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Abstract Title:	**Relative Contribution of Gradient Index Distribution and Surface Geometry to Spherical Aberration in Isolated Primate Crystalline Lenses**
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Purpose: The optical properties of the crystalline lens (and the spherical aberration in particular) are affected by the geometry of the surfaces and the gradient index (GRIN) distribution. We used experimental data of laser ray tracing spot diagrams and surface shape geometry on isolated primate crystalline lenses to estimate the GRIN profile and its relative contribution to spherical aberration.

Methods: A laser ray tracing system (with a diode laser, x-y scanner, and CCD camera) was used on isolated lenses. The lenses were submerged in preservation media in a BK7 container and the camera was positioned under the container. The lenses were scanned at 0, 90 and 45 deg meridians, and a total of 100 spots were obtained per lens, on 4-mm diameters. The container's window thickness and the distances crystalline lens/container/CCD camera were measured in situ with optical coherence tomography (OCT). The shapes of the crystalline lens were measured by shadowphotography or OCT. The optimization method to retrieve the GRIN from the CCD spots used genetic algorithms combined with dumped least squares. We used a GRIN bielliptical model ($n=c0+c1 \cdot r^2$). Similarly, but using a constant index, we calculated the effective homogeneous index of each lens. We report data on two crystalline lenses: an 8-year old cynomologus monkey (M) lens and a 48-year old human (H) lens.

Results: 1) The retrieved surface index was 1.367 (M) and 1.372 (H) and the nucleus index was 1.437 (M) and 1.414 (H). 2) The effective index was 1.448 (M) and 1.438 (H), respectively. 3) The relative contribution of surface power and GRIN to the lens power was 7.43 /39.04 D (M) and 4.20 /15.43 D (H), respectively. 4) The relative contribution of lens surfaces and GRIN to spherical aberration was 0.080/-0.204 µm (M) and -0.007/-0.141 µm (H), respectively. 5) Assuming an effective index, the spherical aberration was 0.553 µm (M) and -0.018 µm (H).

Conclusions: 1) GRIN plays a significant role on the optical properties of the lens, and spherical aberration in particular. While the reconstructed GRIN profile is consistent with the experimental data, other models could be used in the method, with additional input parameters.

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