This clinical case compendium, written by well-known retina specialists selected by *Retina Today*, features surgeries related to the posterior segment.

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Combined Rhegmatogenous and Traction Retinal Detachment With PVR and Full-Thickness Macular Hole

Vitrectomy performed with a full complement of 27-gauge instrumentation facilitates favorable outcomes in complex cases.

BY THEODORE LENG, MD, MS

Repair of combined rhegmatogenous and traction retinal detachment is one of the more complex surgeries we perform as vitreoretinal surgeons. Although these surgeries have been successfully performed with 20-gauge instrumentation, the advent of 23- and 25-gauge systems has allowed for improved surgical techniques and increased efficiency. In the past year, Alcon released a 27-gauge platform for vitreoretinal surgery with a full armamentarium of forceps and instruments previously only available in 23- and 25-gauge sizes. This case represents one of the first uses of the Constellation Vision System (Alcon) with 27-gauge instruments to repair a complex retinal detachment.

CASE REPORT

A 62-year-old woman with a history of pathologic myopia had been followed at our institution for many years. Over time, she developed a full-thickness macular hole with counting-fingers vision in her right eye. The macular hole was successfully repaired with vitrectomy, membrane peeling, and intraocular gas tamponade. She subsequently developed a recurrent full-thickness macular hole that was repaired by vitrectomy, membrane peeling, and intraocular silicone oil tamponade. Her visual acuity under oil was 20/500 because of her pathologic myopia and associated macular atrophy. The visual acuity of her fellow eye measured 20/25.

After a period of stability, the silicone oil emulsified and was removed. The patient’s visual acuity was 20/200. One year later, she presented with a recurrent full-thickness macular hole and associated rhegmatogenous retinal detachment combined with a proliferative vitreoretinopathy (PVR)-associated traction detachment. Her visual acuity had dropped to counting fingers again.

THE PROCEDURE

Vitrectomy was performed under monitored anesthesia care with a retrobulbar block of a 50:50 mixture of 4% lidocaine and 0.75% bupivacaine. Next, I placed three 27-gauge valved cannulas using a beveled insertion technique with conjunctival displacement (Figure 1). I then performed the vitrectomy using the 27-gauge Ultravit cutter under a widefield noncontact microscope system (Resight/Lumera 700, Carl Zeiss Meditec). In addition, I removed residual particles of emulsified silicone oil with the vitrector.

TECHNIQUE

Directing my attention toward the posterior pole, I found a thick membrane adherent to the macula, associated with the full-thickness macular hole and
rhegmatogenous retinal detachment. Using 27-gauge end-grasping forceps, I gently removed the membrane from the macula and submitted it for histologic analysis (Figure 2). With traction removed from the macula, I addressed the thick PVR membranes in the inferior and inferotemporal periphery. Using the 27-gauge Grieshaber Maxgrip forceps (Alcon), I stripped the membranes from the retinal surface, which improved the retina’s mobility. I used Perfluoron (Alcon) to stabilize the macula and enable countertraction during the peeling procedure (Figure 3).

After air-fluid exchange performed with a 27-gauge soft-tip cannula (MedOne Surgical), the retina flattened nicely. Silicone oil (Silikon 1000, Alcon) infused through the 27-gauge scleral cannula was used for an intraocular tamponade. Postoperatively, the retinal detachment resolved, and the macular hole closed. The eye has remained stable for more than 1 year, and the patient’s visual acuity is 20/500.

DISCUSSION

The successful repair of this eye with complicated pathology demonstrates that we can safely and efficiently perform these types of repairs with ultra-small-gauge sutureless surgical techniques. Specifically, the 27-gauge end-grasping forceps safely elevated a premacular membrane and stripped it from the retina.

When peeling peripheral PVR membranes, it is preferable to use a heavy liquid on the posterior pole as a stabilizing agent to serve as countertraction. I switched to the 27-gauge Maxgrip forceps to peel the peripheral membranes to take advantage of its 40 grams of holding force (as compared with the 12-gram holding force of the end-grasping forceps). This additional grip facilitated efficient dissection and peeling of the peripheral membranes without lost contact.

