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OPTIMA Ophthalmic Image Analysis

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Advances in quantifications of outer retinal layers in Geographic Atrophy comparing High-Res and conventional SPECTRALIS OCT

PDF link

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Purpose

Quantification of Geographic Atrophy (GA) biomarkers in optical coherence tomography (OCT) becomes more important due to promising therapeutic options in the near future.

The aim of this study was to investigate differences between standard and advanced devices with **varying axial resolution** in **outer retinal layer segmentations** in GA.

Methods

Differences in layer quantifications between the **High-Res OCT and the SPECTRALIS HRA+OCT** were evaluated (Figure 1, both devices by Heidelberg Engineering, Heidelberg, Germany) Technical differences are listed in Table 1.

	SPECTRALIS OCT	High-Res OCT
Axial Resolution	7 µm	**3 µm**
Lateral Resolution	14 µm	14 µm
Speed	85 kHz	85 kHz
ICG Laser	Yes	**No**
Infrared Laser	815 nm	**730 nm**
Multicolor	468 / 518 / 815 nm	468 / 518 / 730 nm
Power	1,2 mW at 880 nm	**2,2 mW at 850 nm**

Table 1: Technical differences between devices

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Total no. of patients/eyes	12/17
Female (%)	11 (65%)
Mean age (range)	77.4 (67.1-90.3)

Table 2: Patient characteristics

All patients fulfilled complete retinal pigment epithelium (RPE) and outer retinal atrophy (**cRORA**) criteria[1]

Imaged with both devices using a **20°x20°** scan pattern (49 or 97 B-Scans)

RPE, **photoreceptors** (PR) (EZ+IZ), **external limiting membrane** (ELM) and **subretinal drusenoid deposits** (SDD)

presegmented in all B-Scans using **automated algorithms**[2,3] and **manually corrected** in 49 B-Scans/OCT

Layer thickness and loss area, and **SDD volume** were calculated

Comparison between devices using a **mixed effect model**

Figure 1: Methods;
EZ=Ellipsoid Zone, IZ=Interdigitation Zone

Results

RPE thinner in High-Res (p<0.001)
16.00 µm (95%CI 15.18–16.81) vs. 21.66µm (95%CI 20.85–22.48)

PR layer **thicker** in High-Res (p<0.001)
27.37µm (95%CI 20.36–34.38) vs. 25.78µm (95%CI 18.77–32.79)

Myoid Zone + ELM thinner in High-Res (p<0.001)
19.42µm (95%CI 17.77–21.08) vs. 21.54µm (95%CI 19.89–23.20)

PR integrity loss smaller in High-Res (p=0.012)
7.18mm² (95%CI 0.65-13.71) vs. 8.09mm² (95%CI 1.56-14.63)

No significant differences found for RPE, ELM loss or SDD volume.

Conclusion

High-Res OCT with superior axial resolution provides an **improved distinction of layers and PR integrity loss**.

The enhanced boundaries of the Interdigitation zone and the Bruch's membrane result in a **thinner RPE and a thicker PR layer** in the High-Res OCT (Figure 2).

Higher axial resolution could help
- **investigate retinal morphology in vivo**
- **improve individualized patient management**

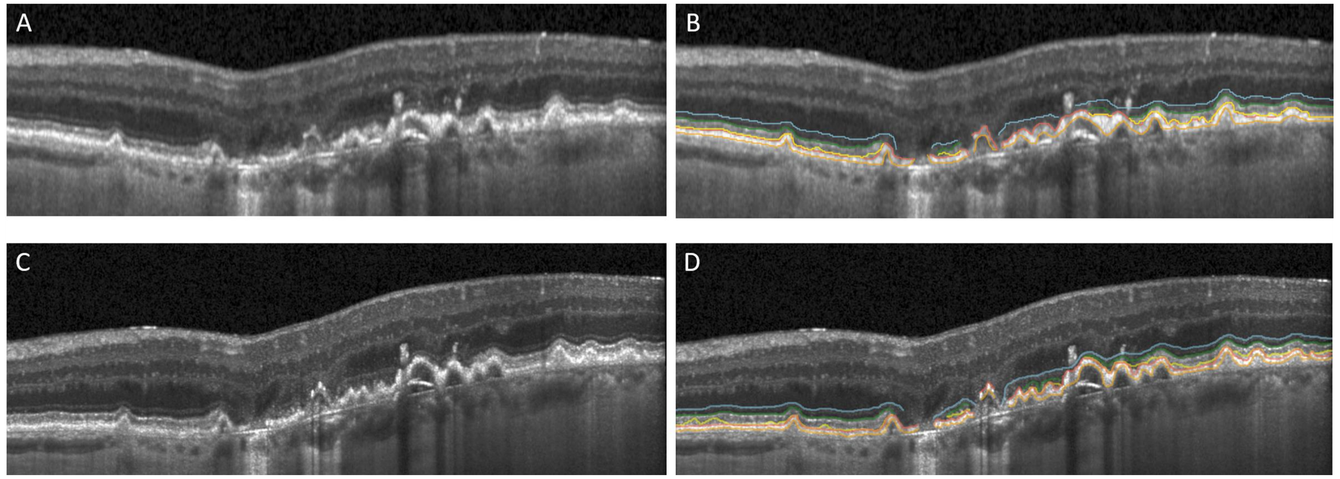

Figure 2: Patient with geographic atrophy; **A, B** OCT B-Scans acquired with **SPECTRALIS HRA+OCT**; **C, D** B-Scans acquired with **High-Res OCT**; **B, D** B-Scans with Layer segmentation of the outer (orange) and inner (red) border of retinal pigment epithelium, the outer (yellow) and inner (green) border of photoreceptors and the external limiting membrane (blue).

References

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[3] Garvin et al., Automated 3-D Intraretinal Layer Segmentation of Macular Spectral-Domain Optical Coherence Tomography Images. IEEE Transactions on Medical Imaging, 2009.