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Studies confirm Spectralis' superior reproducibility of retinal thickness measurements

The reliability of retinal thickness measurements is critical to diagnose, monitor progression, decide on treatment options, and monitor therapy of retinal disease. In a recent paper by Wolf-Schnurrbusch et al.¹ the reproducibility of OCT macular thickness measurements was investigated. The authors compared different OCT instruments looking at central retina thickness (CRT) measurements in healthy eyes. To quantify reproducibility repeated measurements were performed. The instruments tested were: Stratus OCT, SOCT Copernicus, Spectral OCT/SLO, RTVue-100, Cirrus HD-OCT, and SPECTRALIS HRA+OCT.

To assess the reproducibility of thickness measurements the coefficient of variation (COV) was determined. A lower COV indicates better measurement reproducibility. The study by Wolf-Schnurrbusch et al. demonstrated an excellent COV of less than 0.5% for the SPECTRALIS system. The other devices had higher COVs, equivalent to less reproducible thickness measurements. The COV can be used to calculate the smallest measureable change of retinal thickness detectable by a device. With Spectralis changes as small as 1 μm can be identified (see table 1). The other devices in the study identify changes only once they reach 5-9 μm so cannot be used to assess smaller changes.

The study also showed that a switch from time domain (Stratus OCT) to spectral domain OCT (all other devices) does not automatically improve the reproducibility of measurements. The long acquisition time of spectral domain OCT volume scans of 1.5 s and more makes these devices still prone to motion artifacts unless they are equipped with an active eye tracker. Wolf-Schnurrbusch et al. showed that the spectral domain Cirrus system offers less reproducible measurements than the Stratus and the SPECTRALIS system.

The findings of the Wolf-Schnurrbusch group have been confirmed by another independent study performed by Menke et al.². This study looked at intraobserver reproducibility of retinal thickness measurements with the Spectralis OCT in healthy eyes. The smallest measureable change of CRT was found to be 1.5 μm , which confirms the results of Wolf-Schnurrbusch et al. Moreover, the Menke study showed SPECTRALIS offers highly reproducible measurements for CRT and all sectors of an ETDRS grid.

Menke et al. stress that "reproducibility [...] is important for diagnostic precision. [...] reproducibility of retinal thickness measurements is critical if the device is used to monitor progression of disease and/or therapeutic interventions." Wolf-Schnurrbusch et al. further point out that "to observe patients over time it is important to assess changes in macular thickness correctly and to be able to compare baseline findings with follow-up measurements."

The authors concluded that the superior reproducibility of retinal thickness measurements with the SPECTRALIS are due to the Active Real-Time Eye Tracking system and Heidelberg Noise Reduction™ technology. Wolf-Schnurrbusch et al. state that "the unique feature of the Spectralis [...], which allows automatic recognition of the exact scan location, resulted in the best [...] intersession" reproducibility of measurements. The Heidelberg Noise Reduction Technology is the basis for significant gains in signal-to-noise ratio and image contrast. Furthermore, the studies clearly demonstrate the robustness and reliability of the Spectralis' layer segmentation algorithm.

Images acquired with OCT instruments without active eye tracking suffer from artifacts due to eye movements and do not provide automatic re-positioning of scan location during follow-up exams. As shown in the study by Wolf-Schnurrbusch this directly translates into inferior measurement reproducibility, limiting the reliability of these devices to detect early stages and progression of disease.

Table 1

Intersession reproducibility measurements demonstrated by Wolf-Schnurrbusch et al.

Device	Manufacturer	Central Retina Thickness	Coefficient of Variation	Smallest Measurable Change
		(μm)	(%)	(μm)
SPECTRALIS	Heidelberg Engineering	289	0.5	1
OCT SLO	Ophthalmic Technologies Inc.	244	2.2	5
Stratus	Carl Zeiss Meditec	212	3.3	7
RTVue	Optovue	247	2.8	7
Copernicus	Optopol Technology	249	3.5	9
Cirrus	Carl Zeiss Meditec	277	3.1	9

** Smallest Measurable Change is Central Retina Thickness multiplied with Coefficient of Variation.*

- [1] Wolf-Schnurrbusch et al. Macular Thickness Measurements in Healthy Eyes Using Six Different Optical Coherence Tomography Instruments. Invest Ophthalmol Vis Sci 2009 (published online ahead of print)
- [2] Menke et al. Reproducibility of Retinal Thickness Measurements in Healthy Subjects Using Spectralis Optical Coherence Tomography. Am J Ophthalmol 2009; 147:467-472