

Preoperative Corneal Densitometry and Adjustment Burden After Light-Adjustable Lens Implantation in Post-Refractive Eyes

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BACKGROUND

- Cataract surgery after LASIK/PRK is challenging because corneal changes reduce IOL-power accuracy and increase higher-order aberrations (HOAs).
- The Light-Adjustable Lens (LAL) corrects residual refractive error post-operatively through UV light-delivery device (LDD) treatments, which is useful for post-refractive eyes.
- Pentacam corneal densitometry quantifies stromal light scatter and is a candidate marker of cornea-driven adjustment difficulty, but its role in LAL planning is unknown.
- **AIM:** To evaluate whether preoperative corneal densitometry is associated with visual outcomes, higher-order aberrations, or LDD treatment burden in post-refractive eyes undergoing Light-Adjustable Lens (LAL) implantation.

METHODS

- Retrospective review of 28 eyes (14 patients) with prior LASIK or PRK who underwent cataract surgery with LAL implantation by a single surgeon.
- Preoperative Pentacam densitometry analyzed by layer (total, anterior) and zone (central 0–2 mm, paracentral 2–6 mm).
- Outcomes: UCVA, total HOA, coma, spherical aberration, trefoil, and number of LDD treatments at 2 weeks, after final adjustment, and after lock-in.
- Statistics: Spearman correlations and Mann–Whitney comparisons across all, dominant, and non-dominant eyes.

Pentacam densitometry zones (anterior layer)

