The Interface Vitrectomy Technique

The use of instrumentation with silicone oil, gas, and PFO is effective for complex vitreoretinal surgical cases.

BY STEVE CHARLES, MD

Interface vitrectomy describes the use of vitreous cutters, scissors, forceps, and other instruments at the interface between silicone oil, air, or liquid perfluorocarbon (PFO) and residual vitreous, epiretinal membrane, and retina. Vacuum should not be applied to the vitreous cutter or soft tip cannula within the air, oil, or PFO bubble to avoid plugging with oil or air lock, and to reduce the risk of loss of oil or PFO.

For 30 years I have performed removal of residual vitreous traction and performed retinectomy, epiretinal membrane peeling/segmentation/delamination, subretinal surgery, and bipolar diathermy under air and oil. Air stabilizes the retina because of the inherent spring-like properties of a compressible gas. Air also reduces unwanted retinal motion, confines bleeding to the air-retinal interface, and prevents infusion fluid from flowing into the subretinal space.

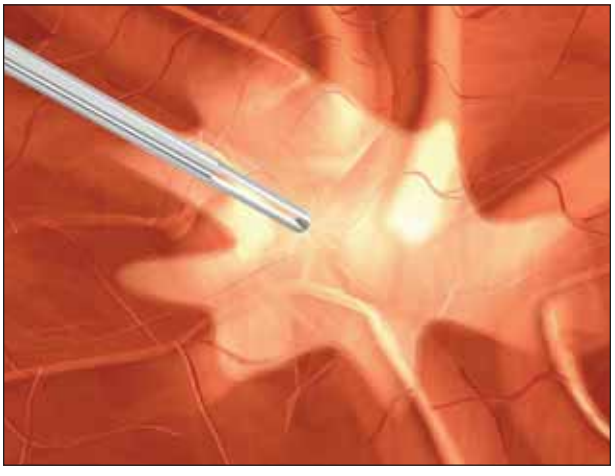

Figure 1. Membrane peeling.

THE TECHNIQUE

I developed internal drainage of subretinal fluid and fluid-air exchange; used simultaneously, these techniques can be used for the reattachment experiment. If subretinal air appears, vacuum should be released as quickly as possible and inspection of the retinal surface initiated to determine the cause of residual traction. Residual vitreous can be removed using interface vitrectomy technique, and the epiretinal membrane, typically in proliferative vitreoretinopathy (PVR) cases, can be managed with forceps membrane peeling (Figure 1) using end-grasping forceps such as the Grieshaber DSP 25-gauge internal limiting membrane (ILM) forceps (Alcon Laboratories, Inc., Fort Worth, TX). If the epiretinal membrane is highly adherent, typically in diabetic traction retinal detachment cases, access segmentation should be followed by inside-out delamination (Figure 2) with Grieshaber DSP 25-gauge curved scissors (Alcon Laboratories, Inc.). If residual vitreous or epiretinal membrane cannot be identified, incremental retinectomy, not "relaxing retinotomy," which leaves tissue anteri-

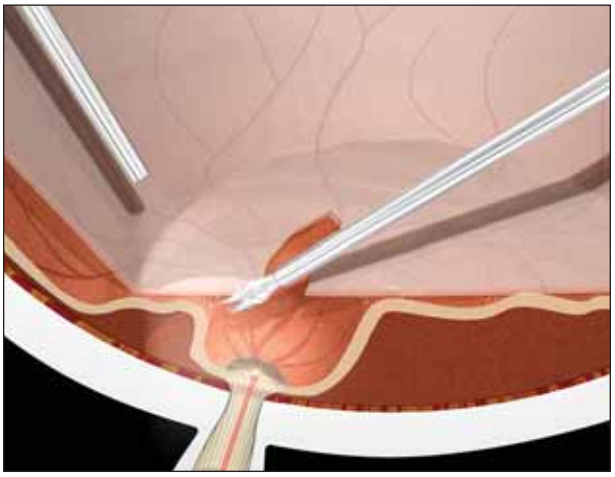

Figure 2. Inside-out delamination with 25g curved scissors.

or to the cut, should be used until the retina becomes attached.

Silicone oil produces viscous dampening, which reduces retinal motion during epiretinal membrane peeling, removal of residual vitreous traction, retinectomy, epiretinal membrane peeling/segmentation/delamination, and subretinal surgery. All of these techniques are easily performed just outside the silicone oil bubble, at or near the retinal surface.

