

Analyzing automated Optical Coherence Tomography choroid thickness measurements



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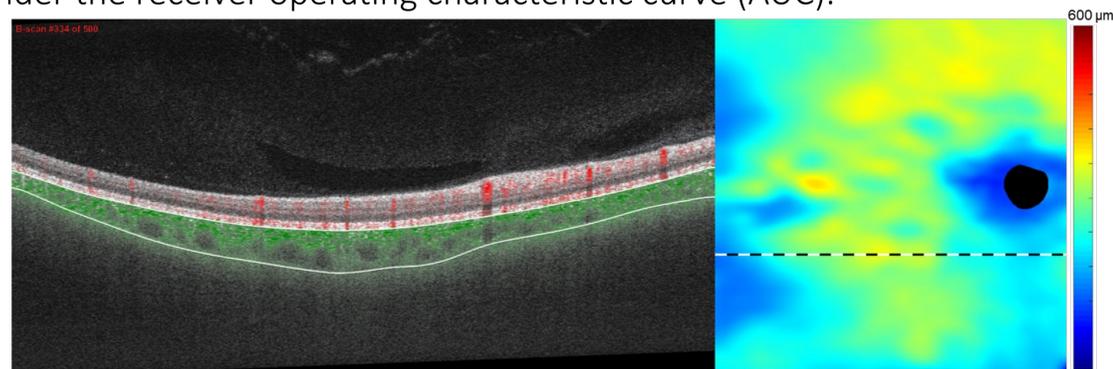
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PURPOSE

Advances in optical coherence tomography (OCT) technology allow larger field of view (FOV) scans and complex processing, such as choroid segmentation. However, little is known about automated choroid quantifications in large FOVs. We evaluate the accuracy and utility of these measurements across different macula sectors.

METHODS

We collected 12x12mm swept-source OCT volumes (PLEX® Elite 9000; ZEISS, Dublin, CA) from 27 healthy and 34 disease eyes (13 intermediate AMD eyes). Bruch's membrane and choroid/sclera interface were annotated manually and automatically using prototype software, and thickness maps were generated by considering the distance between these interfaces (see figure below). The Optic Nerve Head (ONH) location was automatically detected and eliminated from the analysis. We analyzed the differences and correlation between manual and automated thickness values in an extended ETDRS grid and in a custom grid. We also measured the ability to discriminate between healthy and AMD eyes using each sector values for both the manual and automated methods by measuring the area under the receiver operating characteristic curve (AUC).



Example of choroid segmentation in B-scan (left) and choroid thickness map (right)

CONCLUSIONS

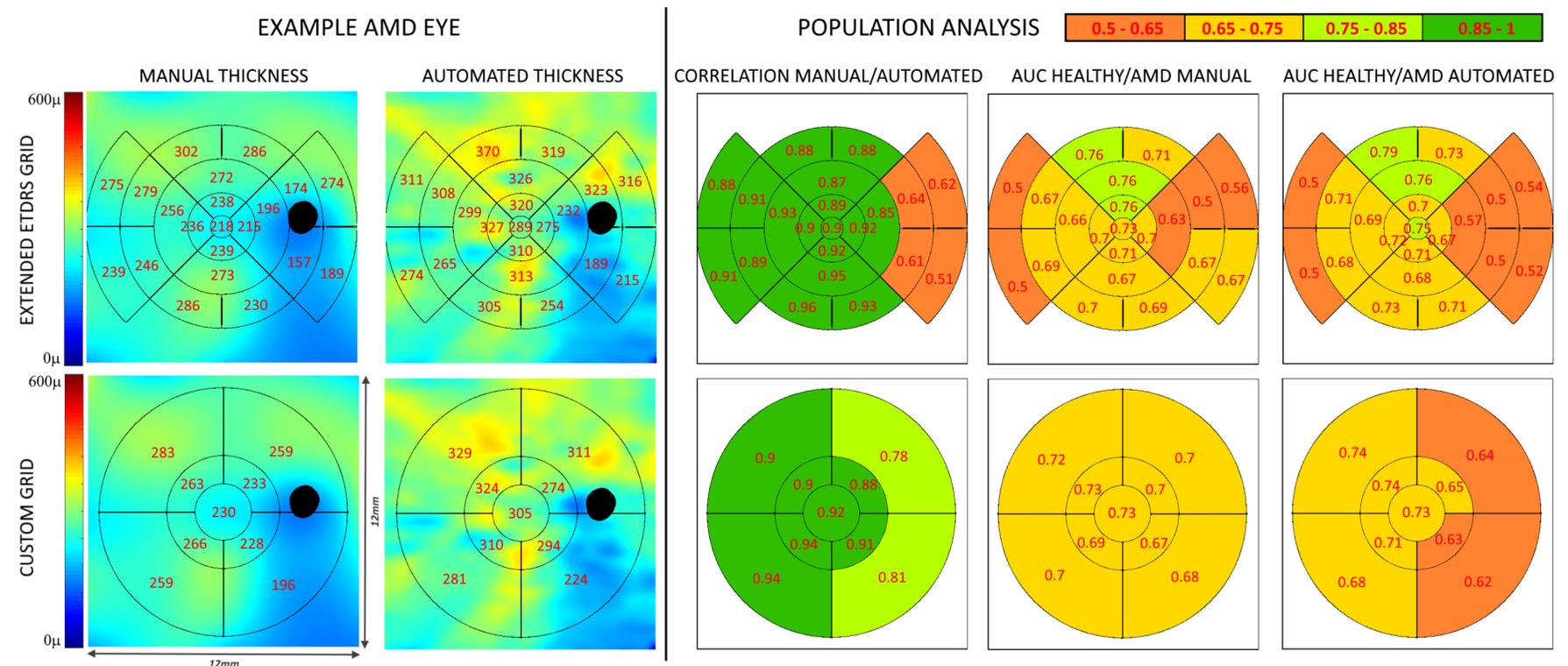
While significantly different, automated choroid thickness measurements show very high correlation and very similar discriminatory power to manual measurements, excluding regions within the ONH.

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RESULTS

- Manual annotation resulted in smoother maps compared to the automated results due to the annotation tool employed.
- There were statistically significant differences ($p < 0.05$) between manual and automated measurements in all sectors analyzed (automated values were consistently higher) due to agreement difficulty on where to draw the choroid/sclera interface.
- All sectors presented significant correlation between manual and automated measurements, with very high correlation (> 0.85) in sectors not including the ONH. Lower correlation within the ONH vicinity was explained by higher difficulties in the segmentation.
- When comparing healthy and AMD patients, thickness was significantly higher in healthy cases (+47.6 and +44.5 μm overall in manual and automated, respectively). Discrimination was similar for both manual and automated methods excluding regions within the ONH, with higher AUC values in regions closer to the fovea.
- The highest AUC was observed in the superotemporal sectors in the extended ETDRS grid.



Left panel: Manual (left) and automated (right) choroid thickness maps in example AMD eye.

Right panel: Correlation between manual and automated measurements (left), AUC measured for discriminating healthy and AMD eyes using manual measurements (middle), and AUC using automated measurements (right).