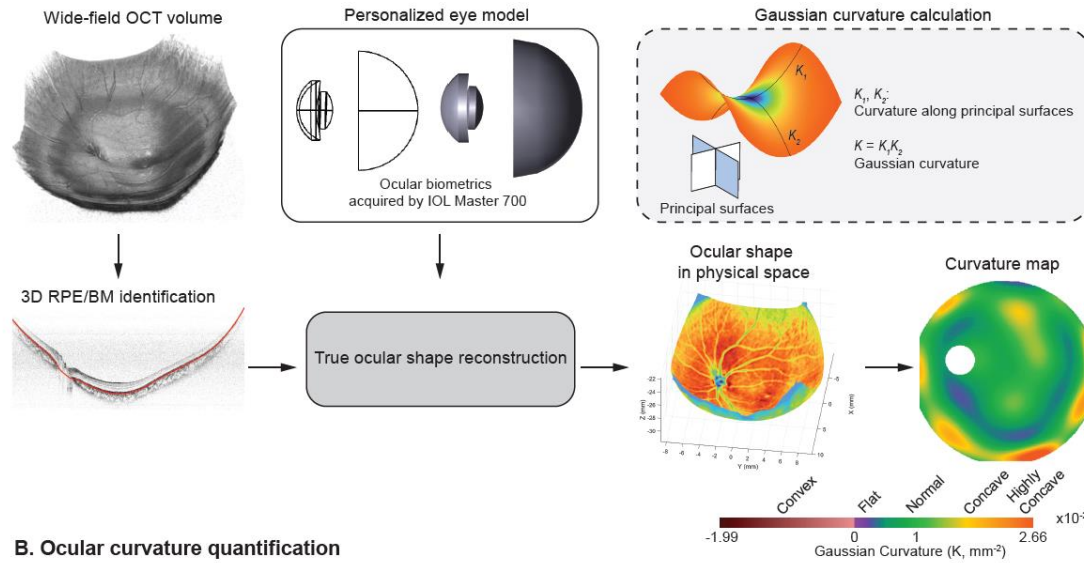


Supplementary Information:

A. Ocular curvature map generation



B. Ocular curvature quantification

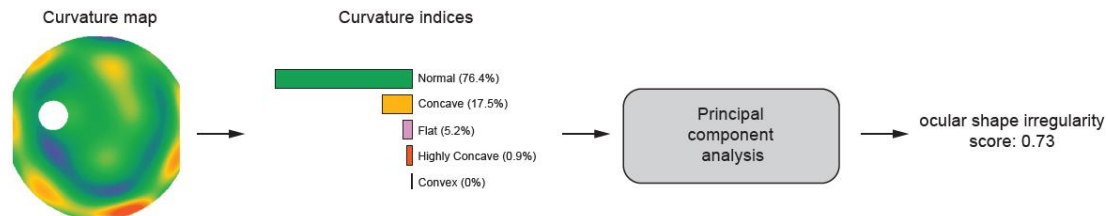


Figure S1. A) **Ocular curvature map generation.** A volumetric scan from a 65° (horizontal) × 62° (vertical) field of view was acquired, and the retinal pigment epithelium/Bruch's membrane (RPE/BM) line automatically was segmented (red line) for ocular shape quantification. Ocular biometrics acquired by ocular biometry (IOL Master700, Zeiss Meditec, USA) were used to develop a personalized eye model for ocular shape reconstruction using a ray-tracing algorithm (OpticStudio, Zemax, USA). The RPE/BM surface was reconstructed in a physical x-y-z space, and the Gaussian curvature represented the localized, quantitative curvature into an *enface* map. The Gaussian curvature was calculated as a product of curvatures on principal surfaces, and an example is shown on a saddle function. B) **Ocular curvature map quantification.** The Gaussian curvature values on the curvature map were categorized into five curvature categories, namely convex, flat, normal, concave, and highly concave, allowing each curvature map to be represented by a mixture of these categories at different percentages. Principal component analysis (PCA) extracted the first principal component that represented the major variation of the data, termed ocular shape irregularity (OSI).

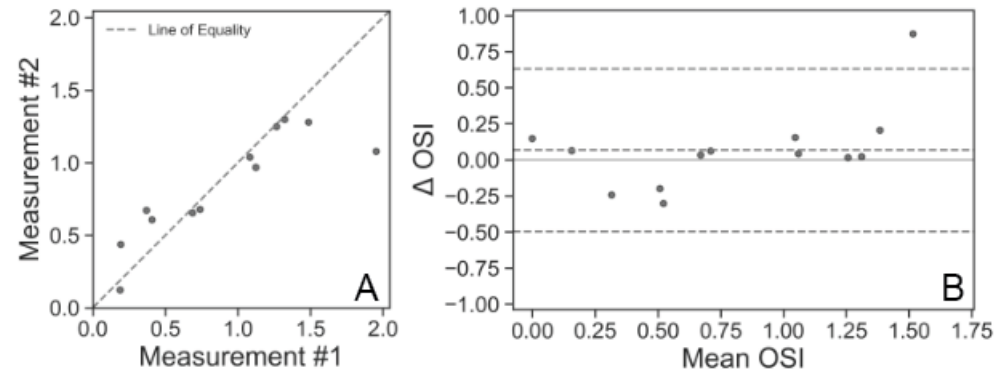


Figure S2. Scatterer plot with a line of equality (A) and Bland-Altman plot (B) compare the OSI values acquired from two repeated measurements. The OSI values computed from the two scans are highly agreeable to each other ($r = 0.88$).

Table S1. Results of curvature categories in eyes with different axial lengths (mm).

	Axial Length (mm)							
	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30
Number of Eyes	8	31	36	25	33	23	17	2
Proportion of curvature category (%)								
Convex	0.01 ± 0.01	0.12 ± 0.60	0.08 ± 0.36	0.31 ± 0.73	0.72 ± 2.11	1.73 ± 3.47	6.31 ± 7.52	15.68 ± 15.66
Highly Concave	0.13 ± 0.27	0.27 ± 0.49	0.37 ± 0.76	0.76 ± 1.79	1.01 ± 1.73	1.11 ± 1.16	4.38 ± 4.99	1.64 ± 1.46
Flat	7.77 ± 8.07	12.44 ± 10.07	13.02 ± 12.59	13.84 ± 9.77	8.77 ± 8.48	11.55 ± 12.68	19.43 ± 12.72	12.79 ± 2.50
Concave	11.21 ± 5.85	13.64 ± 5.92	12.67 ± 10.68	14.90 ± 10.40	24.82 ± 11.52	21.10 ± 10.82	20.65 ± 11.91	19.57 ± 7.32
Normal	80.88 ± 5.99	73.52 ± 9.16	73.85 ± 13.24	70.19 ± 9.61	64.69 ± 12.15	64.51 ± 13.63	49.22 ± 13.20	50.33 ± 12.31