

# Shallow Anterior Chamber

Tips for determining and managing the source.

BY WILLIAM J. FISHKIND, MD, FACS

It is uncommon but disturbing when the anterior chamber becomes shallow during phacoemulsification. Recognizing the complication early helps the surgeon to prevent damage to the endothelium or iris as well as tears in the posterior capsule.

## CLASSIFICATION

The anterior chamber may become shallow due to three main causes. First, fluid outflow through the paracentesis or main incision may be excessive, or an overly high flow setting on the phaco machine may pull a large volume of fluid out of the anterior chamber and through the phaco needle. Second, inflow may be insufficient due to either an obstruction in the phaco tip's sleeve or an inadequate bottle height. Third, positive posterior pressure may develop due to (1) mechanical pressure from a tight speculum or drapes or from a retrobulbar hemorrhage; (2) fluid misdirection syndrome; (3) a suprachoroidal effusion; or (4) a suprachoroidal hemorrhage.

If the paracentesis or main incision is leaking excessively (both caused by poor wound construction), the surgeon should tighten either incision with sutures. If the inflow is insufficient, the physician should enlarge the incision to improve flow through the sleeve or raise the infusion bottle.

It is usually easy to correct mechanical causes of a shallow anterior chamber by loosening the speculum or drapes and by watching for a retrobulbar hemorrhage. After eliminating these causes, the surgeon will

know that the shallow chamber is due to either fluid misdirection or a suprachoroidal effusion. By placing a finger on the eye, the ophthalmologist will be able to sense if the pressure is elevated and the globe firm, findings that confirm a fluid misdirection syndrome or suprachoroidal effusion/hemorrhage.

## FLUID MISDIRECTION SYNDROME

### Pathophysiology

Fluid misdirection syndrome occurs when irrigating fluid passes into the vitreous through intact zonules or through a zonular or capsular tear. The zonular/iris diaphragm acts like a one-way valve. Fluid flows into the vitreous and cannot escape, thus causing vitreous hydration, an expanded volume of vitreous, and subsequently elevated pressure in the posterior segment. As this pressure builds, the lens and iris move forward, markedly decreasing the working space in the anterior chamber. If the surgeon proceeds, more fluid will pass into the vitreous, and the problem will worsen (Figure 1).

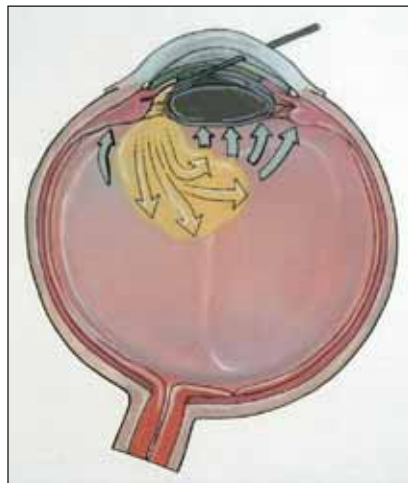


Figure 1. When irrigation fluid passes through the intact zonules into the vitreous, the result is hydration of the vitreous and a shallow anterior chamber. (Reprinted with permission from Fishkind WJ, ed. *Complications in Phacoemulsification: Avoidance, Recognition, and Management*. 1st ed. New York, NY: Thieme Medical Publishers; 2002.)

### Risk Factors

Several risk factors are likely to give rise to fluid misdirection syndrome. Anything that disrupts the zonular apparatus may allow fluid to pass into the posterior segment: pseudoexfoliation syndrome, previous ocular trauma, a radial tear in the anterior capsule, zonulysis, and any opening in the posterior capsule. A small pupil and a narrow

angle may hide these peripheral capsular defects and thereby delay the surgeon's recognition of fluid misdirection syndrome.

### Timing

Fluid deviation can occur during any phase of the operation when the surgeon infuses fluid into the eye. The ophthalmologist must be aware that hydrodissection, phacoemulsification, and I/A can all cause fluid misdirection and positive pressure.