Finally, this case shows that it is possible to infuse silicone oil through 27-gauge cannulas. In this patient, I pressed the 25-gauge metal oil injector up to the entrance of the 27-gauge valved cannula, and the oil flowed into the eye in a timely manner.

CONCLUSION

Vitrectomy with 27-gauge instrumentation can be successfully performed to repair complex retinal disease, and the multiple instruments available can aid in the safe and efficient completion of these cases. Moreover, the smaller-gauge incisions needed for 27-gauge work may also reduce postoperative inflammation and pain and lead to faster recovery after vitrectomy.

Theodore Leng, MD, MS, is director of ophthalmic diagnostics at the Byers Eye Institute at Stanford in Palo Alto, CA, and a clinical assistant professor of ophthalmology at the Stanford University School of Medicine. He has served as a paid consultant to Alcon and Zeiss. Dr. Leng may be reached at vision.md@gmail.com.
Internal Limiting Membrane Removal During Macular Hole Repair

Demonstrating the utility of the Finesse Flex Loop in minimally invasive vitreoretinal surgery.

BY THOMAS A. CIULLA, MD

Maximizing success while minimizing trauma to the macula during macular hole and pucker surgery is paramount. Numerous reports suggest that peeling the internal limiting membrane (ILM) during macular hole surgery may improve surgical success rates and minimize the risk for the macular hole to reopen postoperatively.1 This case demonstrates the utility of the Finesse Flex Loop (Alcon) for ILM removal during macular hole repair.

CASE REPORT

A 35-year-old woman with moderate myopia developed a macular hole in the right eye, decreasing her best-corrected visual acuity to 20/400. I performed 27-gauge vitrectomy.

After staining the ILM with brilliant blue G (Figure 1), I employed the Finesse Flex Loop for peeling (Figure 2). This instrument enables the surgeon to adjust the stiffness of the retractable loop for the amount of pressure needed to gain an edge. The tines on the loop nicely engage the ILM and are designed for no more than 85% penetration, which could limit direct contact with the delicate nerve fiber layer of the macula and the maculopapular bundle.

I then removed the final tags of ILM with the 27-gauge vitrectomy probe set to suction only (Figure 3). This maneuver incidentally obviates the need to use a forceps. I performed air-fluid exchange, followed by gas infusion.

Six weeks postoperatively, the patient’s best-corrected visual acuity had improved to 20/60, and optical coherence tomography confirmed closure of the macular hole with some resolving subfoveal fluid (Figure 4, shown on page 13).

DISCUSSION

In the future, minimally invasive vitreoretinal surgery with 27-gauge instrumentation will be used more frequently (Continued on page 13)
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Intraoperative OCT reveals the intimate relationship between the posterior hyaloid and the ERM in these cases.

BY JUSTIS P. EHLERS, MD, AND RISHI P. SINGH, MD

The most recent hypothesis holds that an epiretinal membrane (ERM) develops from residual cortical vitreous, secondary to a posterior vitreous detachment or partial separation of the posterior hyaloid, which allows for the proliferation of glial cells. Vitrectomy with elevation of the posterior hyaloid and membrane peeling is commonly employed to address an epiretinal membrane.1

Until recently, visualizing the acute impact of surgical maneuvers on retinal microarchitecture in real time was not possible. Surgeons were limited to pre- and postoperative surveillance. Advances in optical coherence tomography (OCT) now enable us to visualize the retinal architecture before, during, and after membrane peeling, allowing for improved decision making in vitreoretinal surgical cases.2-4 The following cases illustrate the clinical utility of intraoperative OCT (iOCT) in patients with combined vitreomacular traction (VMT) and ERM and associated underlying vitreoschisis.

CASE No. 1
A 68-year-old woman with a history of decreased vision in her right eye for 6 to 8 months presents with a visual acuity of 20/80. The anterior segment examination was unremarkable, and the dilated retinal examination was significant for an ERM. OCT revealed broad vitreomacular traction, an ERM, and cystoid macular changes. Figure 1 demonstrates the horizontal and vertical line scans.