Perfluorocarbon liquids, such as n-perfluorooctane (PFO), can be used for interface vitrectomy in addition to being essential for giant break management, as reported by Chang et al.[1] The high specific gravity of PFO (approximately 2X mass) produces both inertial stabilization (2X mass, F=MA) and gravitational stabilization (approximately 2X gravitational force) on the retina. Quiroz-Mercado et al[2] developed perfluorocarbon perfused vitrectomy initially to provide oxygenation to the retina during periods of nonperfusion for tumor resection; it was noted, however, that retinal detachments often disappeared during vitrectomy under PFO. The concept behind intraoperative use of PFO is retinal stabilization to offset dissection forces. After traction forces are removed from the retina, PFO causes retinal reattachment because PFO is immiscible

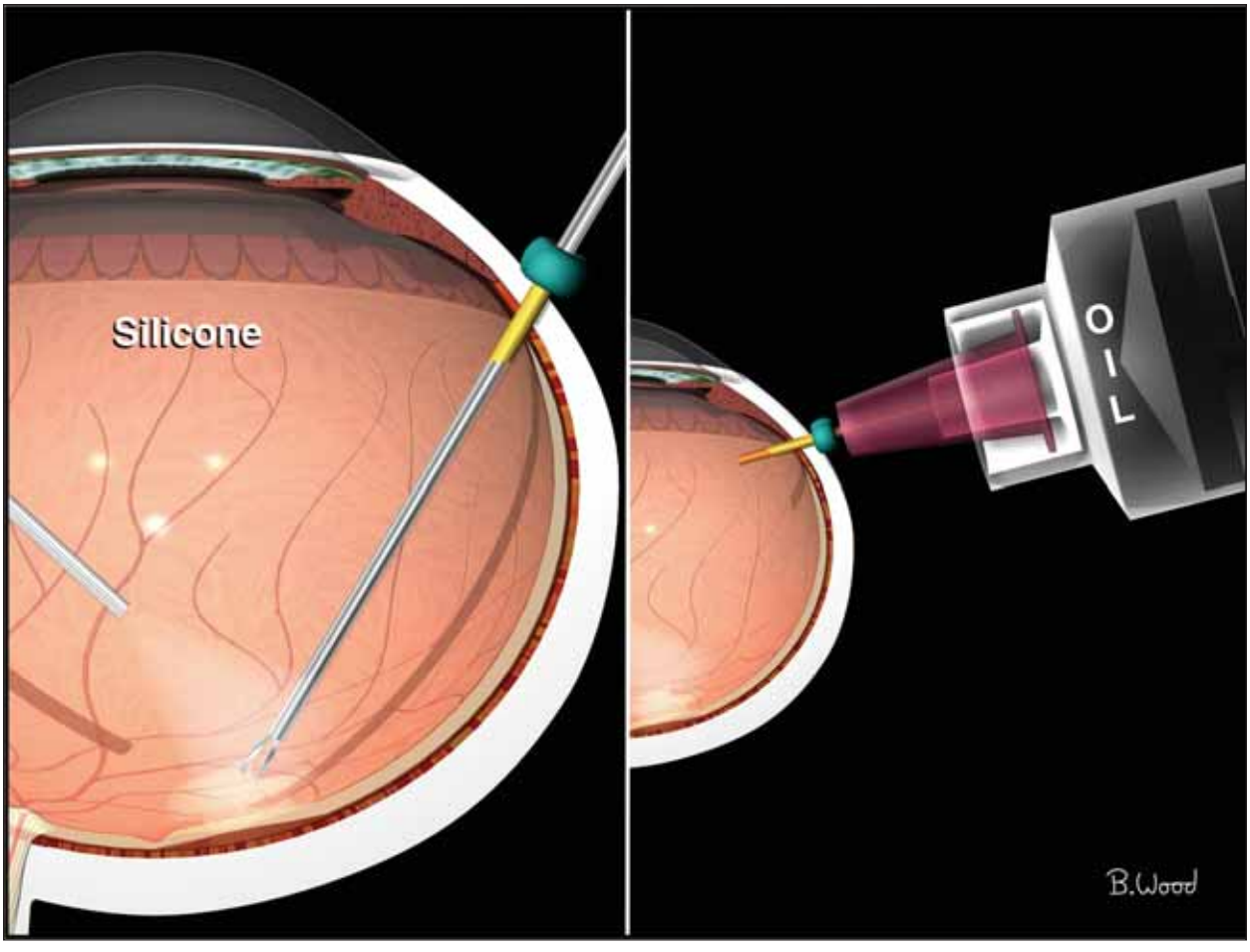

Figure 3. The 25-gauge two-port vitrectomy for reoperation in eyes with silicone oil.

