Chandelier Lighting During Vitreoretinal Surgery

This form of endoillumination may be beneficial in several surgical scenarios.

BY MATTHEW T. WITMER, MD; AND R.V. PAUL CHAN, MD

In this issue of Retina Today, Matthew T. Witmer, MD, and R.V. Paul Chan, MD, discuss the advantages and disadvantages of chandelier lighting systems.

We extend an invitation to readers to submit pearls for publication in Retina Today. Please send submissions for consideration to Dean Eliott, MD (dean_eliot@meei.harvard.edu); or Ingrid U. Scott, MD, MPH (iscott@psu.edu). We look forward to hearing from you.

— Dean Eliott, MD; and Ingrid U. Scott, MD, MPH

Adequate visualization of the retina is critical to the success of vitreoretinal surgery. The advent of endoillumination represents a substantial improvement in the way that surgeons are able to visualize the retina because, compared with prior surgical viewing modalities, it decreases the reflections and scattering from ocular structures such as the cornea, lens, intraocular lens implant, and vitreous.

Chandelier lighting systems provide a stationary and diffuse form of endoillumination from an anterior location.1 Currently, several companies manufacture chandelier lighting systems, including Insight Instruments with the Tornambe Torpedo,2 Alcon, Synergetics, and DORC. Typically, these products are available in 23- and 25-gauge formats.3 More recently, 27- and 29-gauge models have become available.4,5 Some models of chandelier light probes may be placed into traditional trocar systems (Figures 1 and 2), while others require a separate tool to create the sclerotomy incision. The chandelier systems currently available are either single- or dual-fiber systems, and some provide simultaneous infusion.

ADVANTAGES

Chandeliers offer several advantages over the use of a separate endoilluminator probe. The principal advantage is that chandeliers enable bimanual surgery because 1 hand of the surgeon is not required to hold the endoilluminator.

The principal advantage is that chandeliers enable bimanual surgery because 1 hand of the surgeon is not required to hold the endoilluminator. The surgeon is able to use the vitreous cutter or scissors in 1 hand and forceps in the other hand. This affords the surgeon more versatility during surgery and is preferred by some surgeons in complex cases such as proliferative vitreoretinopathy, giant retinal tears, intraocular foreign body, pars plana lensectomy for dropped nucleus, and tractional retinal detachments.

The diffuse illumination provided by chandeliers can
enhance visualization and facilitate the recording of surgical videos by providing constant, consistent illumination during the case. In addition, the chandelier lighting system enables the surgeon to complete many cases without the need of an assistant. One may also consider using a chandelier when performing endoscopic surgery.

**PHOTOTOXICITY**

With any illumination system applied to the retina, including with the use of a chandelier lighting system, there is a potential risk of phototoxicity. Damage to the retina by illumination has been documented for decades in both anterior segment and vitreoretinal procedures. Light-induced thermal damage to the retina, however, is dependent on several factors. These include the light source (for example, metal halide, halogen, xenon, or mercury vapor), the use of any wavelength barrier filters, the luminous flux (commonly referred to as brightness, measured in lumens), the distance of the light from the retina, and the duration of exposure.

Chandeliers have large divergence angles, spreading the light source out over a larger surface area and reducing irradiance. Irradiance is the power of the electromagnetic radiation per unit area and is typically given in the unit watts/m². The decreased irradiance theoretically decreases the risk of phototoxicity to the retina and offers another advantage of a chandelier lighting system in vitreoretinal surgery. This theory has also been tested experimentally. This reduction occurs because the working distance of the irradiance from the light source to the retina is much larger. Increasing the working distance of the light source increases the safety of the light. It is important to note, however, that chandelier illumination is immobile and does not allow the retina time to recover during periods of inactivity, such as occurs with endoillumination.

**DISADVANTAGES**

Despite its advantages, there may also be several disadvantages:

- For bimanual surgery, consider using a chandelier to facilitate visualization.
- Smaller-gauge chandelier systems can provide good illumination without the need for sutured closure of sclerotomies.
- Lighted picks and laser probes can be used in addition to a chandelier in certain situations. Surgeons should always be aware of the potential for phototoxicity.

**PEARLS FOR CHANDELIER LIGHTING**

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shortcomings to this illumination system. The insertion of a chandelier light requires at least 1 extra sclerotomy into the eye. The additional sclerotomy entails the typical risks of creating any sclerotomy, including leakage, hypotony, infection, and dislocation of the light during the procedure.

With chandelier illumination, visualization of the retina may be compromised. When using a single-fiber chandelier, there may be “shadowing” by instruments, which may interfere with the surgical field. In certain cases, the chandelier does not illuminate the entire field and, therefore, may require repositioning during the surgery. Chandelier illumination can also eliminate the surgeon’s ability to reflect the light from an endoilluminator off the vitrectomy cutter to produce a form of retroillumination. Consequently, the diffuse illumination may reduce the ability to see retinal structures clearly.

Another possible disadvantage of chandelier illumination occurs during fluid-air exchange, when the lighting may produce a substantial amount of glare. This often requires either repositioning or turning off the light. Chandeliers may also create safety issues. There have been cases reported in which the chandelier may become very hot and risk thermal damage to the retina, when the chandelier probes are under air11 or when exposed to uveal tissue or hemorrhage.12

BIMANUAL SURGERY

In certain surgical circumstances, surgeons may prefer bimanual surgery rather than having one hand occupied with an endoilluminator probe. In cases of retinal detachment with proliferative vitreoretinopathy or tractional retinal detachments, it is useful to have 2 hands to aid in peeling fibrotic membranes. One hand may use forceps to peel the membranes, and the other may be able to provide counter-traction with a second instrument, such as a pick or even the vitrector. In cases of an intraocular foreign body, a chandelier light allows 1 hand to grab the foreign body with forceps while the second hand supports the elevation of the mass. In patients with a dropped nucleus, the vitrector or fragmatome may be able to elevate the nucleus and the second instrument can be used to chop the nucleus into smaller pieces to facilitate removal by the vitrector or fragmatome. In patients with a giant retinal tear, chandelier illumination provides diffuse illumination to detect the edges of the pathology or the presence of additional retinal tears.

SUMMARY

The use of a chandelier in vitreoretinal surgery is dictated by surgeon preference. It is clear, however, that there are many potential surgical scenarios in which this form of endoillumination is beneficial.

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