Morphological changes of human crystalline lens in myopia

Geethika Muralidharan*[1], Eduardo Martinez – Enriquez[1], Andrea Curatolo[1], Judith Birkenfeld[1], Miriam Velasco Ocana[1], Pablo Pérez Merino[1], Susana Marcos[1]

1.Instituto de Optica, Consejo Superior de Investigación Científicas,Madrid
g.muralidharan@io.cfmac.csic.es

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1 Background & Purpose

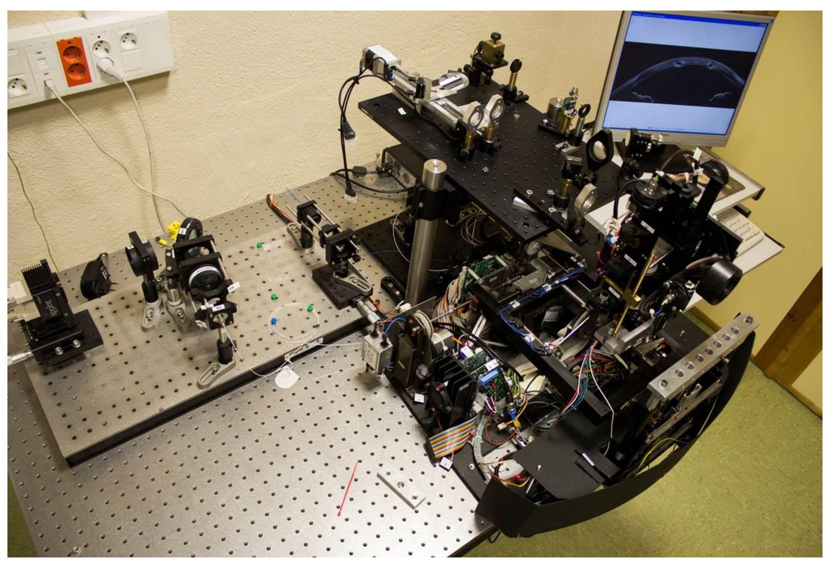
General Purpose: To quantify in vivo the changes in Lens geometry using custom 3-D Spectral Optical Coherence Tomography (sOCT) as a function of refractive state/ axial length and to determine how these factors affect the development of myopia.

Technology background : OCT is a high speed, non invasive Imaging tool that allows to capture images of biological samples with micrometer resolution using optical interferometry [1]. This technique generates in vivo cross sectional depth resolves images of cornea , iris, anterior and posterior lens

Why is the study interesting: Compensatory effects performed by crystalline lens in myopic subjects in order to counteract axial elongation are not very well understood [2,3,4]. This study allows us to find the imbalance in the structural properties of crystalline lens during myopia development.