During hydrodissection, the surgeon inadvertently may not place the cannula under the anterior capsule but under it and thus inject fluid directly through the zonules. This error forces injected fluid to pass through the zonules into the vitreous. In another scenario described by Updegraff et al<sup>1</sup> involving small pupils, injected fluid travels under the anterior capsule and elevates the capsule and lens, thereby causing pupillary block. These investigators proposed that the viscoelastic might contribute to an iridocapsular seal by causing the iris to adhere to the capsule and prevent fluid's egress.

Phacoemulsification may force the fluid posteriorly if a dense viscoelastic prevents the adequate anterior circulation of fluid and the bottle is relatively high. This problem occurs when an occult radial capsular tear or small area of zonulysis develops. An intact vitreous face closes the one-way valve that leads to elevated posterior pressure.

During I/A, aggressively attempting to aspirate subincisional cortex can misdirect fluid. A small, iatrogenic, anterior capsular tear can allow the infusion of BSS into the vitreous, a situation that usually forces the iris up into the incision with positive posterior pressure. Even aspirating the viscoelastic from the eye after placing the lens can lead to BSS misdirection and a shallow anterior chamber. This phenomenon can occur if the surgeon is intent on removing all traces of viscoelastic behind the IOL and there is a small opening in the zonular-capsular diaphragm.<sup>2</sup>

### Diagnostic Tests

An evaluation with an indirect ophthalmoscope or the use of an Osher Emergency Lens to view the posterior segment will reveal a normal periphery that indicates aqueous

misdirection, or it may show an elevated choroidal mass, which would indicate suprachoroidal hemorrhage.

### Treatment

After verifying that a suprachoroidal effusion/hemorrhage has not occurred, the surgeon can alleviate increased IOP by performing a pars plana vitreous tap. Confirming the diagnosis is imperative; a vitreous tap in the presence of a suprachoroidal effusion/hemorrhage is disastrous, because it dramatically worsens the situation. To perform a tap, one should insert a 23-gauge needle 3mm posterior to the limbus and direct it toward the central anterior vitreous until one can visualize the needle's tip through the pupil. Slowly withdrawing 0.1 to 0.3mL of liquid vitreous should deepen the anterior chamber sufficiently to allow the completion of the procedure.

An alternative albeit slower treatment regimen is first to lower rather than raise the bottle to decrease fluid inflow. After intravenously administering Diamox (500mg in an IV push) (Wyeth Pharmaceuticals, Philadelphia, PA) and/or mannitol (1 to 2g/kg of a 25% solution), the surgeon should wait approximately 20 minutes for the drug(s) to take effect, the eye to stabilize and soften, and the chamber to deepen. If the globe remains firm and the chamber is still shallow after this treatment, one should suspect a suprachoroidal effusion. In this situation, it is best to interrupt the surgery and complete the procedure a few days to 1 week later.

### Suprachoroidal Effusion/Hemorrhage

Suprachoroidal effusion is caused by the rupture of the short posterior ciliary vessels with a subsequent outpouring of plasma and blood into the suprachoroidal space. This complication commonly occurs upon the withdrawal of the phaco or I/A tip. The sudden hypotony thus produced is the driving force for damage to the short, posterior ciliary vessels. Extravasation of plasma into the suprachoroidal space ensues. Subsequently increased IOP limits the total amount of extravasated material, and it effectively tamponades the continued accumulation of fluid and prevents hemorrhage. If the surgeon opens the wound, the resultant hypotony will allow continued effusion and eventu-

