

TOP FIVE POINTERS FOR WORKING WITH SILICONE OIL



This viscous tamponade agent can be useful for complex retinal detachments, but it requires finesse.

BY ARIEL TYRING, MD; STEVEN S. SARAF, MD; AND LISA C. OLMOS DE KOO, MD

Silicone oil was first described as an intraocular tamponade for retinal detachment in 1962 by Cibis and colleagues.¹ Indications for the use of silicone oil tamponade include complex retinal detachments due to proliferative vitreoretinopathy (PVR), giant retinal tears, traumatic retinal detachments, and some cases of tractional retinal detachments (TRD).² There are several advantages to using silicone oil over gas as a tamponade agent. Unlike gas, silicone oil remains in the eye until it

is surgically removed and thus may be beneficial for inferior detachments or in patients who are unable to cooperate with postoperative positioning requirements (Figure 1). Additionally, silicone oil volume is unaffected by atmospheric pressure, so it may be used in patients who must undertake high altitude travel.³

COMPARISON OF SILICONE OILS

Silicone oil is a manmade synthetic substance composed of repeating units of siloxane (Si-O). Features of

silicone oil that make it a useful tamponade agent include surface tension and viscosity. Silicone oil is available in 1,000 cs and 5,000 cs forms.⁴ Heavy silicone oil is denser than water, but these products, such as Densiron 68 and Densiron Xtra (Fluron) and Oxane HD (Bausch + Lomb), are not currently available in the United States.

Both 1,000 cs and 5,000 cs oil have similar surface tensions (21.2 mN/m and 21.3 mN/m, respectively) but differ in molecular weights (37 kDa and 65 kDa, respectively) and viscosities.³

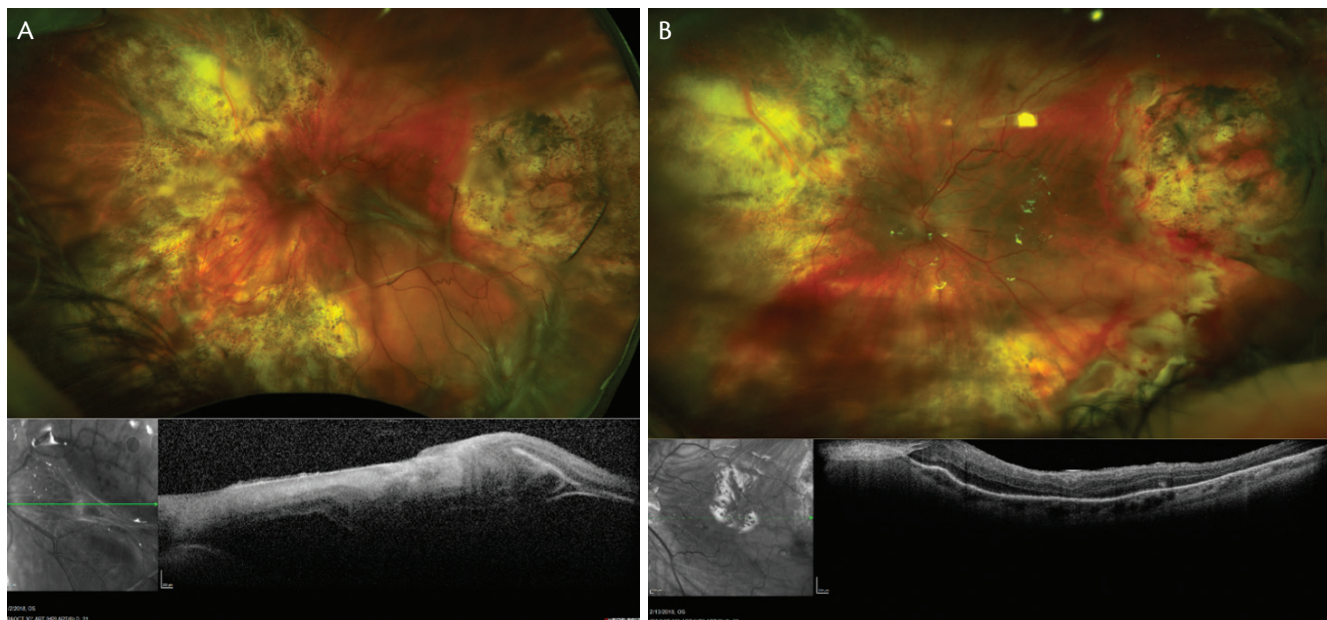


Figure 1. Optomap (Optos) widefield fundus photo and OCT images of silicone oil tamponade for an inferior retinal detachment with associated PVR, preoperatively (A) and postoperatively (B).

