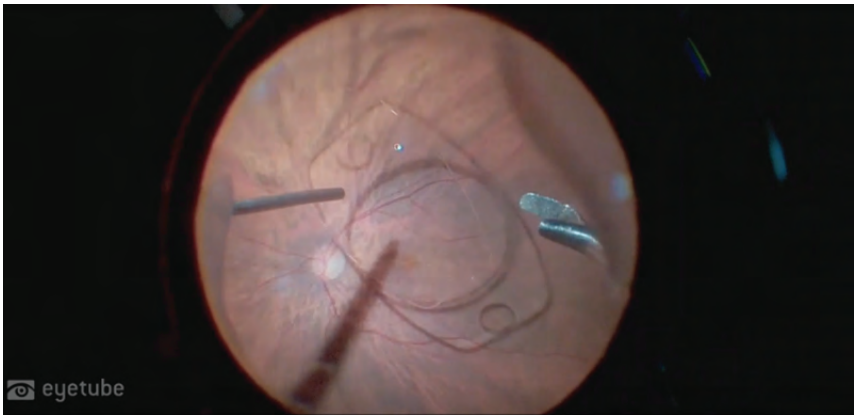

Figure 1. A soft-tip cannula can be used to grasp a plate-haptic IOL that has fallen into the posterior segment.

I prefer larger lenses in most of my cases due to familiarity with the procedure, stability of these larger and rigid IOLs, and the age and corneal status of the patients. Plate haptics can easily be cut or folded and removed from smaller incisions should surgeons prefer to go that route.

AT A GLANCE

- Use of a soft-tip cannula and chandelier lighting during removal of a fallen plate-haptic IOL may reduce the risk of creating a posterior break during surgery.
- Removing the IOL intact requires a large incision that can accommodate insertion of a large IOL.
- Presenting this case to a panel of experts allowed the author to tease out details of the technique.

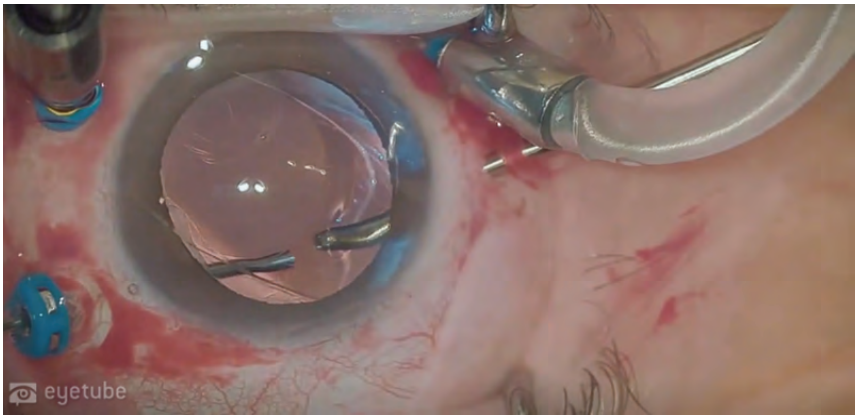

Figure 2. After the IOL is lifted from the surface of the retina with a soft-tip cannula, it is brought to the middle of the vitreous cavity, where it can be more safely maneuvered.

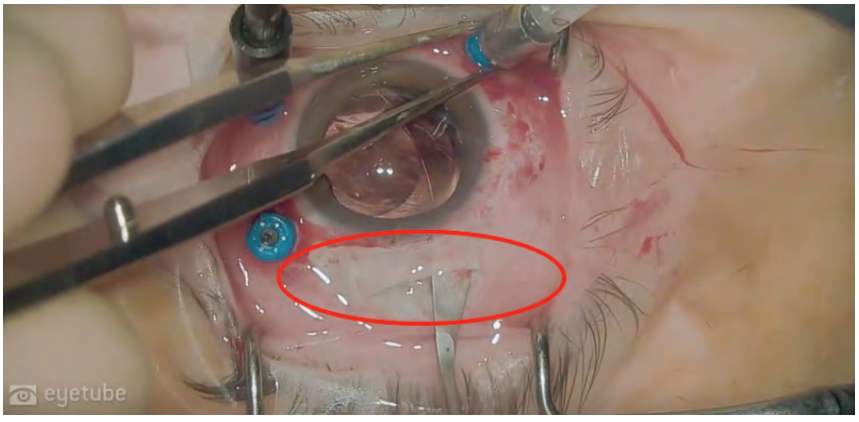

Figure 3. The large incision (red circle) used to remove the intact plate-haptic IOL accommodates insertion of an anterior chamber IOL or a rigid PMMA lens.

Figure 4. The panel of surgeons who reviewed this video at the Alcon Film Festival included Donald J. D'Amico, MD; María H. Berrocal, MD; and Timothy G. Murray, MD, MBA. The author is seated on the right side of the stage.

EXPERT PANEL COMMENTS

When I presented this procedure at the Alcon Retina Film Festival, a panel of surgical experts weighed in (Figure 4).

Donald J. D'Amico, MD, inquired about the risk of damaging the retina by dropping the IOL after grasping it with the soft-tip cannula. This does occur, in which case it is necessary to regrasp the IOL and try again. The light pipe or another instrument can be used to help manipulate the IOL when lifting it into the anterior chamber. But in my experience, dropping the IOL in this situation does not present much risk to the patient. I have not seen iatrogenic injury secondary to a dropped IOL during secondary surgery.

RETINA TODAY ON THE ROAD

This article is adapted from a lecture the author presented at the Alcon Retina Film Festival during the AAO Annual Meeting. To watch Dr. Kitchens's video presentation, visit bit.ly/Kitchens0120.

María H. Berrocal, MD, agreed with my assessment that plate-haptic IOLs are difficult to cut because the material is hard and the lens is slippery. She noted that she cuts flexible acrylic IOLs when she removes them.

Timothy G. Murray, MD, MBA, agreed that creating a large incision is appropriate for extraction if another large lens will have to pass through the wound. He said that, rather than cutting an acrylic IOL before removal, he folds the lens and removes it through a small incision. He noted that he does so only in cases in which he will then implant a foldable acrylic lens through the same incision.