in balanced salt solution and subretinal fluid is less dense than PFO and is displaced anteriorly exiting the subretinal space through retinal breaks, drainage retinotomies, or retinectomies. Laser energy settings must be reduced when treating under PFO because the subretinal fluid is completely gone. This is usually not the case with simultaneous fluid-air exchange and internal drainage of subretinal fluid except anteriorly.

REOPERATION WITHOUT REMOVING SILICONE OIL

Many surgeons unnecessarily remove silicone oil when reoperating for epimacular membrane or recurrent retinal detachment. For more than 25 years I have operated "under" silicone oil when reoperating these eyes.

Key advantages to this approach include decreased surgical trauma (especially to the lens and cornea), realistic assessment of traction removal, and significantly reduced operating times, cost, and trauma. Reducing damage to conjunctiva, Tenon's capsule, and episclera is especially important if the patient has glaucoma and may require filtration surgery.

> Used simultaneously, internal drainage of subretinal fluid and fluid-air exchange can be used for the reattachment experiment.

Silicone oil produces approximately 50% less interfacial surface tension than air or gas interface with infusion fluid or aqueous humor; therefore, reoperation with oil in place gives a realistic assessment of the relative force due to interfacial tension and retinal surface contraction.

Many surgeons have performed fluid-air exchange, endophotocoagulation, and air-silicone exchange for a PVR case only to find the retina was partially detached the next day because of the surface tension disparity.

Typical operating times are 20 minutes or less for epimacular membrane cases and 30 to 45 minutes for PVR or diabetic traction retinal detachment reoperation. Time savings are significant because it is easier on the patient and OR staffing costs (70%) are reduced.

I have used two-port 25-gauge vitrectomy for reoperation in eyes with silicone oil for the past 5 years and a 20/25 technique during the prior 2 years since 25-gauge technology became available. The 20/25 technique is performed by connecting the Viscous Fluid Control (VFC; Alcon Laboratories, Inc.) containing 1000-centistoke silicone oil to a short piece of tubing connected to the infusion cannula for surgeons who prefer 20-gauge surgery. The preferred 25-gauge two-port method (Figure 3) is performed using the Viscous Fluid Injector (VFI; MedOne, Sarasota, FL) 25-gauge cannula to sequentially inject oil after internal drainage of subretinal fluid reduces the intraocular pressure (IOP). The two-port method is effective because the viscosity of the oil prevents reflux out the 25-gauge cannulas and resultant decreased IOP during instrument exchange.

Forceps membrane peeling, scissors segmentation/delamination, cutter delamination, retinectomy, internal drainage of subretinal fluid, removal or resection of subretinal traction elements, retinectomy, and endophotocoagulation all work well with silicone oil in place. It is often necessary to remove a preretinal fluid layer and add silicone oil before initiating epiretinal membrane dissection. A vacuum setting of 600 mm Hg to 650 mm Hg is required for cutter removal of residual vitreous or cutter delamination. A maximum linear vacuum setting of 600 mm Hg to 650 mm Hg is required for internal drainage of subretinal fluid unless extreme care is taken to keep silicone oil out of the soft tip cannula. PVR and diabetic traction retinal cases often require retinectomy; this is accomplished by removing contracted, stiff retina, epiretinal membrane, and subretinal fluid or oil together with the cutter. Large vessels should be coagulated first with bipolar diathermy with the tip in contact with the vessel because, unlike infusion fluid, silicone oil is not conductive.

SUMMARY

In summary, understanding the physical properties of oil, gas, and PFO, and learning the techniques described above will result in effective, efficient vitreoretinal surgery in complex cases. ■

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2. Quiroz-Mercado H, Guerrero-Naranjo J, Agurto-Rivera R, et al. Perfluorocarbon-perfused vitrectomy: a new method for vitrectomy–a safety and feasibility study. *Graefes Arch Clin Exp Ophthalmol.* 2005;243(6):551–562.