

Weak Zonules

Identifying the subtle signs of zonular damage.

BY ROBERT H. OSHER, MD

One of the most dramatic triumphs in cataract surgery is surgeons' improved ability to manage a patient with weak zonules. When I was in training at the Bascom Palmer Eye Institute in Miami and at the Wills Eye Hospital in Philadelphia, I learned that a patient with either a congenital or acquired zonular problem was in serious trouble. Yet, removing the entire lens, especially when phacodonesis was absent, and implanting an ACIOL in a young patient seemed like a suboptimal solution. For that reason, I accepted the challenge of tackling the loose lens with phacoemulsification, one of five contraindications to the procedure defined by Charles Kelman, MD, in the mid-1980s. Preserving all, or a portion, of the capsular bag for the fixation of the IOL seemed worth the effort, especially because my phaco equipment was modified to allow the surgeon variable control of the level of ultrasound power, aspiration rate, vacuum level, and bottle height in a technique I named *slow-motion phacoemulsification*.

The method of IOL fixation was often more problematic than removing the loose lens, and I experimented with asymmetric fixation, crimping prolene haptics, and even sewing through the capsular bag. Although the method of IOL fixation was difficult and often frustrating, the surgical results were very favor-

"One of the most dramatic triumphs in cataract surgery is surgeons' improved ability to manage a patient with weak zonules."

able when I presented my initial series at the American Intra-Ocular Implant Society in 1986.¹

EARLY MANAGEMENT OF WEAKENED ZONULES

A trip to Germany in 1992 abruptly changed my thinking. I was awestruck by the presentation by Ulrich Legler, MD, and Bernd Witschel, MD, who were using the capsular tension ring (CTR; Morcher GmbH, Stuttgart, Germany) to re-expand, tauten, and stabilize the compromised capsular bag.² One of my previous Fellows, Robert Cionni, MD, and I brought the CTR to the US the following year, and the likelihood of achieving successful endocapsular fixation of the lens markedly improved. In the cases of profound zonular weakness, I developed a method of creating synthetic zonules with prolene sutures around the CTR, an advanced technique that became unnecessary when Dr. Cionni developed his innovative modification of the CTR (not

FDA approved).³ I still cannot believe how great his cases looked!

DIAGNOSTIC METHODS

Identifying Subtle Signs

The outcome of cataract surgery performed in an eye with zonular damage often depends upon the surgeon's preparedness. Minimizing intraoperative complications by modifying the surgical technique and having access to a CTR requires that the surgeon make the initial diagnosis of zonular weakness in the office, rather than in the OR. Phacodonesis, iridodonesis, vitreous prolapse, and an obvious subluxation of the lens make the diagnosis easy. However, the diagnosis of compromised zonules is sometimes only possible if a careful examination reveals any one of a number of more subtle signs that my colleagues and I have identified.⁴

"The outcome of cataract surgery performed in an eye with zonular damage often depends upon the surgeon's preparedness."

Iridolenticular Gap

The iridolenticular gap sign is based upon the detection of a space between the anterior lens capsule and the border of the iris at the pupil. Usually, these structures appear to be contiguous as the slit lamp's beam passes across the anterior segment. A gap may signify focal zonular loss that has caused a slight posterior tilting of the lens or microsубluxation.

Decentered Nucleus

A decentered nucleus may also signify zonular weakness and can be better detected if the examiner learns to observe the cross-sectional anatomy of the lens with the slit beam. Both the fetal and the adult nucleus appear symmetrically positioned when the patient's gaze is in the primary position. Focal zonular loss may alter the usual symmetry of forces applied to the lens and result in a subtle, but significant, shift of the lens away from the area of zonular compromise.

Focal Iridodonesis

Focal iridodonesis can be observed as a subtle shimmering of the iris that is limited to several clock hours corresponding to adjacent zonular disruption. The loss of the barrier effect of the zonules permits the vitreous gel to move forward and contact the iris. As eye move-

ments cause the gel to quiver, the overlying iris also shimmers.

Vitreous Tension

Lines of vitreous tension may also signify a focal rupture of the zonules. The vitreous probably herniates forward through the zonular opening into the posterior chamber, yet it may not be visible through the pupil. The *anatomy of the invisible*, a phrase coined by Jan Worst, MD, of Haren, the Netherlands, becomes visible as vitreous strands under tension point toward the damaged zonules.

Lens Equator

Another sign of zonular weakness is the visibility of the lens equator when the patient's gaze is eccentric. Indirect ophthalmoscopy may confirm a microluxation of the lens that can be easily overlooked if the examiner only observes the anatomy of the lens in the primary position.

Lens Contour

Changes in the contour of the lens periphery may indicate a loss in zonular tension at the equator. The usual curvilinear shape may appear flat or even seem to be missing a bite if a focal zonular loss allows the elastic forces of the capsule to retract.

CONCLUSION

It is usually true that the examiner will only see what he is seeking! The eye surgeon should always carefully examine the lens with the zonules in mind. Recognizing these subtle signs may provide crucial information about the zonular integrity. ■

Robert H. Osher, MD, is a professor in the Department of Ophthalmology at the University of Cincinnati College of Medicine and is Medical Director Emeritus at the Cincinnati Eye Institute. He is also the founder and editor of the Video Journal of Cataract and Refractive Surgery. He states that he holds no financial interest in any product or company mentioned herein. Dr. Osher may be reached at (513) 984-5133; rhosher@cincinnatieye.com.



1. Osher R. Paper presented at: the American Intra-Ocular Implant Society: Los Angeles, CA; April 7-10, 1986.
2. Witel B, Legler U. The capsular ring. *Video Journal of Cataract and Refractive Surgery* [videotape]. 1993;9:4.
3. Cionni RJ, Osher RH, Snyder ME. Modified capsular tension ring use for zonular dialysis. *Ophthalmic Practice*. 1999;17:6:320-322.
4. Marques DMV, Marquess FF, Osher RH. Subtle signs of zonular damage. *J Cataract Refract Surg*. 2004;30:1295-1299.