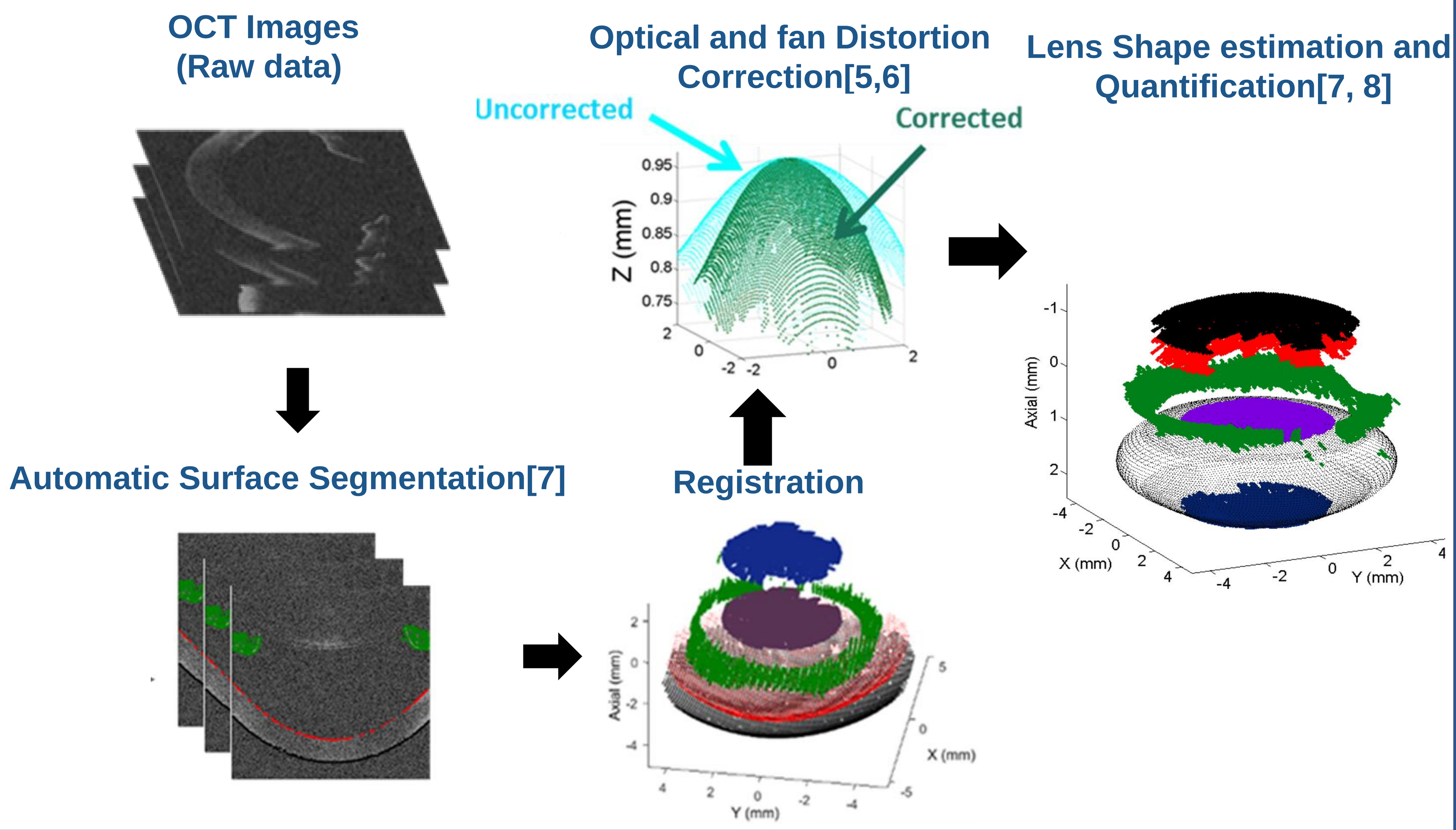
2 Methods

Custom Developed SD- OCT



Wavelength of operation Superluminascent Diode
(λ_0= 840 nm $\Delta\lambda$ = 50 nm)
Axial Resolution = 3.42 µm (In tissue) ;
Measurement Dimensions:11x11mm; 300 A Scans x 50 B Scans
Acquisition Time: 0.6s

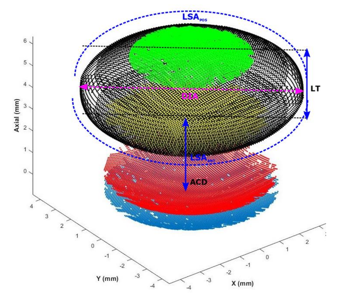
3-D Image Processing Algorithms



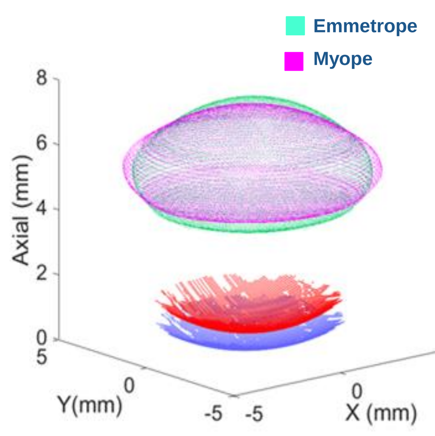
Study Design and Quantification

Measured lens biometric parameters

- Anterior Chamber Depth (ACD)
- Lens Thickness (LT)
- Equitorial Plane Position (EPP)
- Equitorial Diameter (DIA)
- Anterior Lens Radius (RAL)
- Posterior Lens Radius (RPL)
- Lens Surface Area (LSA)
- Lens Volume(VOL)