In a review of 325 eyes with complex retinal detachment, no differences were observed in anatomic or visual outcomes between 1,000 cs and 5,000 cs oil.⁵ A similar review of 82 eyes found no significant differences between the two groups with respect to outcomes or complication rates at 1 year.⁴ However, higher viscosity silicone oils (5,000 cs) are more resistant to emulsification over time.⁵

With the use of small-gauge cannulas during vitrectomy surgery, injection and removal of the higher viscosity 5,000 cs silicone oil becomes more difficult. Despite its higher rate of emulsification, some surgeons prefer using lower viscosity 1,000 cs silicone oil for its efficiency and ease of instillation and removal, and because it gives surgeons better ability to assess fill in real time by direct observation of silicone oil reflux into the infusion line or chimney.⁵

POINTERS FOR SUCCESS WITH SILICONE OIL



1 INSTILLATION OF SILICONE OIL

Silicone oil may be instilled following a fluid-air exchange or by direct perfluorocarbon (PFO)–silicone oil exchange. Direct PFO-oil exchange is useful when there is a risk of retinal slippage, especially in cases of giant retinal tears. Direct PFO-oil exchange requires use of chandelier illumination unless an assistant is present. This technique requires practice and patience, but is effective in minimizing retinal slippage. It may be achieved by performing active infusion of silicone oil via a viscous fluid cannula together with passive efflux of the PFO via a soft-tipped backflush needle held at the base of the PFO.⁶ Bimanual modes (simultaneous active infusion and extraction) are also available on some vitrectomy units, allowing a regular soft-tipped cannula to be used.



2 ATTAINING IDEAL OIL FILL

Ensuring adequate silicone oil fill intraoperatively is imperative to achieving sufficient intraocular tamponade. When there is oil underfill, the inferior retina is exposed and prone to the development of PVR and/or recurrent detachments due to insufficient tamponade. On the other hand, oil overfill can lead to increased IOP, glaucoma, corneal decompensation, and pain.^{3,4}

Inadvertent oil underfilling can be avoided by gradually decreasing air infusion until it is at zero and moving the chimney to different ports to drain off trapped pockets of air. Special attention to the oil meniscus, the infusion line, and the chimney will help prevent overfill.



3 USE OF SILICONE OIL IN APHAKIA

Silicone oil poses additional challenges in the setting of an aphakic eye, as oil migration to the anterior chamber can result in glaucoma and corneal decompensation. Several

steps can be taken intraoperatively to prevent oil prolapse into the anterior chamber. If lensectomy is being performed at the time of silicone oil fill, preserving the anterior capsule can provide an effective barrier, but it is important to make a central capsulotomy so as not to lose view of the fundus postoperatively when the capsule opacifies. Leaving an air-filled anterior chamber and applying a small rim of dispersive viscoelastic around the pupillary border just prior to oil infusion can be useful to prevent oil from entering the anterior chamber. An inferior peripheral iridotomy is also important to prevent pupillary block. In eyes with iris loss (such as in trauma), iris retention sutures have been described to create a barrier between the oil and the anterior chamber.⁷ Finally, postoperative facedown positioning will help keep the oil confined to the posterior segment.



4 INTRAOCULAR DURATION AND COMPLICATIONS

Although silicone oil is chemically inert and may remain

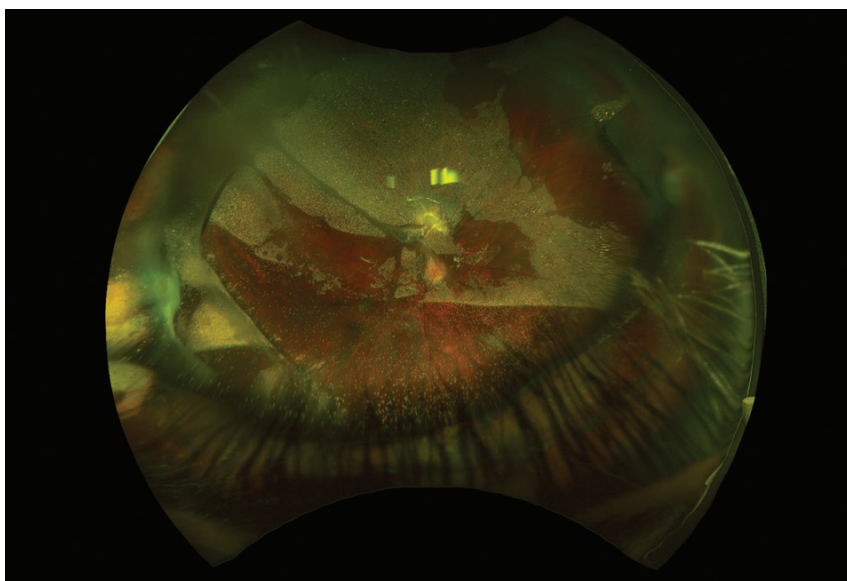
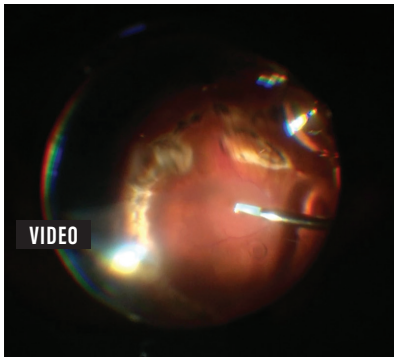


