

Capsulorhexis challenge with long anterior lens zonules

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1. Case report

A 90-year-old African American female with prominent long anterior zonules (LAZ) (Fig. 1) underwent phacoemulsification for a combined cataract. She was hyperopic (4 D) and had moderate stage open-angle glaucoma. LAZ were distributed through 360° on the anterior lens capsule, and the zonule-free zone (ZFZ) was 2.5–3.0 mm wide (Fig. 2A). Since it was impractical to avoid the zonules, continuous curvilinear capsulorhexis was directed through them. At some of the zonules, the capsule would begin to tear radially along the fibers, but regripping it at those points would re-establish control and break through the zonule barriers until the capsulotomy was complete. No post-operative complications occurred.

After its collection, the capsular specimen was processed for scanning electron microscopy. Fig. 2B shows an overview of one of the LAZ fibers, which has branching sub-fibers. Higher magnification (Fig. 3) of this fiber reveals a regularly-arranged substructure composed of tightly-packed microfibrils.

2. Discussion

During slit lamp exam, LAZ are observed as fine, radially-oriented lines on the anterior capsule, often pigmented due to abrasion against the iris pigment epithelium. Other pigment dispersion signs may occur, including Krukenberg spindle formation and trabecular pigmentation. In addition to potential association with late-onset retinal degeneration

(L-ORD)¹ and glaucoma,^{1,2} LAZ also have drawn attention because their presence reduces the ZFZ. This raises the concern that when fibers are inevitably severed during capsulotomy, the risk of radial capsular tearing and intraocular lens dislocation may be increased.³

Current understanding suggests there are at least two phenotypic LAZ varieties. One type, which is rare, manifests in early adulthood and may signal predisposition for L-ORD.¹ This autosomal dominant LAZ variety occurs with a serine to arginine (S163R) substitution in the complement 1q tumor necrosis factor-related protein 5 (C1QTNF5) gene. Another LAZ subtype, with unknown etiology, is more common in hyperopic females with age > 50 years.²

Although previous investigation has described the general morphology and distribution of LAZ, as viewed with slit lamp biomicroscopy, the substructure and composition of idiopathic, age-associated LAZ remain unknown.⁴ We are unaware of any comparable, high-



Fig. 1. LAZ prior to surgery, showing variable central extension (arrows).

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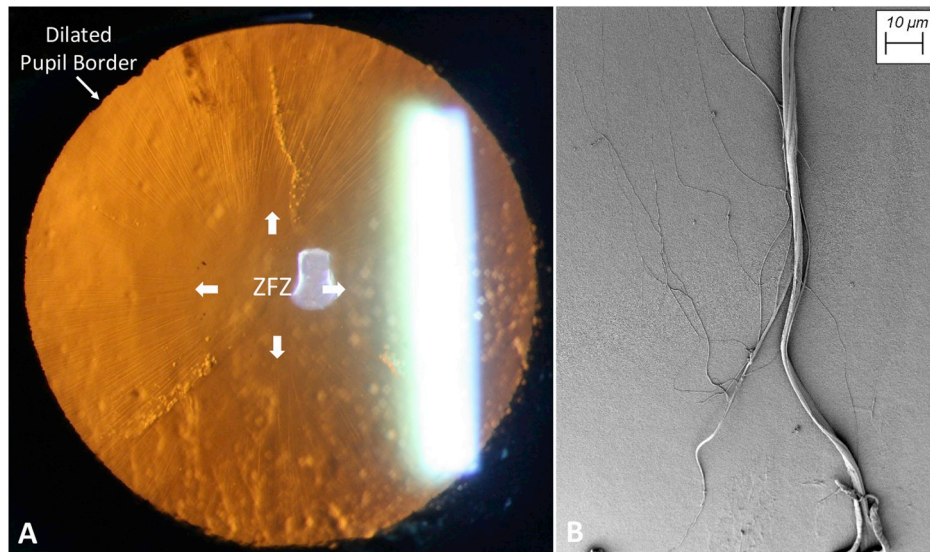


Fig. 2. A. Overview of LAZ, showing the small, zonule-free zone (ZFZ) (arrows). B. SEM image of a LAZ fiber with branching sub-fibers.

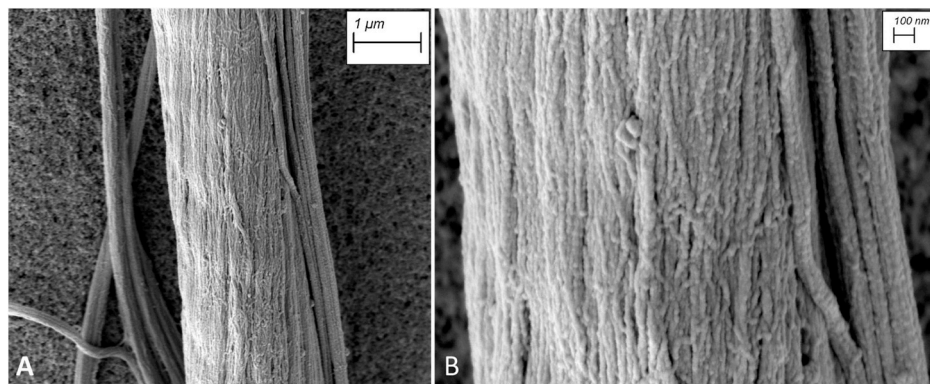


Fig. 3. A, B. Higher magnification of the LAZ in Fig. 2B, showing its tightly-packed microfibrils.

resolution images of idiopathic LAZ in the literature. In future studies, it will be of interest to compare the sub-structure revealed in the current study with that of normal zonular fibers projecting from the ciliary body to the lens equator. This case exemplifies the potential significance of the idiopathic LAZ trait and provides insight into the zonular substructure.

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Authorship

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Patient consent

The patient provided written and verbal consent to use de-identified clinical details and images.

CRediT authorship contribution statement

Susan Ksiazek: Conceptualization, Investigation, Resources, Writing - original draft. **Wendell B. Jones:** Investigation, Writing -

review & editing. **Steven Bassnett:** Funding acquisition, Resources, Supervision, Writing - review & editing. **Daniel K. Roberts:** Conceptualization, Funding acquisition, Investigation, Resources, Supervision, Writing - review & editing.

Declaration of competing interest

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