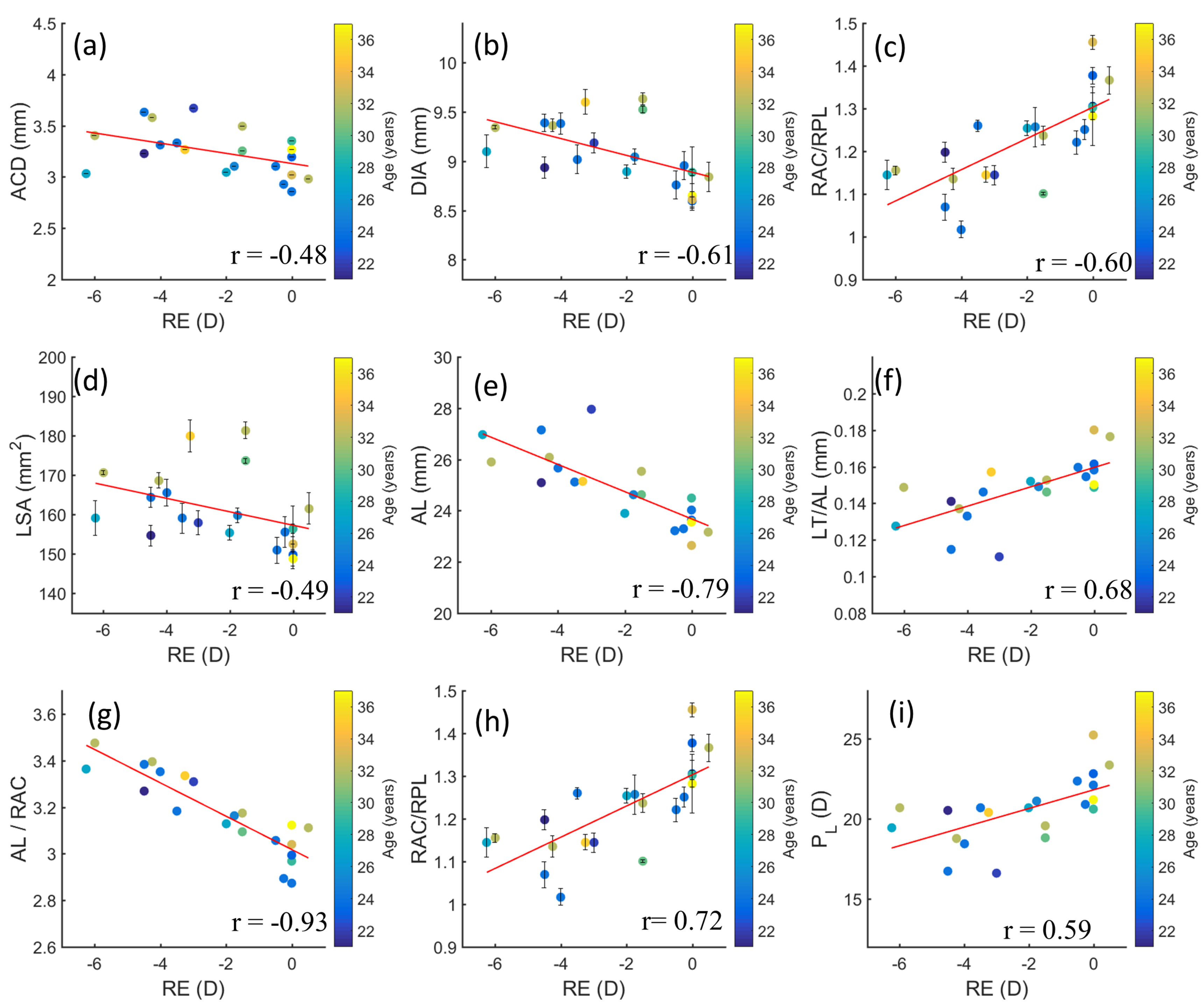


- No of eyes examined: 21
- No of myopic eyes: 13
- No of emmetropic eyes: 8
- Age of myopic subjects: 27 ± 4.29
- Age of emmetropic subjects: 28 ±4.94