AVOIDING RISK, NOT SLOWING DOWN SURGERY

Reducing the risk of iatrogenic injury is paramount during secondary surgery to remove a dropped IOL. However, we must also prioritize efficiency and efficacy. Use of the soft-tip cannula, in my hands, is safer and more efficient than using forceps to directly grab the IOL off the surface of the retina, and it has no observed effect on the final efficacy of the intervention. The technique described here may be appropriate for cases in which the surgeon wishes to reduce the risk of iatrogenic injury during IOL retrieval and replacement. ■

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An Elusive Macular Hole Closed by Eye Drops Alone


Although no major studies have analyzed this phenomenon, anecdotal evidence can be instructive.

BY MADELEINE WEBB, BA, BS; AND BRIAN C. JOONDEPH, MD, MPS

A 64-year-old man presented with a 1-month history of blurred vision in his right eye (OD). His medical and ocular histories were unremarkable. On exam of his right eye and left eye (OS), VA was 20/40 and 20/20, respectively. Borderline high IOPs, mild nuclear sclerosis, and otherwise normal anterior segments were noted.

His fundus exam revealed macular edema OD; it was normal OS. Spectralis OCT (Heidelberg Engineering) high-speed 25-raster macular scans through, above, and below the fovea OD revealed macular edema and subretinal fluid (Figure 1). As the appearance was suggestive of a macular hole (MH), a high-density OCT scan was performed, revealing a small MH missed during the standard OCT scan (Figure 2).

THERAPY AND RESULT

Given the small size of the MH and presence of edema at its edges, medical treatment with a topical NSAID was offered as an alternative to surgery.

The patient was prescribed ketorolac eye drops 0.5% three times a day OD. After 6 weeks, the MH closed and a small pocket of subfoveal fluid persisted, but no macular edema was noted. The patient's visual acuity and symptoms had not changed (Figure 3).

Over the next 4 months, the drops were gradually tapered. At the patient's last visit, at which point he was using ketorolac once daily, the MH remained closed with reduced subfoveal fluid and unchanged visual acuity or symptoms (Figure 4).

AT A GLANCE

- Small MHs detected on high-density OCT scans might be missed on standard OCT scans.
- A course of NSAID drops may be a nonsurgical option for patients who present with small MHs.

COMMENTARY

MHs are believed to form due to tractional forces at the vitreoretinal interface. In 2003, Tornambe proposed a

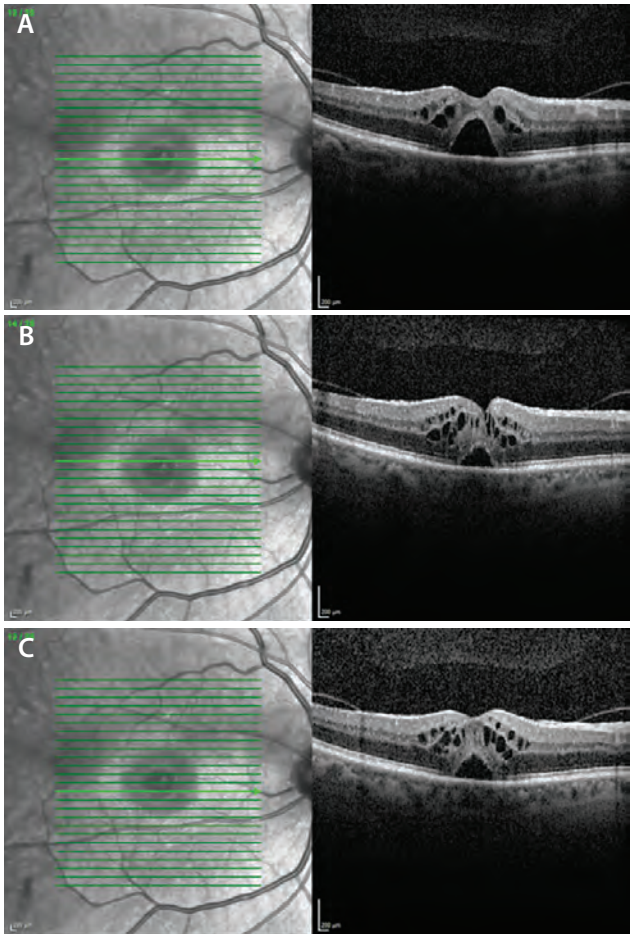

Figure 1. Standard OCT scan through the fovea (A), above it (B), and below it (C).

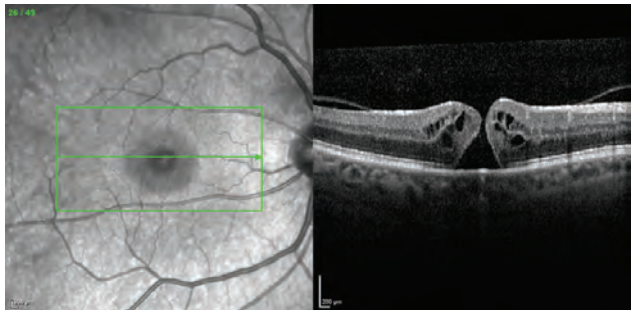

Figure 2. High-density OCT scan through the fovea demonstrating a small MH.

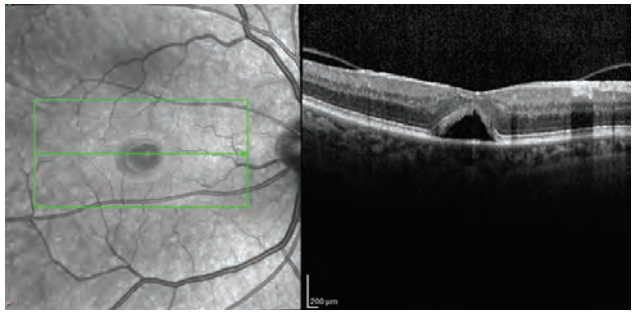

Figure 3. High-density OCT scan through the fovea 6 weeks after starting NSAID treatment showing a closed MH with subfoveal fluid pocket.

