New sign of anterior zonular dehiscence

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A new anterior capsule sign was encountered at the time of phacoemulsification surgery in an eye that had previously sustained blunt trauma. A combination of traumatic dehiscence of the anterior zonular fibers, dehiscence between the lens and capsular epithelium, and recumbency at the time of surgery is posited to be the cause of the appearance.

P hacoemulsification in the setting of zonulodialysis is challenging and has a higher propensity for complications such as vitreous loss and displacement of nuclear fragments into the vitreous. Numerous signs have been described to enhance detection at the slitlamp or intraoperatively as prompt recognition can allow planning that mitigates the risks. In addition to obvious signs such as lenticular displacement or tilt, vitreous presentation, or zonulodialysis, more subtle signs include a visible lens equator, difficulty initiating capsulorhexis, striae in the anterior capsule, or motility of the lens–capsular complex on manipulation. This report describes a new intraoperative sign in the anterior capsule of an eye that had previously sustained blunt trauma resulting in a retinal tear, which is posited to be due to injury to the anterior zonular fibers. A mechanism that would account for the appearance in this setting is proposed. Appreciation of this clinical sign may enhance the preparedness of surgeons in their approach to cataract surgery with impaired zonular integrity.

CASE REPORT

A 65-year-old man presented with reduced vision due to cataract in the left eye. He had sustained a squash ball injury to this eye 20 years previously, which had resulted in a retinal tear, which was treated with laser retinopexy. No further ophthalmic issues arose until he presented with reduced vision. There was no previous occupational exposure that would predispose to anterior capsular abnormalities or any personal or family history of syndromes associated with zonular compromise.

Preoperative uncorrected distance visual acuity was 20/40 in the right eye and 20/80 in the left, improving to 20/30 and 20/40 through pinhole, respectively. Spherical equivalent was +2.125 diopters (D) and +2.00 D, respectively. The anterior chambers appeared symmetrically deep; there was no pseudoexfoliation material visible. A grade 1 to 2 nuclear cataract was present in the right eye and grade 3 nuclear cataract in the left, commensurate with the visual acuity. No phacodonesis, iridodonesis, iridodialysis, or abnormality of the anterior capsule was evident. The left pupil was 1 mm less dilated than the right despite pharmacological mydriasis. There was an area of peripheral chorioretinal atrophy in the left eye, consistent with a previous retinal tear, and a partial-thickness (lamellar) macular hole associated with a mild epiretinal membrane. The examination was, otherwise, normal, as was the intraocular pressure. The mean keratometry was 44.65 D and 43.51 D, axial lengths were 24.32 mm and 24.46 mm, anterior chamber depth was 2.96 mm and 2.89 mm, and lens thickness was 4.86 mm and 5.0 mm in the right and left eyes, respectively.

Under the operating microscope, prior to commencement of planned phacoemulsification surgery, a circular, 6.5 mm diameter lesion was noted in the anterior capsule (Figure 1). It was visualized best when trypan blue (D.O.R.C. International BV) was irrigated from the anterior chamber (Video 1, http://links.lww.com/JC9/A350). Full-thickness redundancies of the capsule billowed back and forth in response to the jet of irrigation from the paracentesis, but they retained an approximately circular disposition. Phacodonesis and capsular striae were observed during continuous curvilinear capsulorhexis (Figure 2). No splitting or undue friability of the capsule was noted. Furthermore, mild phacodonesis was observed...
during hydrodissection and nuclear disassembly. The operation, otherwise, proceeded normally. Given the absence of more serious evidence of zonular compromise, it was decided not to use endocapsular support devices or a 3-piece intraocular lens. A 1-piece acrylic aspheric monofocal intraocular lens was inserted in the capsular bag. Care was taken to orient the haptics vertically in the eventuality that scleral fixation was subsequently required.