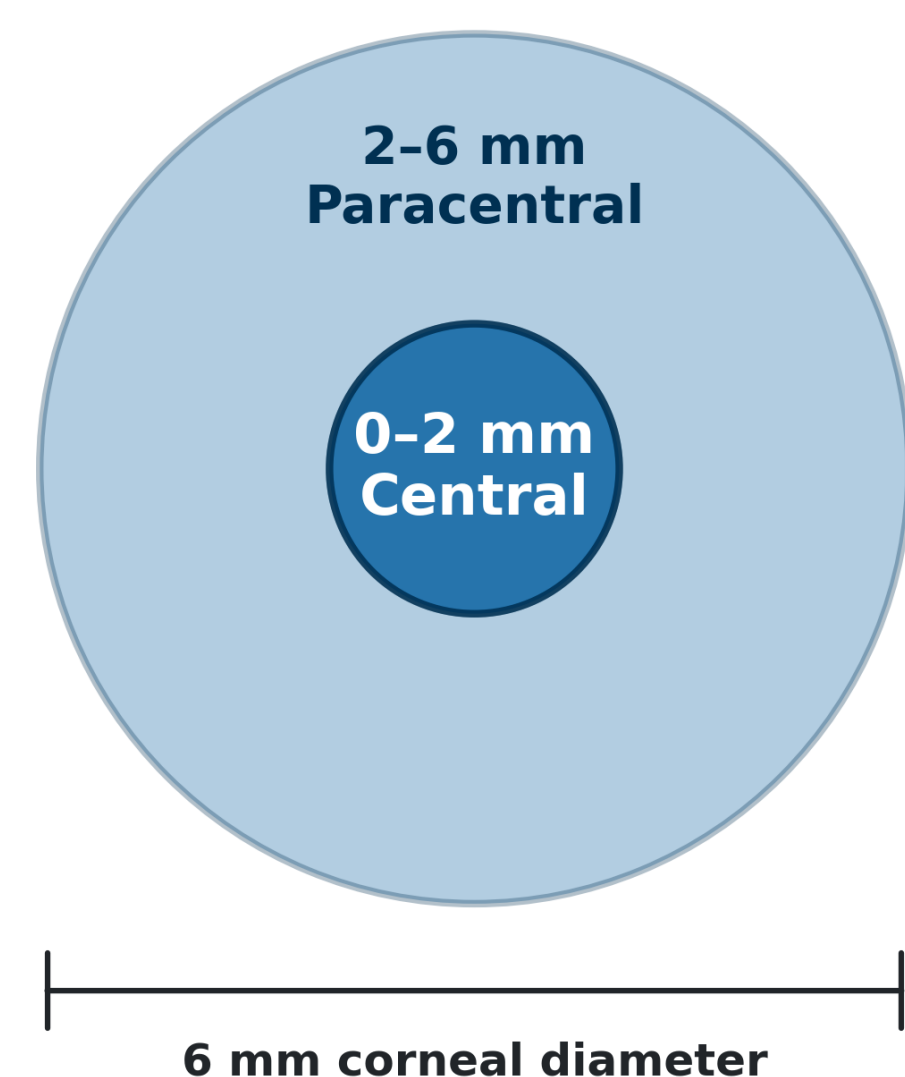
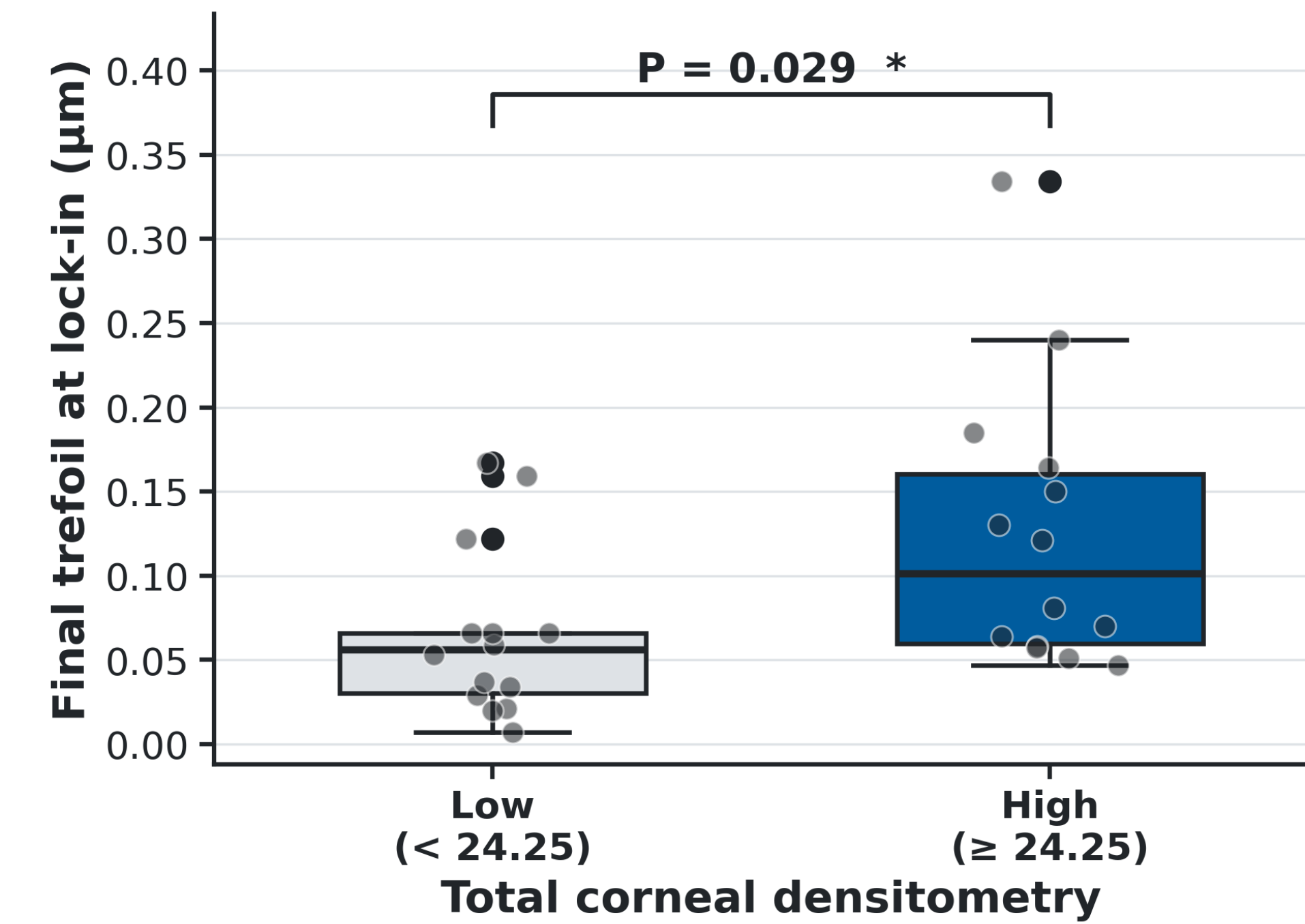