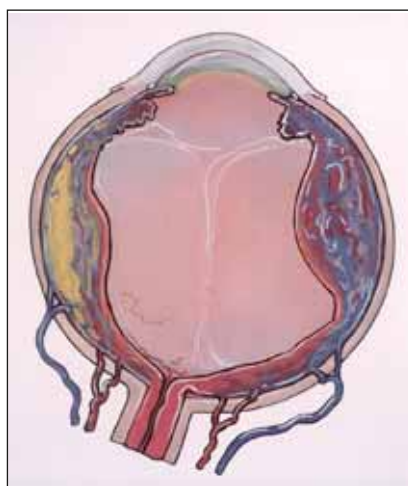
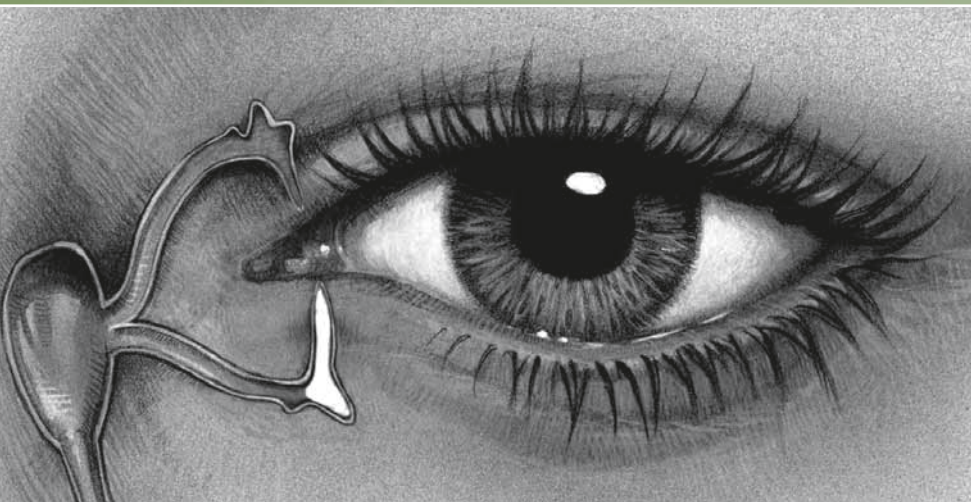


Figure 2. A suprachoroidal effusion appears at left and a suprachoroidal hemorrhage at right. (Reprinted with permission from Fishkind WJ, ed. *Complications in Phacoemulsification: Avoidance, Recognition, and Management*. 1st ed. New York, NY: Thieme Medical Publishers; 2002.)

## One Size Fits All

There's a new advance in Dry Eye treatment. It's called Form Fit™.

- No Forceps
- No Broken Plugs
- Easy To Remove



For more information contact OASIS or visit the **OASIS booth #1439** at ASCRS '05.

TEL 909.305.5400  
FAX 909.305.9987  
www.OasisMedical.com

OASIS® 

*Providing the highest quality products to the eye care professional*

ally hemorrhage with the resultant extravasation of intraocular contents (Figure 2).

Under no circumstance should the surgeon attempt converting to an extracapsular cataract extraction, because an enlarged wound will destabilize the eye and allow a suprachoroidal effusion to become hemorrhagic, leading to an expulsive hemorrhage.

Fluid misdirection will generally respond to the treatment previously described. The surgeon can then cautiously proceed with a lower infusion pressure. Because suprachoroidal effusion/hemorrhage will usually not respond to treatment, waiting 24 hours to complete the case is a reasonable and safe compromise.

As with most potential complications, the key to successfully completing cataract surgery in the presence of a shallow anterior chamber is recognizing the problem early, making a sound diagnosis, thoughtfully assessing one's surgical options, and proceeding with a suitable management strategy. ■

*William J. Fishkind, MD, FACS, is Codirector of Fishkind and Bakewell Eye Care and Surgery Center in Tucson, Arizona, and Clinical Professor of Ophthalmology at the University of Utah in Salt Lake City. He is a consultant to Advanced Medical Optics, Inc., and is the editor of Complications in Phacoemulsification: Avoidance, Recognition, and Management, from which the information contained in this article is partly derived. Dr. Fishkind may be reached at (520) 293-6740; wfishkind@earthlink.net.*



1. Updegraff SA, Peyman GA, McDonald MB. Pupillary block during cataract surgery. *Am J Ophthalmol.* 1994;117:328-332.

2. Arnold PN. Positive pressure. In: Fishkind WJ, ed. *Complications in Phacoemulsification: Avoidance, Recognition, and Management.* 1st ed. New York, NY: Thieme Medical Publishers; 2002: 63-74.