Surgical Technique

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Illumination Techniques for Complex Pediatric Anterior Retinal Detachment and Associated Retrolental Plaque

Advanced pediatric traction retinal detachment (TRD) in conditions, such as retinopathy of prematurity and familial exudative vitreoretinopathy, may be complicated by a retrolental plaque of varying density. In particular, in Stage 5 (total TRD) or advanced subtotal TRD in both retinopathy of prematurity and familial exudative vitreoretinopathy, the retrolental plaque can be densely opaque and traverse the entire anterior hyaloid face, thus completely obscuring the view of the structures immediately behind the plaque. In such advanced diseases, multiple folds of retina typically adhere to or come very close to the back of the retrolental plaque, precluding safe entry into the posterior segment through the pars plicata. The only safe option is dissection through the plaque from an anterior segment approach. In our experience, standard microscope-based coaxial illumination (as is used for all anterior segment surgery, e.g., cataract and corneal surgery) is inadequate, for both highlighting the layers within the plaque and for identifying a safe dissection zone that is free of retinal folds immediately behind the plaque (Figure 1). Underpinning the need for better intraoperative visualization is the critical requisite to avoid an iatrogenic retinal break at all cost[1] as this has been shown to almost inevitably result in surgical failure, which includes phthisis bulbi and no light perception vision in 2 series of Stage 4B and 5 retinopathy of prematurity.[2,3] In our experience, the following techniques significantly improve upon intraoperative visualization of retrolental plaque and the adjacent underlying retina, thus optimizing safety and efficacy of surgery.

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Technique: Innovative Anterior Illumination of Retrolental Plaque and Adjacent Retina

In brief, the technique uses oblique illumination emitted from a standard endoilluminator, positioned transcorneally or intracamerally. The surgical plane is viewed and manipulated through an unlit operating microscope (see **Video, Supplemental Digital Contents 1 and 2**, http://links.lww.com/IAE/A359; http://links.lww.com/IAE/A360, which demonstrate the technique in detail).

First, the basic elements consist of (1) a standard posterior segment endoillumination probe in 20 or 23 gauge, (2) an operating microscope, and (3) a surgical assistant. A purely anterior segment approach is undertaken, with three limbus-based vitrectomy ports fashioned. The endoillumination probe is positioned obliquely with respect to the surgeon's viewing axis through the operating microscope, directed at the surgical plane of interest. The probe is positioned either intracamerally through one of the 3 ports or transcorneally (held by an assistant) when bimanual dissection is required (Figure 1). The surgical field is viewed using an unlit operating microscope.

Anterior illumination techniques:

1. Direct illumination
2. Retroillumination
3. Transscleral illumination

Direct Illumination

As opposed to a microscope-based coaxial illumination system, we use an oblique light (noncoaxial to microscope viewing axis) directed at the point of interest

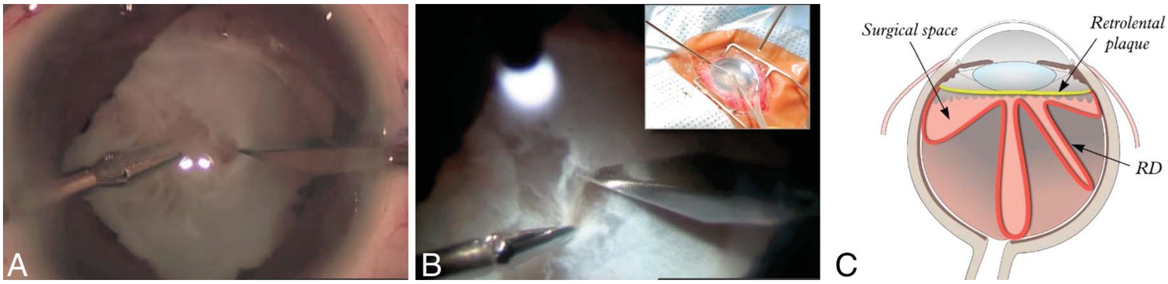

Fig. 1. Views of retrolental plaque: comparison between microscope-based coaxial illumination (**A**) and transcorneal noncoaxial oblique illumination (**B**). Note the greater amount of detail seen with the latter. **C.** Schematic of cross-section through such pediatric eyes showing typical highly elevated retinal folds directly behind an opaque retrolental plaque traversing the entire anterior hyaloid face.

