Journal Article Review

Effect of Head Tilt and Ocular Compensatory Mechanisms on Retinal Nerve Fiber Layer Measurements by Cirrus Spectral Domain and Spectralis Optical Coherence Tomography in Normal Subjects

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Background and Purpose

Correct anatomic alignment of spectral domain optical coherence tomography (SD-OCT) scans to the optic nerve head is critical for retinal nerve fiber layer thickness (RNFLT) measurements. Scan alignment artifacts due to rotation of the eye and head tilt may contribute to incorrect comparisons of RNFLT relative to the device's reference database, negatively impacting the diagnostic accuracy of the test. Such alignment artifacts may also significantly impact follow up scans and limit the ability to detect changes over time. This study compared misclassification of RNFLT due to head tilt on both Zeiss Cirrus® HD-OCT and Heidelberg Engineering SPECTRALIS® SD-OCT devices.

Methods

The study included 30 eyes from 30 healthy subjects with normal visual fields and no confounding ocular pathologies. SPECTRALIS circumpapillary RNFL (cpRNFL) scans were performed with the AutoRescan function to ensure scan placement, and cpRNFL scans extracted from the Cirrus 200x200 optic nerve cube were used for comparison. Subjects were scanned on each device in a randomized manner with 'standard' head position using the internal fixation of each respective device. Subjects then tilted their head 30° either to the ipsi- or contra-lateral direction while maintaining fixation. Subjects then returned to tilted 30° in the opposite direction for the last set of scans. Three measurements were taken at each position to control for inter-scan variability.

Discussion

The authors state: "previous studies reported that the parameters with greatest diagnostic ability for glaucoma detection by the Cirrus HD OCT were average and inferior RNFLT." This study indicates that the RNFLT of the inferior sector is significantly affected by head tilt on the Cirrus, suggesting that tilt will impact the diagnostic sensitivity and specificity of glaucoma classification on this device. There were no significant changes observed on the SPECTRALIS in any sector during tilt. These results support the benefits of the unique fovea-to-disc (FoDi) alignment technology built into the SPECTRALIS, which accommodates for head tilt and ensures that scans are correctly oriented during imaging. This real-time alignment results in precise scanning and accurate comparison of the RNFL thickness values to the reference database, even during head tilt.

Conclusions

This study illustrates the impact of head tilt on RNFLT, the commonly-used glaucoma diagnostic parameter. The study results indicate that head tilt can artificially alter RNFLT results on the Cirrus, which can lead to inaccurate results when compared to the device's reference database. Furthermore, the authors remind clinicians that RNFL thickness values collected over time can be significantly affected by head tilt, and small pathological changes can be obscured. The SPECTRALIS automatic real-time tracking (ART) technology and AutoRescan feature ensure that RNFL thickness parameters are accurately aligned according to anatomic landmarks, preventing misclassification and ensuring consistent RNFLT measurements over time.

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