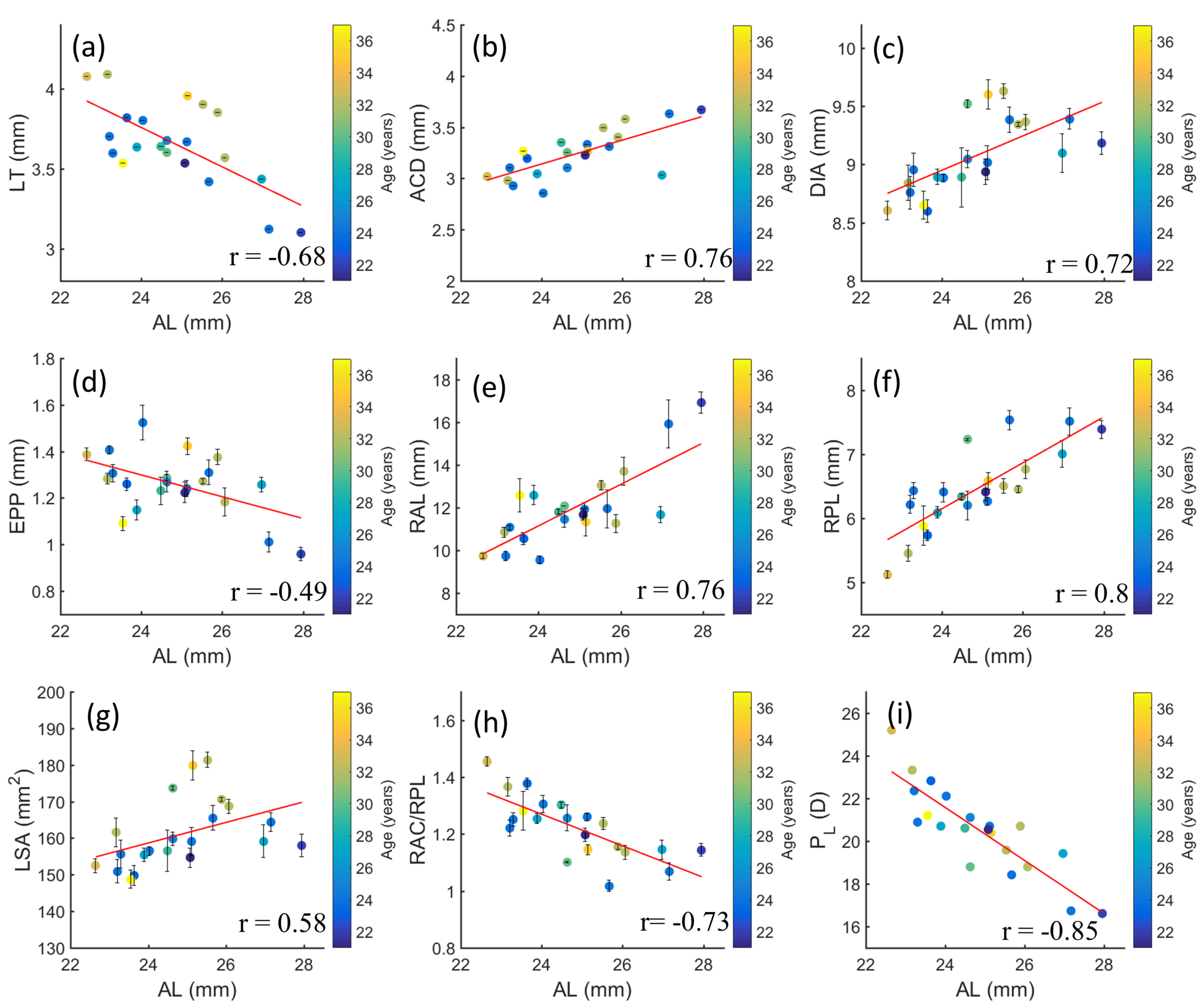
3 Results

Ocular Biometry and Refractive Error



r = Partial correlation (Controlling age)

Ocular Biometry and Axial Length



r = Partial correlation (Controlling age)

4 Conclusion

- Quantitative 3-D OCT allows full quantification of the lens shape, and allows full assessment of lens morphology in myopic eyes.
- The lens does not appear to gain volume with myopia as it may happen if growth factors would be released during axial elongation which would make the lens grow larger. But instead, the lens reshapes by flattening, thinning and by having a stretched capsule in mypoes compared to emmetropes.
- The combined effect of geometrical changes is reflected in the total dioptric power of the lens with no change in corneal power , where lower power lenses are observed in subjects with higher refractive error.

5 References

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