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Dynamic Vessel Analysis using surface-mount device LEDs as light source

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Footnotes

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Abstract

Purpose : In human retinal blood flow research dynamic vessel analysis (DVA) with the Retinal Vessel Analyzer (Imedos Systems UG) is the Gold standard to measure alterations in vessel diameter. However, vessel contrast is often reduced due to stray light caused by illumination of

lash, lid, or opaque lens such as cataract lens. For reasons of spatial adaptation, we developed and validated a novel 24-fold segmented LED light source for fundus cameras based on surface-mount technology.

Methods : We studied 16 young volunteers (7f, 8m, 24.7 ± 1.5 years) all free of ocular or systemic disease. To compare the new setup with the Gold standard the relative maximum vaso-dilation value was determined. We measured four primary vessels: one superior temporal artery and vein (STa/STv), one inferior temporal artery and vein (ITa/ITv), as well. The surface-mount device LED-based light source was connected to a mydriatic fundus camera (Visucam, Carl Zeiss Meditec AG). We followed the DVA standard protocol. The beam geometry was annular (all segments on). Each volunteer was measured two times. One measurement with the Gold standard and one with the new setup, in a random order. A resting period of approximately 10 minutes was adhered between the DVA measurements to avoid suppression of retinal vessel reactions in consecutive experiments. Comparison of the two setups were demonstrated and analyzed using the Bland-Altman method. To value the differences among the group means we performed a paired t-test. All four data sets ($n=16$, each) were normal distributed (Shapiro-Wilk).

Results : The comparison analysis according to Bland-Altman, with no outliers, resulted in the following mean differences (MD) and Limits of Agreement (LoA) with $n=16$ for every type of vessel (Gold standard vs. new setup). STa: MD=-0.28%, LoA=-3.28%/+2.71. ITa: MD=-0.09%, LoA=-3.01%/+2.84. STv: MD=-0.44%, LoA=-2.63%/+3.52. ITv: MD=-0.54%, LoA=-2.55%/+1.02. The t-test p-values were 0.473 (STa), 0.818 (ITa), 0.276 (STv), and 0.050 (ITv). $p \geq 0.05$ means no significant difference.

Conclusions : We successfully performed a new approach of Dynamic Vessel Analysis using a miniaturized surface-mount device LED-based light source. Statistically, there are no significant differences in the maximum dilation value of the new setup compared to the Gold standard. The new setup can be used for dynamic vessel analysis in humans as well.

This is an abstract that was submitted for the 2018 ARVO Annual Meeting, held in Honolulu, Hawaii, April 29 - May 3, 2018.

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