(Figure 1). The resultant effect, due to the manner in which light is incident upon and reflected off the point of interest, is enhanced visualization of retrolental plaque detail. In our experience, it is significantly easier to visualize the individual plaque fibers and layers, enabling a more precise and directed tissue dissection (see **Video, Supplemental Digital Content 1**, http://links.lww.com/IAE/A359, which demonstrate the technique in detail).

Retroillumination

Taking advantage of the principles of retroillumination, the obliquely placed light probe is pointed away from and slightly to one side of the point of interest (Figure 2). Areas in the plaque that exhibit visible retroillumination (i.e., plaque looks less white and may exhibit a faint orange glow) suggest that the detached retina is some distance away from the back of the plaque, thus a potentially safe point of entry. Conversely, where there is no retroillumination (i.e., plaque still looks white), there is a good possibility a fold of retina is immediately behind the plaque and incision through the plaque at the point should be avoided if possible (see **Video, Supplemental Digital Content 1**, http://links.lww.com/IAE/A359, which demonstrate the technique in detail).

Transscleral Illumination

This is a variation on transcorneal and intracameral illumination (Figure 3). In essence, the endoilluminator is used to indent and illuminate through the sclera adjacent to the area of interest when dissecting very anteriorly and can highlight the border between tissue types, for example, retina and fibrous tissue (see **Video, Supplemental Digital Content 2**, http://links.lww.com/IAE/A360, which demonstrate the technique in detail).

Case

This is a case of a premature infant, born at a gestational age of 29 weeks and birthweight of 1200 g (Figure 4). She presented to us quite late at 53-week postmenstrual age with bilateral Stage 5 retinopathy of prematurity (total TRD). In the first eye, a 3-port limbus-based vitrectomy was performed, beginning with lensectomy, followed by retrolental plaque removal, vitrectomy, and membrane peeling. The use of our aforementioned techniques, particularly direct and retroillumination, enabled safe dissection through the retrolental plaque while avoiding an iatrogenic retinal break. An air tamponade was left in situ at the end of the case. A success anatomical outcome was achieved, indicated by the partially reattached posterior

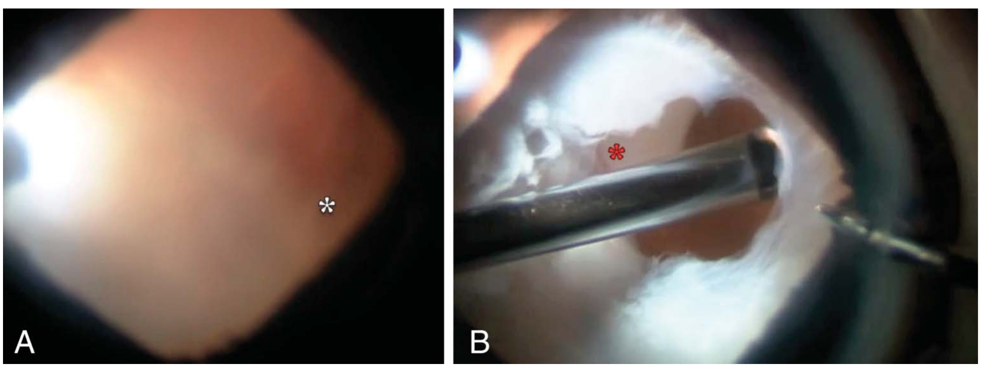

Fig. 2. Retroillumination of retrolental plaque. **A.** Intracameral oblique light is used to illuminate the left-half of the retrolental plaque. Retroillumination is evident on the right edge of the plaque (white asterisk), (**B**) dissection through that retroilluminated area of the plaque confirmed no elevated retina immediately behind it. Note that there is highly elevated retina immediately behind the plaque close to the incised area (red asterisk), confirming the significant risk of iatrogenic retinal break during retrolental plaque dissection.