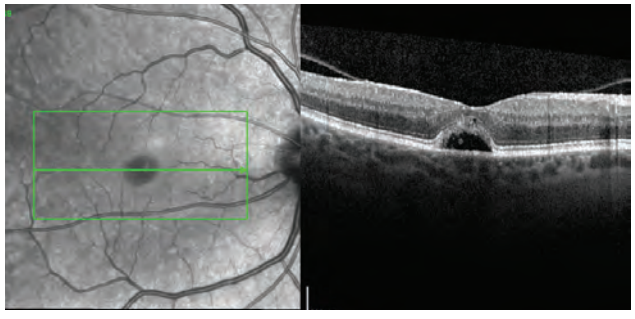

Figure 4. High-density OCT scan through the fovea 4 months after starting treatment showing a closed MH with a slightly smaller subfoveal fluid pocket.

hydration theory of MH formation,[1] whereby posterior hyaloid traction creates a small inner foveal retinal defect which then absorbs vitreous cavity fluid, causing retinal swelling around the defect. As the inner retina swells, it retracts anteriorly, widening the hole.

This theory suggests that reversing the hydration process may lead to hole closure. Surgery with internal limiting membrane peeling and gas bubble tamponade accomplishes this with a high degree of success.

It stands to reason that, if the retinal hydration can be reduced medically, the MH should close without surgery, which it did in the case presented here. The hole closed, and likely over time the subfoveal fluid pocket will reabsorb. In an analysis of OCT findings in surgically closed MHs in the PIONEER study, subfoveal fluid was present in 49% of eyes at 1 month after surgery, decreasing to 37% at 6 months.[2]

IT STANDS TO REASON THAT, IF THE RETINAL HYDRATION CAN BE REDUCED MEDICALLY, THE MACULAR HOLE SHOULD CLOSE WITHOUT SURGERY.

In the case presented here, the subfoveal fluid was improving at the patient's most recent visit, similar to what is seen in surgically closed MHs, but it may take a year or longer to fully resolve.

Our choice of ketorolac was based on insurance formulary coverage and the cost to the patient. Any of the available NSAID drops would be suitable for a similar patient.

LESSONS TO LEARN

Although prospective randomized clinical trials are the gold standard for validating treatments, new treatment modalities can be introduced to the retina community based on anecdotal experience shared with others.

Two lessons can be drawn from this case. First, standard OCT scans can miss a small MH. If there is a high degree of clinical suspicion that an MH is present based on other clinical features, a high-density scan through the fovea may reveal the hole.

Second, for small MHs with some degree of retinal edema, a trial of NSAID drops is a reasonable initial treatment option, avoiding the potential adverse effects and patient inconvenience of surgical treatment without compromising future surgical treatment if needed. ■

1. Tornambe PE. Macular hole genesis: the hydration theory. *Retina*. 2003;23(3):421-424.
2. Ehlers JP, Han J, Petkovsek D, Kaiser PK, Singh RP, Srivastava SK. Membrane peeling-induced retinal alterations on intraoperative OCT in vitreomacular interface disorders from the PIONEER study. *Invest Ophthalmol Vis Sci*. 2015;56(12):7324-7330.

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The Beauty of a Dual-Blade Vitrectomy Probe

A new probe makes a big leap.

BY PETER A. KARTH, MD, MBA

MY FAVORITE INSTRUMENT

We are called *vitreoretinal surgeons*, but, for the most part, we are *vitreous* surgeons. Membrane peels are an important part of our skill set, but I would venture to say that most of our surgical time is spent dealing with vitreous. Even straightforward surgery for an epiretinal membrane may take an unwanted turn if a retinal tear occurs, which is nearly always caused by vitreoretinal traction.

Retinal detachment surgery, too, is all about the vitreous. The vitrectomy cutting probe is front and center during this important task. We have seen huge improvements in vitrectomy probe cut speed and gauge size in the past decade. To me, the biggest leap in development has arrived in the form of the HyperVit Dual Blade Vitrectomy Probe (Alcon), which has quickly become my favorite instrument for vitreoretinal surgery (Figure).

USER EXPERIENCE

In my experience, this probe has dramatically reduced vitreous movement (due to constant vitreous flow) and nearly eliminated retropulsion. These innovations have led to a decrease in vitreous turbulence, which reduces vitreous traction on the retina.

SINGLE-BLADE SYSTEMS

In a single-blade system, turbulent retropulsion occurs each time the port is closed. When the port is open, vitreous is aspirated into the port; when the port closes, there is turbulent retropulsion and vitreous recoil, which turns vitreous strands into whips and transfers kinetic energy back to the retina. We see this most clearly when performing peripheral vitreous shaves on detached retinas, scenarios in which we often see iatrogenic retinal breaks (secondary to retropulsion and vitreous recoil).

DUAL-BLADE SYSTEMS

Vitrectomy probes that are always open allow continuous and constant flow, free from retropulsion. Fluid and vitreous are constantly aspirated into the port, allowing smooth aspiration without turbulence and traction on the retina. This allows me to move the probe directly onto the detached retina without the fear of creating a break. I no longer see turbulent vitreous whipping. This has led to fewer iatrogenic breaks, even in surgical cases involving the macula.

With this higher flow, a dual-blade port allows me to quickly remove vitreous, and the 27-gauge port practically eliminates any wound leak. Overall, I believe the 27-gauge HyperVit Dual Blade Vitrectomy Probe represents a huge leap forward from the 25-gauge systems I previously used, and even the 27-gauge 10,000 cpm system. ■

Figure. The dual-blade design of this probe allows constant vitreous aspiration, reducing retropulsion and vitreous recoil during vitrectomy.

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AT A GLANCE

- An important difference between single-blade and dual-blade vitrectomy probes is the rate and constancy of vitreous flow during vitrectomy.
- A dual-blade system facilitates safer, more efficient removal of vitreous due to a design that constantly keeps the port open, allowing constant even flow.