Treatment Options
The options for this patient include ocriplasmin intravitreal injection (Jetrea, ThromboGenics), observation, or surgery. Given the length of visual decline, the significant visual complaints, the broad VMT size, and the ERM, a surgical option was chosen.

The patient underwent a 27-gauge pars plana vitrectomy with elevation of the posterior hyaloid. After the trocars were placed, iOCT was performed with the Rescan 700 (Carl Zeiss Meditec), which showed the same configuration of VMT and ERM as in the preoperative OCT scan (Figure 2).

The vitreous was stained with triamcinolone to improve visualization, and the hyaloid was elevated (Figure 3). After removing the posterior hyaloid and before ERM peeling, iOCT confirmed that the ERM and the posterior hyaloid had been completely removed during the initial steps of the procedure (Figure 4). Therefore, no ERM peeling was necessary.

The 3-week postvitrectomy OCTs demonstrate complete removal of the ERM and VMT with improvement of the cystoid edema (Figure 5). The patient’s visual acuity improved to 20/50.

CASE No. 2
The patient in this case showed a similar pathology as in case No. 1. A 70-year-old man with quiescent vitreous...
proliferative diabetic retinopathy presented with VMT and underlying ERM with reduced visual acuity to 20/70. (Figure 6). During surgery, iOCT feedback revealed complete removal of the hyaloid-ERM complex during elevation of the hyaloid, suggesting vitreoschisis (Figure 7). Post-hyaloid elevation iOCT scans confirmed complete membrane removal (Figure 8). This finding eliminated the need for staining with indocyanine green and also negated the need for additional surgical maneuvers. Postoperatively, the foveal contour improved, and the patient’s visual acuity improved to 20/40.

**DISCUSSION**

These two cases illustrate the intimate relationship between the posterior hyaloid and the ERM, recognized by the use of iOCT. Over the last decade, clinical management of vitreoretinal diseases has been transformed by the use of OCT within the outpatient clinic. It is clear that the clinician’s en face assessment may not detect subclinical abnormalities that are functionally and structurally important. For example, it is possible to miss subtle intraretinal fluid in patients with neovascular age-related macular degeneration or diabetic macular edema. Without spectral-domain OCT, the identification of these alterations would not be possible.

**New iOCT Systems**

New-generation, microscope-integrated iOCT systems will allow surgeons to not only assess the successes of their surgical interventions, but also evaluate traction forces during membrane engagement with instruments and the immediate repercussions of these interactions.
The Rescan 700 received FDA clearance in the United States in 2014, and the Haag-Streit iOCT system received FDA clearance in 2015. The variety of systems commercially available will continue to expand. For example, Bioptigen recently announced its EnFocus microscope-integrated intraoperative OCT system.

**PIONEER Study**

The PIONEER study is a large, prospective, multisurgeon study that examined the feasibility and utility of iOCT for ophthalmic surgery. More than 700 eyes were included in the study, which used iOCT for anterior or posterior segment applications. One of the most interesting findings from this study was that in about 10% of cases, the use of iOCT changed the surgical course because of the feedback provided to the surgeon, such as confirming completion of a peel when the surgeon thought there was more to peel, or revealing residual membrane that was not identified through the microscope.

**CONCLUSIONS**

We offer the following concluding thoughts:

- An intimate relationship exists between the ERM and the posterior hyaloid, and the removal of the posterior hyaloid alone may be sufficient in some cases.
- Intraoperative OCT can be a useful decision support tool, even in routine vitreoretinal surgical cases such as ERM removal.
- Small-gauge surgery, including 27-gauge vitrectomy, provides efficient vitreous removal along with the vacuum capabilities to elevate the posterior hyaloid successfully, even in difficult cases such as VMT.

Justis P. Ehlers, MD, is an assistant professor of ophthalmology at the Cleveland Clinic Lerner College of Medicine in Cleveland, OH, and is on the vitreoretinal service of the Cole Eye Institute. He is codirector of intraoperative OCT research at the Ophthalmic Imaging Center of the Cole Eye Institute. Dr. Ehlers is a consultant for Alcon, Alimera Sciences, Bioptigen, Carl Zeiss Meditec, Leica, and ThromboGenics. He receives research support including equipment and/or funding from Bioptigen, Carl Zeiss Meditec, Genentech, Leica/Surgical One, and Regeneron. He also has intellectual property licensed to Bioptigen and Synergetics. Dr. Ehlers may be reached at ehlersj@ccf.org.

