Signal-to-Noise Ratio Comparisons Between Spectral-Domain and Swept-Source OCTs

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Purpose

Swept-source (SS) OCT utilizing a laser with wavelength centered at 1050 nm has a smaller sensitivity falloff and deeper penetration compared to spectral domain (SD) OCT with light centered at 850 nm. SS-OCT can produce images with clearer structural details from vitreous to choroid simultaneously. This study demonstrated the image quality differences by comparing signal-to-noise ratios (SNR) of retinal layers between SD- and SS-OCTs.

Method

60 eyes from 30 healthy volunteers (age ranged 23-67 yrs) were imaged by an SD-OCT and an SS-OCT (3D OCT-1 Maestro and DRI OCT Triton, Topcon Corp, Japan). At least one high quality retinal image was captured per image mode - macula, disc, and wide - per machine. The machine-generated SNR, expressed as TopQ scores, were estimations of the degree of overlap and distribution similarity between background (noise) and foreground (retina + choroid) signals. The OCT scans were also divided into various retinal layers, including RNFL, GCL, IPL, INL, OPL, ONL + Henle fiber (ONL+), IS/OS, RPE, and choriocapillaris, and the SNRs were estimated similarly. TopQ and SNR from retinal layers were compared between the devices. Sensitivity falloffs estimated by the percentage change of SNR ratios of various retinal layers normalized to the RNFL.

Results

The average SD-OCT TopQ scores were 49.8 ± 5.1, 52.9 ± 4.5, 40.7 ± 5.3 for disc, macula, and wide scans respectively. The average SS-OCT TopQ scores were higher for all scan modes, at 62.3 ± 4.7, 66.8 ± 3.6, and 62.5 ± 4.0. SS-OCT also had higher SNR in various retinal layers. Sensitivity falloffs in the inner retina (ranged from 22 to 55% in SD-OCT and 14 to 35% in SS-OCT). Maximum sensitivity falloffs occurred in ONL+ with 75%, 67%, and 80% signal reduction in SD-OCT, which were higher than SS-OCT, at 59%, 50%, and 55%. Sensitivity falloffs in choriocapillaris were 13%, 9%, and 13% in SD-OCT and 5%, 1%, and 2% in SS-OCT.

Conclusions

Overall there were higher SNRs measured in SS-OCT images. Data indicated SS-OCT produced images with a deeper imaging depth and clearer retinal and choroidal structural laminations.

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