Bi-Blade Cutter Provides Fast Speeds, Improved Fluidics

The 100% duty cycle allows constant aspiration with a consistent flow rate.

BY RAHUL K. REDDY, MD, MHS

MY FAVORITE INSTRUMENT

Over the past decade we have seen unprecedented advances in the field of surgical retina. The surgical landscape continues to expand and evolve, with emphasis placed on outcomes, efficiency, and cost. As we strive to provide the best possible care for our patients, surgeons have a variety of options with regard to surgical platforms and vitreous cutters. However, we face challenges including increasing costs of instrumentation and decreasing reimbursements.

In this economic environment, it is vital for surgeons to determine the optimal vitrectomy platform to suit their purposes. The ideal system is a platform that maximizes fluidics while exerting minimal retinal traction. With the introduction of dual cutting, modern surgical platforms have maximized the speed with which central vitreous can be removed, and we are reaching the ceiling with current pneumatic cutter designs.

I am a surgical retina specialist in Phoenix in a large academic private practice with two fellows, nine providers, and 13 locations. With a busy surgical practice operating out of ambulatory surgery centers, our vitreous cutter must be chosen to facilitate efficiency and excellent outcomes. The dual-port Bi-Blade vitreous cutter of the Stellaris Elite Vision Enhancement System (Bausch + Lomb) enables us to achieve a high degree of efficiency in the OR (Figure).

The dual-port Bi-Blade cutter is available in 23-, 25-, and 27-gauge platforms. The efficiency of the cutter is based on a double-cut mechanism, with a completely open port and 100% duty cycle. The cutter achieves speeds of 15,000 cuts per minute. Its design allows constant aspiration with a consistent flow rate, resulting in efficient vitreous removal.

Because of the importance of efficiency in central vitreous removal, perhaps the greatest advantage of the Bi-Blade cutter is the fluidic predictability that surrounds the cutter port. This predictability gives the surgeon an intuitive ease of movement within the vitreous and promotes a high level of confidence as the cutter port can shave near the surface of retina to perform a variety of maneuvers. With the superior fluidics of the system, delicate maneuvers can be accomplished with minimal retinal traction.

I have noted minimal turbulence at the tip of this cutter probe as compared with other platforms. In particular, I can more efficiently and safely perform segmentation and delamination of diabetic membranes as well as removal of peripheral vitreous on mobile retina. I particularly like to use the system's *shave* mode to address thick preretinal bands, facilitating access to dissection planes.

Figure. A close-up shot of the dual-port Bi-Blade cutter (Bausch + Lomb).

I cannot overemphasize the benefit of the predictability of this cutter probe and the surrounding flow, providing the surgeon with a high degree of control. The Bi-Blade vitreous cutter has become integral in my OR, as it enables me to maintain quality, improve efficiency, and minimize risk of complications. ■

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- Financial disclosure: Consultant (Bausch + Lomb)

AT A GLANCE

- The Bi-Blade cutter on the Bausch + Lomb Stellaris achieves high cutting speeds and optimized fluidics.
- Maneuvers close to the retina can be accomplished safely and with confidence.

WIDEFIELD MULTIMODAL IMAGING

Documenting the periphery is vital in many retinal pathologies.

BY MANISH NAGPAL, MS, DO, FRCS(EDIN); GAYATHRI MOHAN, MS; AKSHAR SONI, MS; SHAM TALATI, DO; AND NAVNEET MEHROTRA, DNB, MNAMS

The peripheral retina is commonly involved in retinal pathologies such as diabetic retinopathy, vein occlusions, retinal detachments, and uveitis. Ultra-widefield imaging is becoming an essential part of retinal assessment, as it facilitates screening and documentation of the retinal periphery.[1] Devices that perform widefield imaging can capture images in a number of modalities, including color photography, fluorescein angiography (FA), ICG angiography (ICGA), and OCT. Our experience with one such device, the scanning laser ophthalmoscope (SLO) Mirante (Nidek), is detailed in this article.

FOUR LASERS, ONE DEVICE

The SLO-based Mirante provides multiple imaging modalities in one device: high-definition OCT and confocal SLO (cSLO), both with widefield capabilities; OCT angiography (OCTA); fundus photography, FA and ICGA; green and blue fundus autofluorescence; and retro modes. An optional advanced widefield (163° measured from the center of the eye) lens attachment is available for this device.

According to Nidek, the Mirante is the only device that includes four separate lasers, each of which penetrates to different depths: blue (480 nm, which is reflected by the nerve fiber layer), green (532 nm, reflected by the ganglion cell layer), red (670 nm, penetrates through the retina), and infrared (790 nm, penetrates through the choroidal layer). Each of the lasers can scan the retina through a confocal optical setup with a small coaxially placed pinhole that lets in only light coming from the focal planes, while blocking backscattered and out-of-focus light. The multiple lasers allow the Mirante to reproduce pseudocolor images that almost mimic the natural colors of the fundus.

The Mirante's spectral-domain OCT (SD-OCT) captures 85,000 A-scans per second. It can obtain macula maps that include a 16.5-mm by 12-mm area, facilitating detailed assessment of a wide field from the vitreous to the choroid in a single shot. This is a wider OCT imaging field than is possible on other devices at 16.5 mm.

The capabilities of the Mirante make it useful in a number of scenarios. Here we present case examples in which we used one or more modalities for widefield imaging on the device.

CASE No. 1. SILICONE OIL-FILLED BUCKLED EYE

A 36-year-old man presented for routine postoperative follow-up 3 months after pars plana vitrectomy with scleral buckle for a total retinal detachment. He had undergone encirclage with 25-gauge pars plana vitrectomy and silicone oil injection in the left eye (OS). His BCVA was 6/18 OS. Widefield fundus color photo montage showed a 360° buckle effect and a silicone oil reflex. The retina was well settled. Laser marks around the retinotomy site can be seen at 10 o'clock (Figure 1).