Rishi P. Singh, MD, is a staff surgeon at the Cole Eye Institute, Cleveland Clinic, and assistant professor of ophthalmology at the Lerner College of Medicine in Cleveland, OH. He also currently serves as the medical director of informatics at the Cleveland Clinic. He is a consultant for Alcon, Genentech, Regeneron, Shire, and ThromboGenics. He conducts contracted research for Alcon, Genentech, Ophthotech, and Regeneron. Dr. Singh may be reached at drrishisingh@gmail.com.


Figure 8. Posthyaloid elevation iOCT scans confirm complete membrane removal.
Macula-Involving Combined Rhegmatogenous and Traction Retinal Detachment

Using various small-gauge tools for different surgical maneuvers optimizes safety and efficiency.

BY DILRAJ S. GREWAL, MD, AND TAMER H. MAHMOUD, MD, PhD

Common indications for pars plana vitrectomy in patients with proliferative diabetic retinopathy include nonclearing vitreous hemorrhage, traction retinal detachment (TRD) involving the macula, combined traction and rhegmatogenous retinal detachment, and diabetic macular edema associated with posterior hyaloid traction. Although 23- and 25-gauge transconjunctival systems have been shown to be effective in managing complicated diabetic TRD, 27-gauge instrumentation offers several advantages over using larger systems, including better wound construction and closure, faster cut rates, and greater stability over a mobile retina.

CASE REPORT

A 51-year-old man with insulin-dependent type 2 diabetes presented with proliferative diabetic retinopathy and TRDs involving the macula in both eyes. Here, we describe surgery of the right eye for a macula-involving combined rhegmatogenous detachment and TRD.

Transconjunctival valved 23-gauge trocars were placed to facilitate the use of instruments of different gauges. Figure 1 shows the difference in size between the 23-gauge endoilluminator (Straight Endoilluminator, Alcon) and the 27-gauge vitrectomy probe (Ultravit 27+ Vitrectomy Probe, Alcon) inserted through the 23-gauge cannula. In challenging cases, the diffuse light provided by the 23-gauge endoilluminator is an advantage over the more focused light delivered by the 27-gauge endoilluminator.

Staining and Peeling

After release of the anteroposterior traction using the 27-gauge vitrectomy probe, the fibrovascular tissue was stained with triamcinolone acetonide (Kenalog, Bristol-Myers Squibb). Triamcinolone-stained membranes, fibrovascular tissue, and vitreous can be peeled from the detached retina’s surface with ease and minimal movement of the underlying detached retina. To accomplish this step, the surgeon uses the 27-gauge vitrectomy probe at 7,500 cuts per minute (Figure 1). In addition, the smaller gauge allows better access to tight tissue planes with reduced traction on the underlying retina.

Illumination

A 25-gauge Alcon Chandelier was inserted inferonasally to allow for a bimanual approach in this eye that had large adherent plaques of fibrovascular proliferation. Bimanual surgery was accomplished with various 27-gauge instruments. The thick membranes were grasped using the 27+ gauge Grieshaber Advanced DSP Tip End-Grasping Forceps (Alcon) and were cut using the 23-gauge pneumatic scissors (Figure 2).

The 27-gauge vitrectomy probe offers several advantages in tissue segmentation, because the port of the cutter is close to the tip of the instrument and can often be used instead of scissors. The blunt tip of the cutter was introduced into the plane between the detached retina and the membranes (Figure 3). This maneuver allows segmentation with the 27-gauge cutter, set to the “shave” duty cycle mode in which the cutter is closed during most of the time.
Use of Scissors

In cases with extensive traction extending peripherally, the stiffness of the 23-gauge pneumatic scissors facilitates working in the periphery using a bimanual approach. Pneumatic accessories, such as forceps and scissors, offer improved precision and tip control. The manual tremor and forward movement experienced when closing the forceps are eliminated, and it is easier for the surgeon to grab the exact target. The surgeon regulates opening and closing pressures of the tip with the vitrectomy pedal. A range of parameters can be customized, and scissors can be used in two modes: (1) multicut at a frequency of 450 cuts per minute, and (2) proportional, which is a straightforward cut. Pneumatic scissors are particularly useful for cutting thick and extensive proliferative membranes, increasing safety and efficiency for segmentation.

