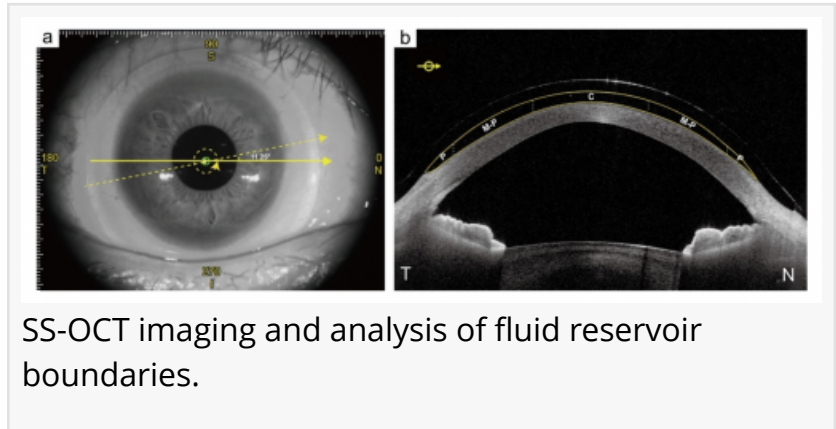


Mapping fluid reservoir dynamics in scleral lens wear

FAYETTEVILLE, GA, UNITED STATES,
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-- Researchers have demonstrated how fluid reservoir thickness beneath scleral contact lenses changes dynamically across the entire cornea during short-term wear. Using advanced wide-angle [optical coherence tomography](#) (OCT) and customized computer software, the study captured high-resolution measurements over four hours of lens wear in both healthy and irregular corneas.



SS-OCT imaging and analysis of fluid reservoir boundaries.

Scleral lenses create a fluid-filled reservoir between the cornea and the lens, which plays a critical role in visual correction and eye health. While a sufficiently thick reservoir supports optical quality, excessive thickness can lead to lens decentration, corneal edema, or midday fogging. Conversely, inadequate clearance may result in mechanical trauma to the cornea. Previous research has largely focused on the central cornea, overlooking peripheral variations that may contribute to complications. As scleral lenses gradually settle into ocular tissues, regional differences in fluid reservoir thickness become clinically relevant. Due to these challenges, comprehensive evaluation of fluid reservoir changes across the entire cornea is needed.

A research team from Wenzhou Medical University, in collaboration with Queensland University of Technology, published (DOI: [10.1186/s40662-025-00443-3](#)) their study in [Eye and Vision](#) on July 14, 2025. The work applied wide-angle optical coherence tomography (OCT) imaging and automated software analysis to examine how scleral lens settling affects fluid reservoir thickness across a 12 mm corneal diameter. By studying participants with both regular and irregular corneas, the researchers addressed a long-standing limitation in scleral lens research: the lack of full-cornea assessment. Their results provide a more complete understanding of scleral lens fitting dynamics and clinical management.

The study included 75 participants: 29 with regular myopic corneas, 35 with keratoconus, and 11 post-keratoplasty. Customized scleral lenses were fitted, and OCT scans were performed

immediately after lens application and up to four hours later. Results revealed that reservoir thickness decreased significantly across all groups, averaging reductions of 165 μm in myopia, 154 μm in keratoconus, and 148 μm post-keratoplasty. Approximately 73% of the total reduction occurred within the first two hours of wear. Importantly, patterns varied by region: in myopia and post-keratoplasty, the thinnest reservoir was in the superior mid-periphery, while in keratoconus, it was central. For all groups, the thickest reservoir was inferior, creating vertical asymmetry along the cornea. These results confirm that scleral lens settling is most dynamic early in wear and emphasize the role of corneal morphology and lens decentration in shaping reservoir distribution. The study highlights that evaluating only the central cornea is insufficient, as peripheral asymmetries may affect oxygen delivery, optical quality, and long-term safety of lens wear.

“Our findings showed that the scleral lens reservoir undergoes rapid changes, particularly within the first two hours, and that these changes were consistent between regular and irregulars cornea groups,” said Dr. Jun Jiang, one of the study’s senior authors. “This vertical asymmetry is important for clinicians to consider, as it can influence both comfort and visual outcomes. By using wide-angle OCT and automated analysis, we can now obtain a more accurate and clinically meaningful assessment of the reservoir, which will guide safer and more effective scleral lens fitting.”

These findings have direct clinical implications for contact lens practitioners and patients with complex corneal conditions. By identifying regional differences in fluid reservoir thickness, clinicians can adjust scleral lens fitting to improve comfort, visual performance, and oxygen delivery to the cornea. This is particularly significant for patients with keratoconus or post-keratoplasty, where lens decentration and corneal irregularities are common. The use of wide-angle OCT imaging combined with automated analysis offers a powerful diagnostic approach for refining lens design and reducing complications such as edema or midday fogging. In the long term, this methodology may guide personalized scleral lens fitting and enhance ocular health outcomes.

References

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