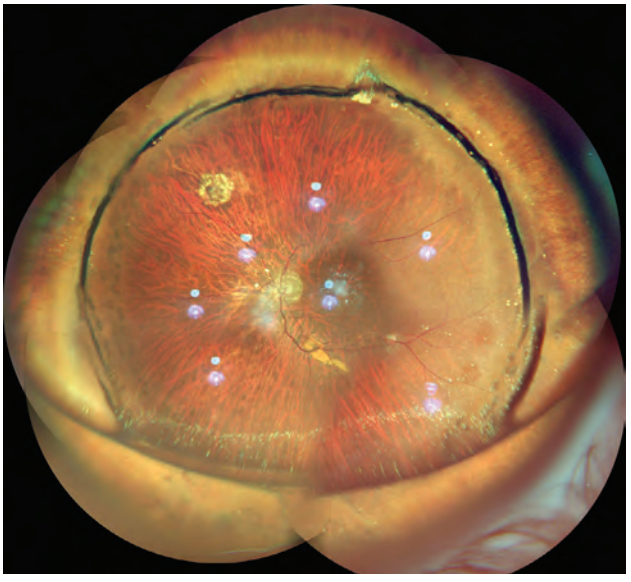

Figure 1. Widefield color fundus photo montage OS of a buckled eye with silicone oil reflex. The retina is well settled, and laser marks can be seen nasally.

AT A GLANCE

- The peripheral retina is usually involved in numerous frequent retinal pathologies.
- Ultra-widefield imaging facilitates screening and documentation of the retinal periphery.
- The Mirante SLO uses four lasers to capture images in a variety of modalities.

CASE No. 2. REDETACHMENT IN A BUCKLED EYE

A 24-year-old man presented with decreased visual acuity OS that had persisted for 1.5 years. His ocular history included scleral buckling performed 2 years ago. Widefield fundus color photo montage showed a subtotal retinal redetachment involving the macula OS in a buckled eye with only the superonasal portion attached (Figure 2).

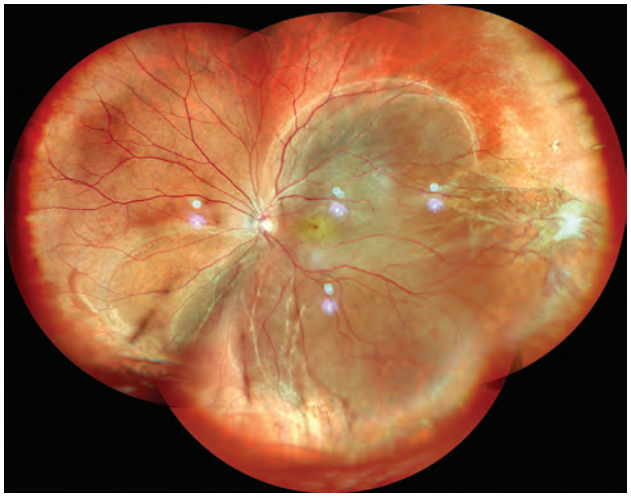

Figure 2. Widefield color fundus photo montage OS shows a subtotal retinal redetachment with superonasal portion attached.

CASE No. 3. LASERED RETINOBLASTOMA

A 13-year-old girl presented for a routine follow-up. She had undergone chemotherapy plus laser ablation and cryotherapy for retinoblastoma 10 years ago. Widefield color fundus montage OS showed sclerosed vessels extending nasally from the disc (Figure 3). An elevated mass was seen in the nasal periphery with laser and cryo marks. The rest of the retina was normal with a good foveal reflex. No new lesions were seen.

CASE No. 4. LASERED HORSESHOE TEAR

A 46-year-old man presented for a routine follow-up. BCVA in the right eye (OD) was 6/6. The patient was myopic and had used correction since childhood. He had undergone prophylactic laser barrage OD 5 years ago. Widefield fundus photograph showed a myopic fundus with tessellated background (Figure 4). A large disc with peripapillary atrophy was noted, along with pigmentary alterations at the macula. A well-barraged horseshoe tear can be seen at 2:30 o'clock.

Figure 3. Widefield color fundus photo montage OS shows an elevated retinoblastoma lesion nasally with cryo and laser marks. Sclerosed vessels are seen extending from the disc to the lesion nasally.

Figure 4. Widefield color fundus photo OD shows a myopic fundus with tessellated background. A well-lasered horseshoe tear can be seen at 2:30 o'clock.

CASE No. 5. CENTRAL RETINAL VEIN OCCLUSION

A 52-year-old man with hypertension presented with decreased vision OD lasting 2 months. His BCVA was 6/12

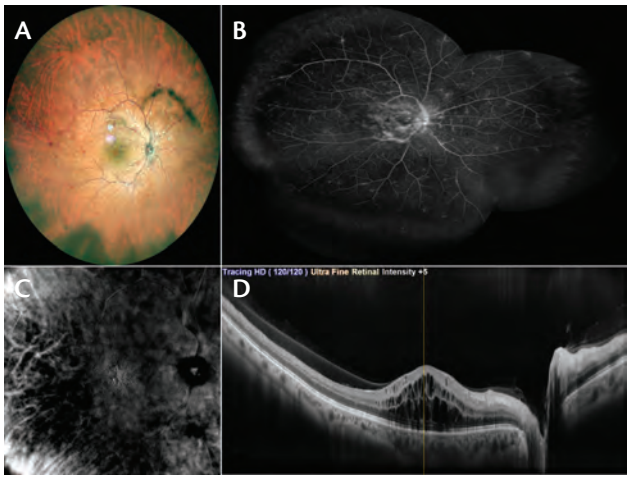

Figure 5. Fundus photo shows multiple hemorrhages, cotton wool spots with macular edema (A). FA widefield montage shows multiple hyperfluorescent dots with diffuse leakage at the macula (B). Retro mode infrared illumination shows multiple tiny elevations at the macula suggestive of edema (C). SD-OCT shows an altered foveal contour with cystoid spaces (D).

with early cataractous changes. Fundus examination revealed multiple hemorrhages in all quadrants and cotton wool spots with macular edema (Figure 5A). FA widefield montage showed multiple hyperfluorescent dots with diffuse leakage at the macula (Figure 5B). Retro mode infrared illumination showed petaloid elevation at the macula suggestive of edema (Figure 5C). A 16-mm horizontal line scan on SD-OCT showed an altered foveal contour with cystoid spaces (Figure 5D).