Discussion

In this case, we took advantage of the 23-gauge system with the diffuse illumination offered by the straight endoilluminator. We started with the 27-gauge vitrectomy cutter to relieve anteroposterior traction and removed the posterior hyaloid membrane over the detached retina with minimal traction. We switched to pneumatic scissors to cut the
CONCLUSION

In conclusion, 27-gauge instrumentation is a valuable addition to our armamentarium for the surgical repair of diabetic TRD. Using a combination of various small-gauge tools, each of which offers specific advantages for different surgical maneuvers, may optimize safety and efficiency in these challenging cases.

Tamer H. Mahmoud, MD, PhD, is an associate professor and program director of the vitreoretinal fellowship at Duke University Eye Center. He reports no financial or proprietary interests in the products or companies discussed herein. Dr. Mahmoud may be reached at tamer.mahmoud@duke.edu.

Dilraj S. Grewal, MD, is a clinical associate and vitreoretinal fellow at the Duke University Eye Center, Durham, NC. He reports no financial or proprietary interests in the products or companies discussed herein. Dr. Grewal may be reached at dilraj.grewal@duke.edu.

Figure 4. Six weeks postsurgery, OCT confirms closure of the macular hole with some resolving subfoveal fluid.


CONCLUSION

In conclusion, 27-gauge surgery and new instruments such as the Finesse Flex Loop nicely facilitates membrane stripping in a capsulorhexis fashion and provides excellent visualization and versatility in 27-gauge surgery. Furthermore, visibility of the working area through the loop is excellent. The loop disperses force to a large surface area, minimizing the risk of focal injury.

Thomas A. Ciulla, MD, was co-director of the retina service and associate professor of ophthalmology at Indiana University School of Medicine prior to joining Midwest Eye Institute, a multisubspecialty group in Indianapolis, where he performs clinical research and serves on the board of directors. He reports no financial or proprietary interests in the products or companies discussed herein. Dr. Ciulla may be reached at thomas.ciulla@gmail.com.

Retinal Detachment Secondary to Chorioretinal Coloboma in a Pediatric Patient

Microscope-integrated intraoperative OCT provides integral visualization of the anatomy and evidence of surgical success.

BY MATTHEW B. DONOVAN, BS; AJAY E. KURIYAN, MD, MSC; AND AUDINA M. BERROCAL, MD

Chorioretinal coloboma formation occurs when the embryonic fissure fails to properly close at 5 to 7 weeks’ gestation. Improper closure results in the absence of choroidal and retinal pigment epithelium layers in the colobomatous area and replacement of normally layered retinal layers with poorly developed intercalary membrane (ICM). The frailty of the ICM leads to a high rate of retinal detachments in affected individuals, approaching a 40% lifetime risk. Retinal detachments in patients with chorioretinal colobomas can be tractional, rhegmatogenous, or exudative (in cases of retrobulbar cysts in communication with the subretinal space).

OPTICAL COHERENCE TOMOGRAPHY

Performing vitreoretinal surgery in these cases of detachment is technically challenging due to the wide array of anatomic abnormalities that can be present. Such difficulty accounts for the relatively high rate of postoperative complications—most commonly, recurrent retinal detachment. Optical coherence tomography (OCT) is used to assess the anatomy of chorioretinal colobomas and has provided a greater understanding of their associated retinal detachments. Although intraoperative OCT (iOCT) has been used for several years, microscope-integrated iOCT is a relatively new tool in the management of these complex cases. We present a case of retinal detachment associated with chorioretinal coloboma repaired with a scleral buckle, pars plana vitrectomy, and silicone oil, which was performed using microscope-integrated iOCT.