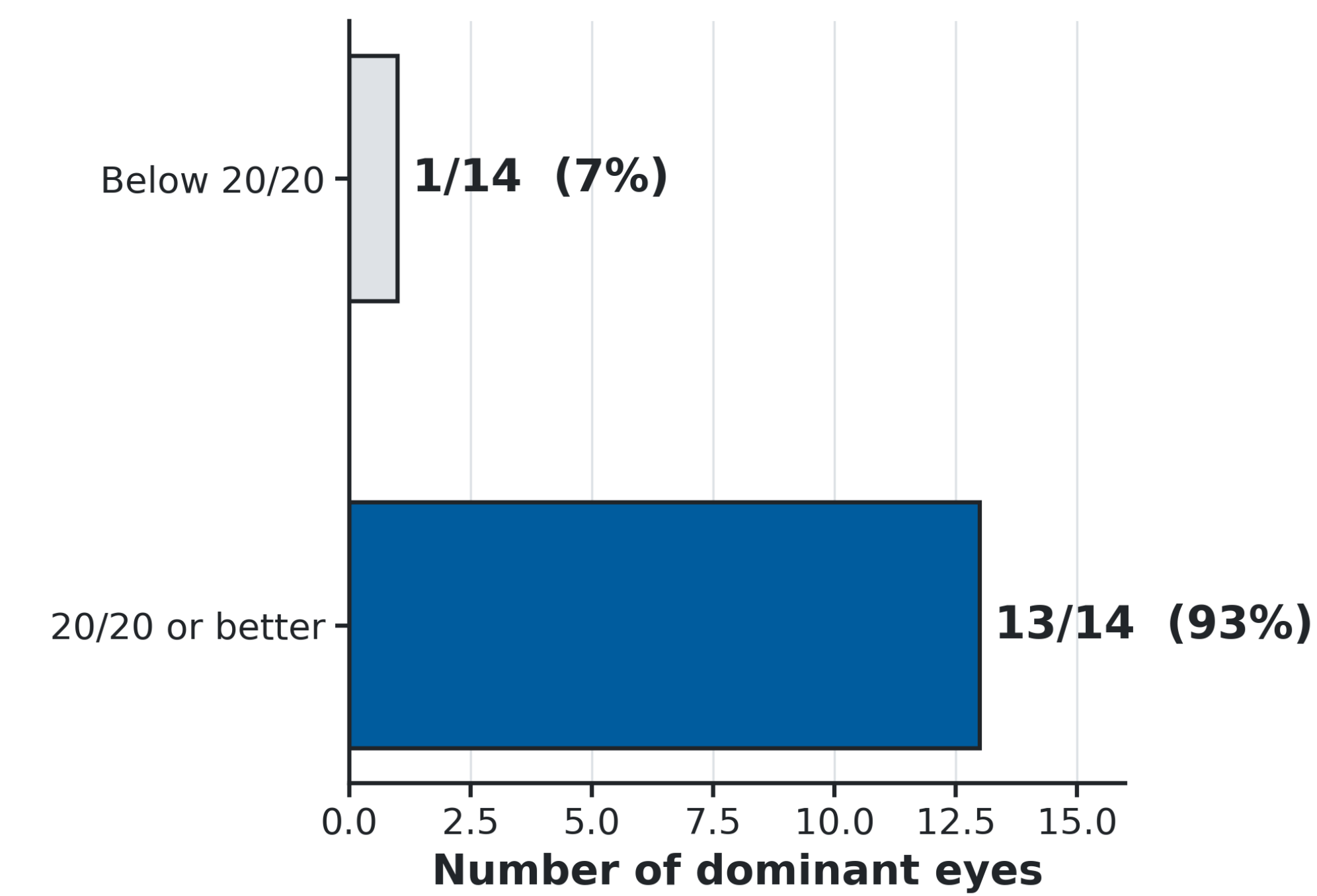
Figure 1. Pentacam densitometry zones: central (0–2 mm) and paracentral (2–6 mm) of the anterior corneal layer.