Figure 2. Optomap widefield fundus photo of a 16-year-old patient with a history of retinal detachment due to trauma in whom silicone oil emulsification occurred approximately 2 years after instillation, resulting in decreased fundus view for the ophthalmologist and decreased visual acuity for the patient.

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in the eye for extended periods of time, its use is generally intended to be temporary, as complications may develop with prolonged intraocular duration. Silicone oil can be associated with the formation of cataract, elevation of IOP, and the onset of corneal complications including edema and band keratopathy. Some reports have described unexplained vision loss after use or removal of silicone oil accompanied by loss of foveal depression and scotoma on microperimetry.^{8,9} The mechanism of vision loss in these cases is unknown and remains difficult to elucidate.

Many of the complications associated with oil use are secondary to its emulsification.³ Over time, the surface tension of the oil decreases and the oil emulsifies, which can obscure the view to the fundus (Figure 2). Hemorrhage and intraocular inflammation can accelerate this process.¹⁰ Because higher viscosity silicone oils are more resistant to emulsification, they are the preferred choice when prolonged duration of intraocular tamponade is anticipated. Additionally, placement of a scleral buckle has been shown to reduce rates of emulsification in some cases.¹¹

The optimal timing for silicone oil removal is not universally agreed upon, but many surgeons recommend a minimum of 3 to 6 months of intraocular tamponade before removal.¹² Several studies have found

that the duration of silicone oil tamponade does not affect anatomic success or risk of redetachment.^{2,11} The reported risk of retinal redetachment after oil removal ranges from 10% to 25%, and factors that portend an increased risk of redetachment include PVR, remaining peripheral vitreous, and prior failed retinal detachment surgery.^{10,12}

Redetachment after oil removal necessitates repeat repair with replacement of oil for longer duration, often indefinitely. For this reason, it is important to counsel patients regarding the risk of redetachment and the possible need for chronic oil tamponade. Timing of oil removal should be individualized to the patient's needs with consideration of the underlying pathology and the surgeon's assessment of the risk of recurrent detachment.



OIL REMOVAL STRATEGIES

Because of the risk of complications from retained oil droplets, complete removal is desirable insofar as it is possible. Several techniques for oil removal have been proposed. We prefer the soup-and-sandwich technique described by Mandelcorn.¹³ In this approach, the bulk of the oil is aspirated using a viscous fluid extraction cannula under infusion of balanced salt solution. This is followed by a series of multiple fluid-air exchanges with the tip of the soft-tipped cannula placed at the air-fluid interface to remove the thin film of silicone oil that collects on the surface of the infusion fluid (Video). Finally, the saline solution is flushed through the anterior chamber to remove any hidden oil droplets from the angle or from behind the iris.

GREAT POTENTIAL IF USED WITH CARE

Silicone oil is a useful tool in the armamentarium of the vitreoretinal surgeon for repairing complex retinal detachments. Mastering its use requires practice and patience.

Selection of oil type may depend on the individual case. Ensuring adequate oil fill and avoiding overfill are important for preventing complications. Timing of oil removal is best planned in an individualized manner. With attention to these details, silicone oil can be a useful and safe tamponade agent. ■

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LISA C. OLMOS DE KOO, MD

- Associate Professor of Ophthalmology, University of Washington, Seattle, Washington
- lolmos@uw.edu
- Financial disclosure: No relevant disclosures

STEVEN S. SARAF, MD

- Retina Fellow, University of Washington, Seattle, Washington
- sarafs@uw.edu
- Financial disclosure: None

ARIEL TYRING, MD

- Retina Fellow, University of Washington, Seattle, Washington
- atyring@uw.edu
- Financial disclosure: None