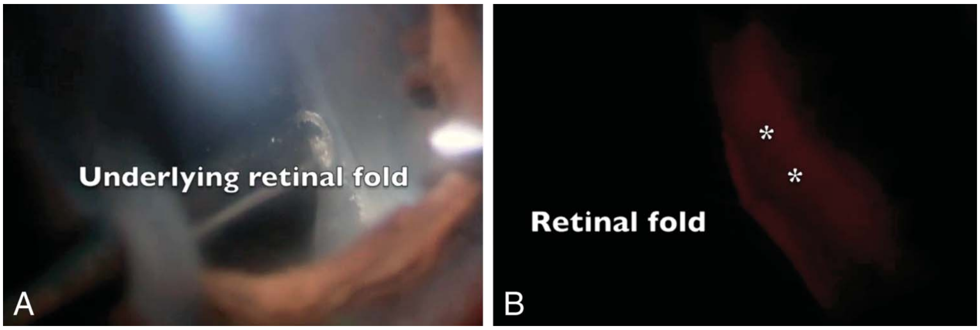

Fig. 3. Transscleral illumination. **A.** It was difficult to be certain if there was retina adjacent to an area of fibrous tissue when cutting very anteriorly with a vitrector. **B.** Transscleral illumination confirmed a retinal fold (white asterisks) to the immediate right of a band of fibrous tissue.

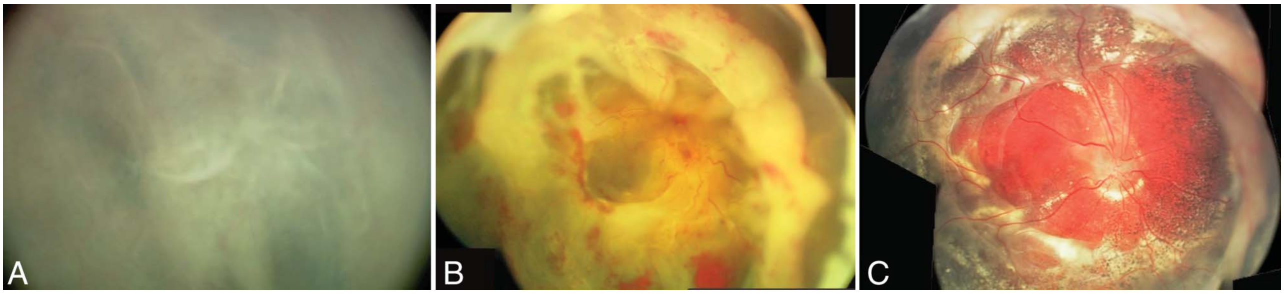

Fig. 4. Case. **A.** RetCam image through lens showing dense retrolental plaque and a very vague view of underlying highly elevated folds of retina. Dissection through the retrolental plaque was performed using the techniques described in this article. **B.** One week postoperatively with a total TRD evident. **C.** Three months postoperatively with a partially attached posterior pole without further surgery.

pole at 3 months, which remained stable at 6 months (see **Video, Supplemental Digital Content 2**, http://links.lww.com/IAE/A360, which illustrates the case).

Conclusion

Advanced anterior pediatric TRD are particularly challenging to manage with a significant risk of sight-threatening iatrogenic retinal break. In our experience, the use of these anterior illumination techniques significantly enhances visualization and enables safer surgical manipulation of fibrovascular tissue and retina.

Key words: retrolental plaque, pediatric retina, retinal detachment, traction, anterior segment illumination, limbus-based surgery, retro-illumination, microscope, endo-illumination.

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