CASE No. 6. LASERED DIABETIC RETINOPATHY

A 52-year-old man with diabetes presented with decreased visual acuity OS lasting 6 months. BCVA OS was 6/24. A 163° widefield fundus image showed a few hemorrhages in the posterior pole and 360° laser marks (Figure 6A). Widefield FA revealed an altered foveal avascular zone (FAZ) and 360° staining from laser marks (Figure 6B).

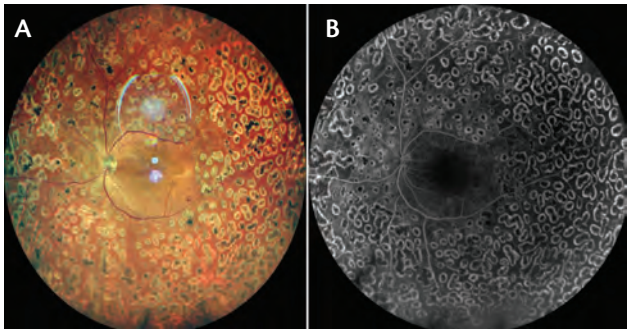

Figure 6. Fundus photo shows multiple hemorrhages along the posterior pole and superior arcade with 360° laser marks (A). Widefield FA shows altered FAZ and 360° laser staining marks (B).

CASE No. 7. MULTIFOCAL CHOROIDITIS

A 60-year-old hypertensive woman presented with complaints of floaters and decreased vision OS for the past 10 days. Her BCVA OS was 6/12. Fundus examination revealed disc edema with vitritis and scattered multiple hypopigmented subretinal lesions (Figure 7A). On widefield ICGA, multiple hypofluorescent lesions in the posterior pole corresponded to the clinical picture (Figure 7B). These spots remained hypofluorescent thorough the mid and late phases (Figure 7C, D), indicating active lesions.

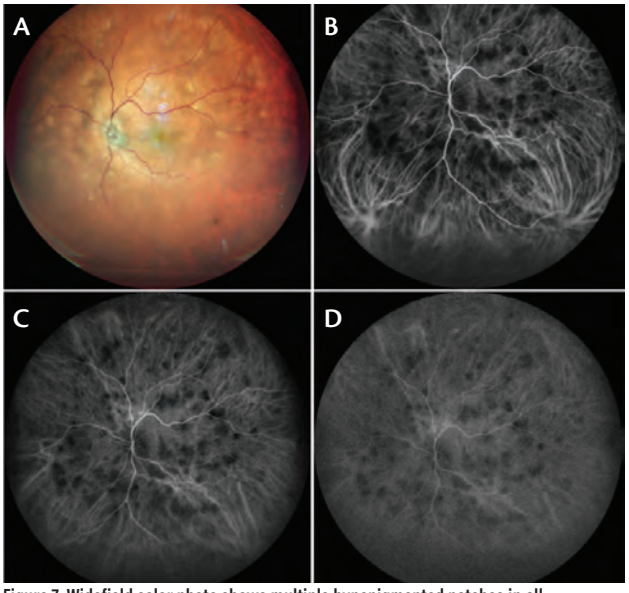

Figure 7. Widefield color photo shows multiple hypopigmented patches in all quadrants with vitritis and disc edema (A). Widefield ICGA in early phase shows multiple hypofluorescent lesions in all quadrants, suggestive of choroiditis (B). Hypofluorescence remained in mid (C) and late phase (D) ICGA, suggesting that the lesions were active.

CASE No. 8: VOGT-KOYANAGI-HARADA DISEASE

A 32-year-old man had decreased vision in both eyes for the past 7 days. His BCVA was 6/36 in both eyes. Fundus examination showed vitritis OD and disc edema with subretinal fluid pockets in all quadrants (Figure 8A). Widefield FA montage revealed an altered FAZ with a hot disc along with

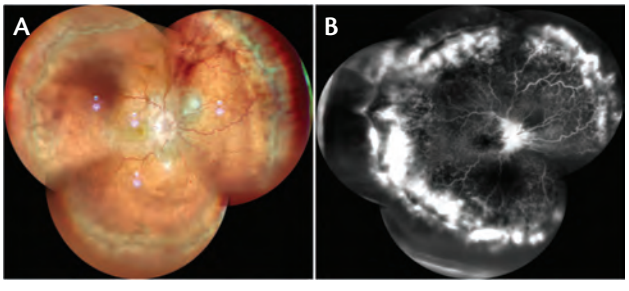

Figure 8. Widefield color photo montage OD shows vitritis and disc edema with subretinal fluid pockets in all quadrants (A). Widefield FA montage reveals altered FAZ with multifocal areas of pinpoint leakage, with leakage over disc with extensive peripheral leakage visible in late phase (B).

extensive peripheral leakage visible in late phase. Multifocal areas of pinpoint leakage are seen (Figure 8B).

Peripheral leakage is a finding often missed during routine imaging when treating patients with Vogt-Koyanagi-Harada disease. It can be used to measure treatment success and may inform the decision to taper a patient off of steroids.

CONCLUSION

Ultra-widefield imaging helps us to document peripheral pathologies such as horseshoe tears and lattice degenerations as well as tumors such as retinoblastoma. In cases with vascular involvement (eg, diabetic retinopathy and retinal vein occlusions), ultra-widefield imaging helps capture areas of neovascularization and capillary dropout in the extreme periphery. Often, these observations would have been missed during routine imaging of central fields.

In multifocal choroiditis, lesions in the periphery are better picked up on ultra-widefield imaging. This imaging also aids in monitoring disease activity and progression. In Vogt-Koyanagi-Harada disease, ultra-widefield imaging helps identify areas of peripheral leakage.