RESULTS

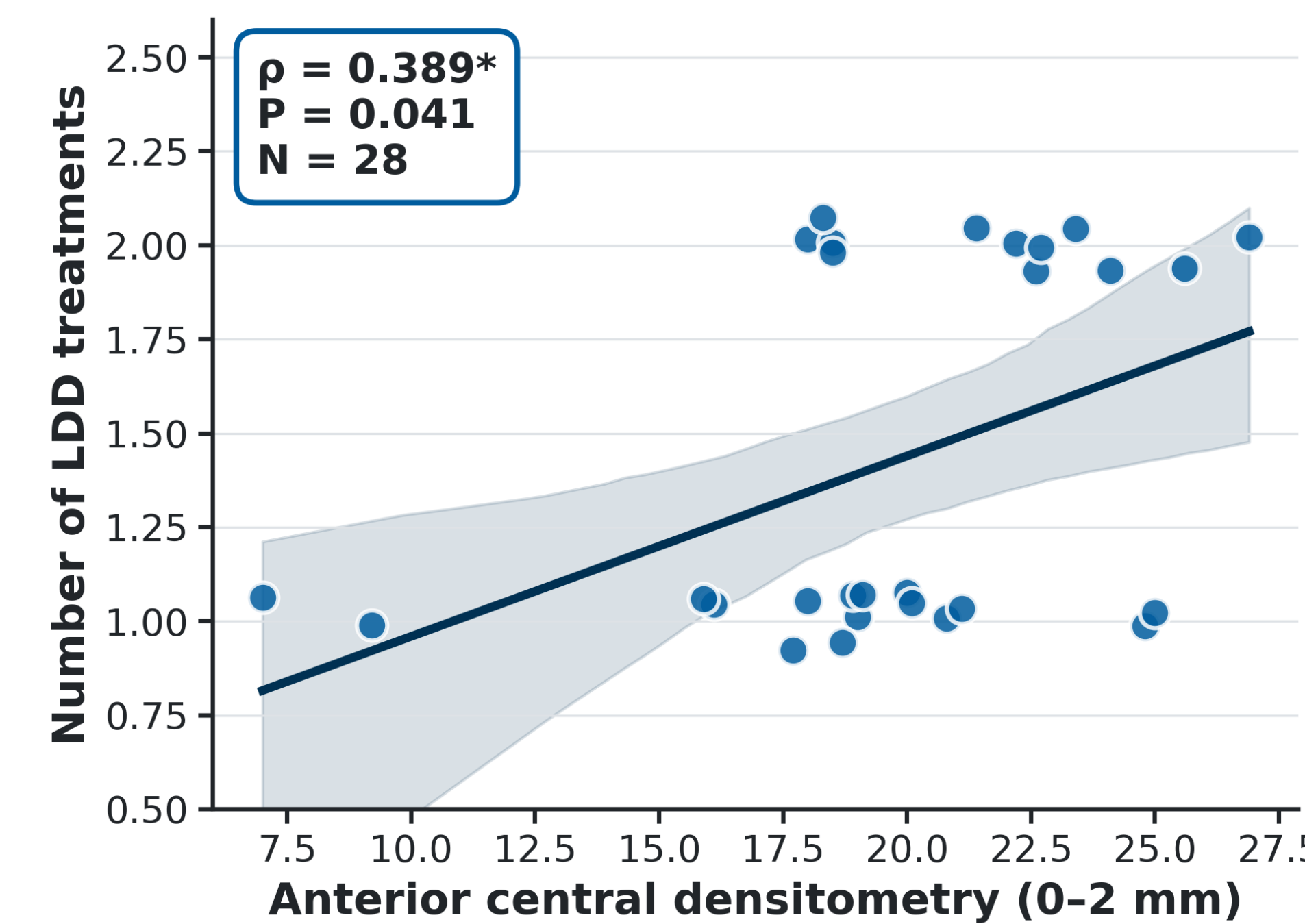
Higher total densitometry → higher final trefoil



