Endoscopy in Pediatric Vitreoretinal Surgery

Although not a replacement for the microscope, the endoscope has an important place in retina surgery.

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Endoscopy has applicability in pediatric patients who have severe retinal disease that requires vitrectomy. In this subgroup of pediatric retina patients, the pathology is difficult to visualize fully during surgery using a conventional, microscope-based technique; as well, the presentation of the pathology may seem atypical compared to what surgeons encounter in adult cases. For example, retinal detachments secondary to retinopathy of prematurity (ROP) may be far more anteriorly displaced than those seen in adult patients and may be oriented anteroposteriorly. For these reasons, endoscopy is an important surgical tool for use in pediatric patients.

In this article, I discuss two unique clinical properties of the endoscope that make it highly applicable to pediatric patients: the surgeon’s perspective and the illumination. I also offer some surgical pearls for achieving optimal results.

ENDOSCOPY: THE SURGEON’S PERSPECTIVE

The conventional vantage point for the surgeon is to look down an operating microscope through the patient’s anterior segment and into the vitreous cavity and retina. Such conventional (contact and noncontact) systems provide a bird’s-eye view of the posterior segment through the pupil; the anterior retina is frequently the most anteriorly visible structure, although sometimes the vitreous base is visible.

The endoscope view is not through a microscope, but rather directly from within the eye. It allows the surgeon to have a side-on perspective that is approximately 90° off or perpendicular to the patient’s visual axis (Figure 1). The surgeon can look at a liquid crystal display (LCD) screen and view the inside of the eye and vitreous cavity, easily visualizing anterior structures such as the vitreous base, pars plicata, pars plana, ciliary body, lens, posterior iris surface, and even the anterior hyaloid face (see Case Study on page 42).

Children with ROP may have extremely anterior retinal detachments that are adjacent to or involve some of the aforementioned anterior structures. Endoscopy, because it depicts retroirideal structures, allows the surgeon to see the full extent of anterior and anteroposteriorly oriented pathology. This can be helpful, for example, in cases of pediatric vitreoretinopathies and

At a Glance

- Endoscopy allows the surgeon to have a side-on perspective that is approximately 90° off or perpendicular to the patient’s visual axis.
- With endoscopy, the source of intraocular illumination and the surgeon’s view of the reflected light are coaxial.
- Maintaining orientation within the eye is the key to successful endoscopy.
retinal detachments, in which success depends on the extent to which fibrovascular proliferation and traction are relieved.\(^1\)

**ENDOSCOPY: ILLUMINATION**

When conventional vitrectomy techniques through a microscope are used, light from an endoilluminator in the vitreous cavity bounces off ocular structures and is transmitted through the patient’s pupil and ocular media before being visualized by the surgeon through the operating microscope. There is dissociation between illumination from the light pipe (endoilluminator) and where the surgeon actually sees that light (ie, the intraoperative image).

The endoscope is unique because the source of intraocular illumination and the surgeon’s view of the reflected light, which has bounced off the retina/vitreous, are coaxial. In other words, both light emission and viewing occur at exactly the same point in the posterior segment, as the endoscope incorporates both illumination and viewing fibers. Because of the coaxial viewing and illumination, the vitreous and membranes appear more opaque than transparent (Figure 2). This is helpful in visualizing membranes and scar tissue that emanate from a point of traction on the retina, thereby enhancing the ability to perform safe and effective tissue dissection.\(^2\)

**STEPPING OUTSIDE YOUR COMFORT ZONE**

Following are some surgical pearls I have gathered. I find that they serve as a foundation for achieving optimal results using endoscopy in pediatric vitreoretinal patients.

- A common hesitation about using the endoscope is that the surgical experience is different. With the microscope, the surgeon receives direct visual feedback when manipulating surgical instruments. The endoscope, on the other hand, requires some relearning of hand-eye coordination, as the user is indirectly viewing surgical maneuvers on an LCD screen. Additionally, the on-screen image is 2-dimensional rather than 3-dimensional, and the surgeon has to adapt to nonstereoscopic clues, such as shadows, to judge distance.
- It is likely that retina surgeons who start using endoscopy will already have experience using vitrectomy with conventional microscope-based viewing techniques, so the learning curve should be short. It is useful to have a full viewing system set up—the endoscope as well as the microscope with a wideangle, noncontact attachment, such as the Binocular Indirect Ophthalmomicroscope (BIOM 5, Oculus Surgical) or Resight 500 (Carl Zeiss). When first attempting to use
endoscopy, I strongly recommend setting up both systems so that the surgeon can readily switch between the two viewing systems for quick and easy reorientation while dealing with the initial learning curve and to ensure that the surgery is performed safely.

- Maintaining orientation within the eye is the key to successful endoscopy. When I am operating in the anterior part of the vitreous cavity (eg, close to or anterior to the vitreous base), I always keep the patient’s lens level at the 12-o’clock position on the screen so that I know where everything is at all times. In addition to the x- and y-axes, there is an axis of rotation with the endoscope that can be disorienting. Ensuring that I keep my normal anatomic landmarks in a consistent place—anteriorly, by keeping my lens level at the top of the screen at 12-o’clock at all times or posteriorly, leveling with the horizontal meridian of the retina—limits the potential to become disoriented.

- The endoscope can have as wide as a 140° field of view or can be brought close to a point of interest with a high level of magnification to 20 µm or 30 µm, such that retinal capillaries are visible. As one varies the distance of the endoscope from a point of interest, it is important to regularly adjust the brightness to ensure optimal image illumination and visualization, which can be easily accomplished with the attached foot pedal.

- Safe surgery is the cornerstone of pediatric retinal surgery. Be sure when you are cutting with the vitrector (or performing any surgical maneuvers) that the vitrector (or other instrument) is kept within the center of the image circle of the endoscope to avoid inadvertent and unrecognized damage to adjacent ocular structures (Figure 3).

CONCLUSION

Endoscopy is a unique addition to the field of pediatric retinal surgery, affording a surgical perspective that enables access to the most anterior of pathologies that, in some cases, we would otherwise struggle to fully visualize with conventional microscope techniques. The endoscope is not a replacement for the microscope, but rather a highly useful adjunct to conventional viewing techniques in pediatric retinal disease and surgery.

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