Ultra-widefield multimodal imaging is an important clinical and research tool. By combining images from different modalities, clinicians can develop a detailed understanding of functional and morphologic aspects of various retinal diseases. ■

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VISUAL DISTURBANCES IN HEADACHE

Just a pain for the patient or a canary in a coal mine?

BY KIMBERLY M. WINGES, MD

Headache syndromes often involve the visual system, and patients frequently seek eye care for symptoms that may or may not be related to migraine aura. Although it is always important to evaluate these patients for ocular causes of visual disturbances and to treat those causes, if present, ophthalmologists often face patients who are experiencing visual disturbances in the absence of visible ocular pathology. Primary headache disorders such as migraine with aura produce positive visual phenomena, and secondary headaches such as compressive intracranial lesions cause visual changes due to increased intracranial pressure or mass effect on the intracranial visual pathways. It is important to distinguish between primary and secondary headache syndromes because both the patient's health and peace of mind are at stake.

MIGRAINE

Headaches come in many forms, as described in International Headache Society guidelines.[1] Migraine is the second most common form of primary headache disorder, behind only tension-type headache. The Global Burden of Disease Study of 2015 ranked migraine the third-highest cause of disability worldwide in both men and women less than 50 years of age.[2,3] Migraine is classified into migraine with aura (classic migraine) and without aura (common migraine). This distinction is important because several meta-analyses of the literature have shown a twofold increase in the risk of ischemic stroke for patients who experience migraine with aura versus those who experience migraine without aura.[4]

Left untreated, the headache in migraine lasts 4 to 72 hours and is associated with at least two of the following four characteristics:

- Having a unilateral location;
- Exhibiting a pulsating quality;
- Carrying a moderate or severe pain intensity; and
- Being aggravated by, or causing avoidance of, routine physical activity (eg, walking or climbing stairs).

The headache is accompanied by at least nausea and/or vomiting or by photophobia and/or phonophobia.[1]

AURA

Aura in migraine consists of recurrent attacks of unilateral, fully reversible visual, sensory, or other central nervous system symptoms that evolve over minutes and last less than an hour (most commonly 10–30 minutes). Aura is often unilateral and dynamic and involves at least one positive visual phenomenon. It is usually followed by headache but can occur in isolation without reported pain. The term *ocular migraine* is commonly used to refer to painless, typical visual auras. More cautious usage of that term is warranted, however, because it can imply a visual migraine aura that

VISUAL SNOW

A persistent positive visual phenomenon associated with migraine but distinct from persistent migraine aura is known as *visual snow*.[1] This chronic illusion persists in the absence of acute attacks and is more frequently found in patients with a history of migraine. They often describe the phenomenon as looking through TV static or snowfall.

Visual snow is distinct from persistent migraine aura (Figure). Positron emission tomography scan studies have linked this phenomenon to hypermetabolism in the supplementary visual cortex (lingual gyrus).[2] A similar link has been found in patients with chronic photophobia, linking light sensitivity to migraine on a pathophysiologic level.[3] Although visual snow is harmless in isolation, any positive visual phenomenon that is new should prompt visual field testing and further workup based on accompanying historical details as described elsewhere in this article.

Figure. Visual snow is one type of chronic altered perception commonly reported by patients with a history of migraine. They describe a TV static-like disruption of their entire visual field that is constant and present even in the absence of headache.

1. Liu GT, Schatz NJ, Galetta SL, Volpe NJ, Skobieranda F, Kosmorsky GS. Persistent positive visual phenomena in migraine. *Neurology*. 1995;45(4):664-668.
2. Schankin CJ, Maniyar FH, Digre KB, Goadsby PJ. 'Visual snow' – a disorder distinct from persistent migraine aura. *Brain*. 2014;137(pt 5):1419-1428.
3. Chong CD, Starling AJ, Schwedt TJ. Interictal photosensitivity associates with altered brain structure in patients with episodic migraine. *Cephalalgia*. 2016;36(6):526-533.

HEADACHE AND DRY EYE

By Gillian McDermott, MA, Editor-in-Chief, Clinical Content, Anterior Segment

Patients with migraine often experience aura, photophobia, and eye pain. Investigators for a cross-sectional survey-based study evaluated visual quality of life, headache impact, aura, dry eye, and photophobia in 62 patients with migraine.[1] Of these patients, 17 had episodic migraine and 45 had chronic migraine. Twenty-three of the patients reported experiencing aura, and 39 did not report aura.

Patients completed several validated questionnaires, such as the Visual Functioning Questionnaire-25, the Headache Impact Test, the Visual Aura Rating Scale, the Ocular Surface Disease Index, and the Utah Photophobia Score. Investigators looked for correlations between patients' responses to the questionnaires. The researchers found that dry eye had the greatest negative effect on visual quality of life and headache impact.

1. Ozudogru S, Neufeld A, Katz BJ, et al. Reduced visual quality of life associated with migraine is most closely correlated with symptoms of dry eye. *Headache*. 2019;59(10):1714-1721.

presents bilaterally with intracranial pathology, or it can refer to a retinal migraine with vasospastic vision loss in one eye. Visual disturbances seen in migraine aura may be divided into three types.

- **No. 1: Positive Visual Phenomena/ Hallucinations.** The patient sees things that are not there, including lights, patterns, or something obstructing vision. These are the classic migraine aura descriptions of scintillating scotoma or fortification spectra (Figure, left).
- **No. 2: Negative Visual Phenomena.** Areas of vision are missing, such as homonymous field loss, constriction of the visual field—often described as *tunnel vision*—scotomas, or a total loss of vision in either or both eyes (Figure, center).
- **No. 3: Visual Distortions/ Illusions.** The patient's visual perception misrepresents reality (Figure, right). Examples include bilateral metamorphopsia, micropsia or macropsia, halos, kaleidoscopic or fractured scenes, sensation of looking through waves of heat or water, persistence of visual imagery (palinopsia), or loss of color vision (achromatopsia).

A migraine patient may experience any single or combined version of the aforementioned visual symptoms, which completely reverse, have a stereotyped pattern for each patient, and can change over a lifetime (see *Visual Snow*). Visual auras can be debilitating, instilling fear in patients during highly demanding visual tasks such as driving because these auras interfere with the visual field.