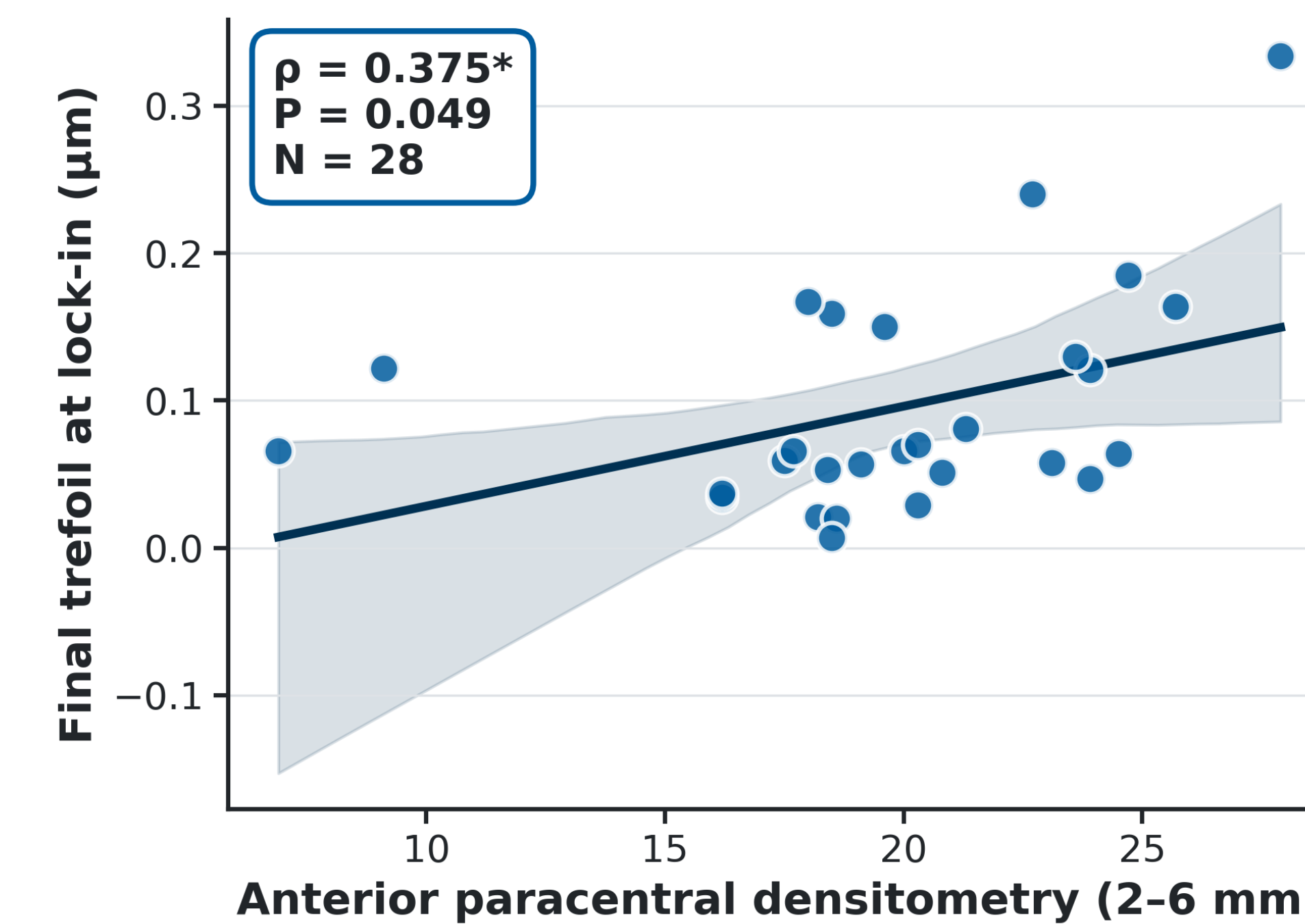
Final UCVA in dominant eyes at lock-in



More central anterior haze → more LDD adjustments



Paracentral anterior haze → higher residual trefoil



Densitometry did NOT predict final UCVA failure, but it tracked adjustment complexity and residual trefoil.

LIMITATIONS

- Small retrospective cohort (28 eyes, 14 patients)
- Exploratory analyses without correction for multiple comparisons.
- Densitometry is a surrogate for stromal scatter and does not replace histopathology.
- 13/14 patients achieved 20/20 or better UCVA at lock-in, creating a ceiling effect for final UCVA success.

CONCLUSIONS

- Final UCVA in post-refractive LAL eyes was excellent. Densitometry did not predict visual failure.
- Preoperative anterior corneal densitometry was associated with greater LDD adjustment burden and higher residual trefoil at lock-in.
- Pentacam densitometry may help risk-stratify post-refractive candidates for chair-time burden and IOL selection (LAL vs multifocal).
- Future work: prospective validation in larger cohorts to test densitometry-based qualification metrics.

REFERENCES

- Moshirfar M, Henrie MK, Payne CJ, Hansen AM, Ronquillo YC, Hoopes PC. Comparing Visual Outcomes of Light Adjustable Intraocular Lenses in Patients With and Without Prior History of Corneal Refractive Surgery. *J Refract Surg.* 2023;39(5):311-318. doi:10.3928/1081597X-20230222-01
- Yang Q, Ju G, He Y. Corneal densitometry: A new evaluation indicator for corneal diseases. *Surv Ophthalmol.* 2025;70(1):132-140. doi:10.1016/j.survophthal.2024.09.007
- Jones M, Terveen DC, Berdahl JP, Thompson V, Kramer BA, Ferguson TJ. Clinical outcomes of the light-adjustable lens in eyes with a history of prior corneal refractive surgery. *J Cataract Refract Surg.* 2024;50(9):936-941. doi:10.1097/j.jcrs.0000000000001481