The patient’s postoperative recovery was prolonged by cystoid macular edema that required an additional course of topical corticosteroids and nonsteroidal anti-inflammatory drugs. No similar abnormalities in the anterior capsule were observed at the time of right cataract surgery, which was performed 2 years subsequently. Left uncorrected distance visual acuity at 2 years postoperatively was 20/30 with spherical equivalent of −0.25 D; the intraocular lens remained stable with no undue development of capsular phimosis.

**DISCUSSION**

This unusual appearance of the anterior capsule was likely related to the patient’s previous trauma and may constitute a hitherto undescribed sign of zonular compromise. There are 3 relevant observations. First, primary zonular injury can occur because of the equatorial distension caused by anteroposterior compression that accompanies blunt trauma. This is supported by an experimental model that suggested that the anterior zonular fibers rupture at lower tensile force than the other zonular fibers, although it is possible that the mode of testing—which applied tension to the anterior capsule ex vivo—may not have distributed force equally across the zonular complex. Second, the anterior capsule can be subject to significant deformation at the time of blunt injury—sufficient, in some cases, to cause rupture. Although this patient’s capsule was not ruptured, we believe that deformation on impact resulted in dehiscence between the anterior capsule and the lens epithelium, allowing the anterior capsule to shear over the lens. Finally, we speculate that dehiscence of the anterior zonular fibers allowed a posterior movement of the lens on recumbency. A similar mechanism—of anterior movement—has been described in anterior chamber depth studies in eyes with pseudoexfoliation. As this sign was apparent only when the patient was recumbent, the lens had a deceptively normal appearance on preoperative slitlamp examination. However, this observation of a circular fold of redundant anterior capsule would be explained by a posterior movement of the lens under the effect of gravity, allowing the dehisced anterior capsule to slide slightly anteriorly.

Lens liquefaction due to hypermaturity and consequent loss of anterior lenticular volume could cause anterior capsular laxity. However, this did not apply in our patient as the lens thickness was comparable between the eyes, and although dense, the cataract did not exhibit signs of hypermaturity or tumescence. The posterior capsule can also be damaged by blunt trauma, potentially allowing posterior lens movement on recumbency. Yet, in the absence of a concomitant zonular injury, neither scenario would account for phacodonesis.

Traumatic dehiscence of the anterior zonular fibers, which allowed the lens to move slightly posteriorly when recumbent, permitting dehisced regions of the anterior capsule to assume a circular configuration, would account for this appearance. Although sectoral dialysis of the anterior zonular fibers has been reported to cause the capsular equator to snap over the plane of the anterior capsule during cataract surgery, signs related specifically to anterior zonular damage are, otherwise, sparse. This unusual sign was likely a consequence of the unique forces wrought on the patient’s eye at the time of injury, which were sufficient to cause this pattern of injury without a more serious zonular dehiscence that would have resulted in more substantial preoperative or intraoperative signs. Ultrasound biomicroscopy can be
used to evaluate zonular integrity prior to cataract surgery when there is suspicion of zonular injury, and deficiencies may be evident as an interruption of the hyperreflective zonular signal, with or without increased curvature of the peripheral anterior lens capsule. Asessment of the anterior capsule with optical coherence tomography of the anterior segment may also be valuable, within the limits of an erect examination. Otherwise, in patients in whom there is sufficient clinical suspicion of a subtle zonular injury, it may be warranted to perform a preoperative, supine examination with a portable slitlamp, or a clinic-based microscope that can elicit a red reflex, to determine whether a similar sign is present.

WHAT WAS KNOWN
• Phacoemulsification surgery in the setting of zonulodialysis is more challenging and more likely to result in complications.
• Prior recognition, especially in subtle cases, can be challenging.

WHAT THIS PAPER ADDS
• A sign associated with circumferential injury of the anterior zonular fibers has not previously been reported.
• Isolated injury of the zonular apparatus may result in this unique clinical sign.

REFERENCES

Disclosures: None reported.

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