Although more than 90% of auras are visual, patients may experience other phenomena such as concurrent sensations of pins and needles emanating from a point to a side of the body or face or, more rarely, aphasia or other speech disturbances. Other prodromal symptoms (eg, blurry vision and fatigue) may signal an oncoming migraine 24 to 48 hours before headache onset.

DIAGNOSIS

A thorough history provides critical guidance on the differential diagnosis and workup. Neurologists frequently ask patients to keep a headache or headache aura journal or calendar. By documenting the characteristics, timing, and evolution of symptoms as well as any associated neurologic features, patients may be able to identify environmental triggers and gauge their responses to treatment more accurately. Common environmental triggers include dietary consumption of chocolate, red wine, sugar, or monosodium glutamate. High-stress environments, erratic sleep schedules, bright sunlight, strong odors, extreme exertion, and/or medication use or overuse can also be to blame. Triggers are individualized and can change over time.

Figure. Visual disturbances seen in migraine aura. Positive visual phenomena are the most common. An object in the way of the patient's view moves from center to periphery in a centrifugal, spreading pattern (left). Negative visual phenomena such as a missing area of visual field develop, last for 10 to 30 minutes, and then resolve (center). Visual distortions or illusions happen when the patient perceives a normal scene as if it were fractured, underwater, or otherwise altered, often in a dynamic pattern (right).

By definition, the diagnosis of isolated migraine and other primary headache syndromes requires that there be no causative pathology on diagnostic evaluation. The examination of a patient presenting with headache and visual disturbances should therefore include careful documentation of BCVA and color vision, assessment for a relative afferent pupillary defect, and a dilated fundus examination to identify retinal or optic nerve pathology indicating a causative structural lesion. Both confrontation and formal visual field testing is highly recommended to identify optic neuropathy or homonymous defects, localizing the defect posterior to the chiasm. OCT imaging of the macular ganglion cell layer and retinal nerve fiber layer may help to localize and obtain a baseline of optic nerve structural changes, especially if optic nerve atrophy is suspected.

RED FLAGS

When do a patient's visual disturbances and headache warrant further workup? Several situations should raise concern about a secondary headache syndrome:

- Homonymous visual field defects;
- Loss or alteration of consciousness;
- Concurrent neurologic signs or symptoms, such as slurred speech, hemiparesis, Horner syndrome, or cranial nerve palsy. Although complex migraine can produce these symptoms in a recurrent fashion, targeted neuroimaging and a neurology workup should be performed to exclude ischemic or embolic stroke from carotid artery atherosclerosis, artery dissection, arteriovenous malformation, or intracranial aneurysm;
- Persistent vision loss or positive visual phenomena that do not fully resolve;
- Onset of migraines in patients older than 50 years of age;
- Dramatic change in the character or worsening severity of migraines or migraine aura;
- Transient monocular vision loss, often described as a curtain over vision and usually lasting only a few minutes before complete resolution. This phenomenon is indicative of amaurosis fugax and requires a retinal and cardiac workup for embolic stroke; and
- Significant associated systemic symptoms such as scalp tenderness, jaw claudication, and arthralgias that may accompany transient vision loss or diplopia with headache. These require an emergency workup for giant cell arteritis and immediate empiric steroid treatment.

CONCLUSION

Many eye care providers are undertrained in headache classification, but knowing the basic features common among patients with associated visual disturbances and recognizing the warning signs of secondary headache are critical to making clinical decisions. Prompt referral to an emergency department, a neurologist, or a neuro-ophthalmologist may be necessary when the diagnosis or management strategy is uncertain. ■

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DILRAJ GREWAL, MD

PLEASE DESCRIBE THE EXPERIENCE OF BEING A MENTOR AS A YOUNG DOCTOR.

It is a real privilege to be able to work with fellows, residents, and medical students. I think that when you are recently out of training yourself, it is both challenging and a lot of fun being a mentor. On one hand, you are still refining your own clinical, surgical, and research skills. On the other hand, you are trying to transition into a mentorship role by leading research projects and supervising complex surgeries. It is a huge learning experience both clinically and academically, and it is incredibly gratifying. It also teaches you a lot about soft skills, including time management and people skills.

HOW DID YOU BECOME INTERESTED IN ADVANCED OCULAR IMAGING FOR RETINAL DISEASES AND UVEITIS?

I worked on ocular imaging during a pre-residency research fellowship at the Bascom Palmer Eye Institute, which gave me access to early generation spectral-domain OCT prototypes. That field has grown exponentially, and now OCT is considered what some have termed an *ocular vital sign*.

During my residency at the Northwestern University Feinberg School of Medicine, I worked with leading imaging experts Lee M. Jampol, MD; Amani A. Fawzi, MD; and Debra A. Goldstein, MD. They motivated me to pursue imaging in retina and uveitis. During my vitreoretinal fellowship at Duke University and my uveitis fellowship at the Moorfields Eye Hospital, I learned from some of the world's leaders in ocular imaging, and became involved with the Duke Reading Center, which further developed my interest in imaging.

WHAT DREW YOU TO RETINA?

I found vitreoretinal surgery interesting and challenging, and the overall breadth of pathology in retina fascinating. During residency, seeing retina treatment affect a patient's quality of life was tremendous. Working with imaging tools in the clinic and the OR for diagnosis and assessing response to treatment was the final clincher.

Dr. Grewal pictured on a hike of the Tour du Mont Blanc trail in Europe.

WHAT WOULD YOU LIKE TO ACCOMPLISH IN 2020?

I plan to be more organized and efficient with my time. I have research projects that I would like to see progress. I am also trying to grow the uveitis service at the recently launched Ocular Inflammatory Center at the Duke Eye Center. Personally, there are some mountain treks planned that I hope to complete.

WHAT FICTITIOUS CHARACTER DO YOU ADMIRE?

Colin Firth's turn as King George VI in *The King's Speech*. I think it's a great role about the power of believing in yourself and overcoming your impediments. ■

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