CASE REPORT

A 3-year-old boy with a history of bilateral iris and macula-involving chorioretinal colobomas was found to have a retinal detachment of the left eye during a regularly scheduled follow-up examination under anesthesia (Figure 1). The patient’s previous visual acuity was fix and follow, and he had congenital nystagmus. Six months prior to the retinal detachment, he developed a choroidal neovascular membrane nasal to the optic disc in the right eye. He was treated with intravitreal bevacizumab (Avastin, Genentech) twice and diode indirect laser once with no evidence of leakage on fluorescein angiography last performed on the day of the retinal detachment repair.

At the start of the case, a 360° encircling silicone band was affixed to the sclera using scleral loops. Subsequently, the surgeon performed a pars plana vitrectomy using the Rescan 700 surgical microscope (Carl Zeiss Meditec) equipped with real-time iOCT. During the vitrectomy,

Figure 1. A child with a history of bilateral iris and macula-involving chorioretinal colobomas presented with a retinal detachment of the left eye during a regularly scheduled follow-up examination.
the iOCT was used to visualize the traction retinal detachment and the transition between the healthy retina and the coloboma at the margins.

Following removal of the adherent vitreous, which was aided by staining with intravitreal diluted kenalog and fluid air exchange, the retina flattened. The surgeon applied an endolaser 360° around the retinal break. Silicone oil was infused, and iOCT confirmed the absence of subretinal fluid. The surgery was performed without complications, and the patient’s retina remained attached under silicone oil at the 3-month follow-up visit. Silicone oil removal will be scheduled in the near future.

DISCUSSION

Chorioretinal coloboma formation and the associated anatomical abnormalities result from improper fisure fusion. A key pathologic anatomical abnormality is the replacement of the fully formed retinal layer with ICM, which retains remnants of the inner sensory retinal layers but lacks the integrity of normal retina. This condition predisposes the ICM to breaks, schisis, and fluid collections.1,2

Tractional forces exerted by the ICM on a normal retina are a potential mechanism for retinal detachments in these patients.3 Because of these tractional forces, endolaser application along the border of the chorioretinal coloboma has been recommended.4 We believe the laser should be applied as minimally as possible, and the area of the fovea should be recognized and, if possible, left untouched by the laser. The iOCT will be helpful to identify the fovea in these cases. Additionally, iOCT can be used to confirm retinal reattachment and identify any persistent ICM-retina traction, which predisposes the patient to recurrent retinal detachments.5

During this procedure, we used the iOCT to visualize the anatomy of the normal retina and chorioretinal coloboma at the margin. The intraoperative scans allowed us to clearly visualize the traction between the ICM and the retina (Figure 2). The iOCT also confirmed that the retina was flat, and all traction between the ICM and the healthy retina was relieved (Figure 3).

CONCLUSION

This case highlights surgical intervention for retinal detachment associated with chorioretinal coloboma using the microscope-integrated iOCT, which provided integral visualization of our patient’s anatomy and evidence of surgical success. Intraoperative OCT can provide important real-time information that can aid in the surgical management of complex retinal cases.

Matthew Donovan, BS, is a third-year medical student at the University of Miami Miller School of Medicine. He reports no financial or proprietary interests in the products or companies discussed herein. Mr. Donovan may be reached at mdonovan@med.miami.edu.

Ajay Kuriyan, MD, MSc, is a first-year vitreoretinal fellow at the Bascom Palmer Eye Institute in Miami. He receives grant funding from Bayer Pharmaceuticals and is a consultant for Diagnos, Inc. Dr. Kuriyan may be reached at Kuriyan@med.miami.edu.

Audina M. Berrocal, MD, is a professor of clinical ophthalmology and Medical Director of Pediatric Retina and Retinopathy of Prematurity at the Bascom Palmer Eye Institute in Miami. She is a member of the Retina Today editorial board and a consultant for Alcon, Allergan, Clarity Medical Systems, and ThromboGenics. Dr. Berrocal may be reached at aberrocal@med.miami.edu.

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