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High Reproducibility of Retinal Blood Flow Velocity Measurements Using the Retinal Function Imager

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Optical Imaging

Purpose

The Retinal Function Imager (RFI) measures blood flow velocity in multiple retinal arterial and venous branches simultaneously. The purpose of this study is to assess the RFI intra-session and inter-session reproducibility of blood flow velocity measurements in the perifoveal vessels.

Method

Twenty six eyes of 20 subjects who have no history of ocular trauma or evidence of any eye disease were recruited for this study. All subjects were imaged by the RFI (Optical Imaging, Ltd) and blood flow velocity of secondary and tertiary branches was measured in arteries and veins (Figure 1). Scans were repeated 3 times on the same day.

To assess the short term variability of the RFI blood flow velocity measurement, we used segments common to all 3 series and calculated each series average. The standard deviation of the series' values divided by their average resulted in the coefficient of variance.

In addition, 5 healthy subjects were imaged on two separate visits, days to months apart; each times 3 series were taken. The inter-visit analysis variability was evaluated using interclass correlation (ICC=1-sd^2/SD^2, where sd is the typical error and SD is the mean between-subject standard deviation in the two trials; derived by weighting the variances by their degrees of freedom) with 95% confidence limits. Values are corrected for heart rate differences between trials.

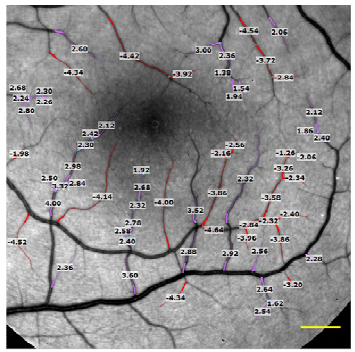
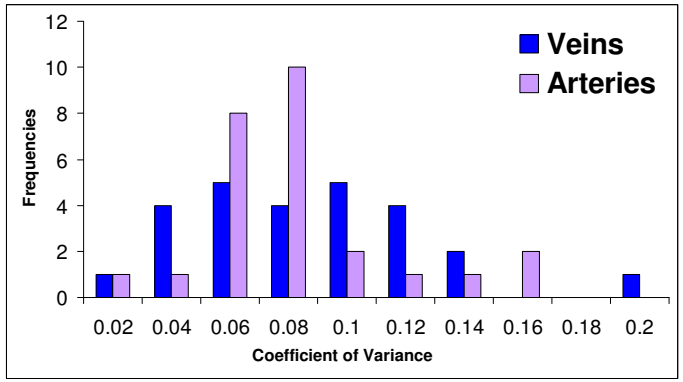


Figure 1 RFI image showing calculated blood flow velocity in mm/s, obtained automatically from secondary and tertiary arteries and veins). In veins (purple) velocity is defined as positive and in arteries (red) as negative, corresponding to the flow direction to and from the heart.

Results

The average venous velocity was 3.3 ± 0.6 mm/sec; the average arterial velocity was 4.3 ± 0.9 mm/sec. On average, 16 ± 6 arterial segments and 16 ± 5 venous segments were measured in each eye. The average coefficient of variance between measurements in the same day was 7.5 ± 3.7 % for all vessels; 7.8 ± 4 % for venules and 7.2 ± 3.4 % for arterioles (Figure 2). When comparing the measurements on different days on the same subjects the average ICC was r = 0.744 (Figure 3).

Figure 2 The distribution of the coefficient of variance between measurements in the same day.



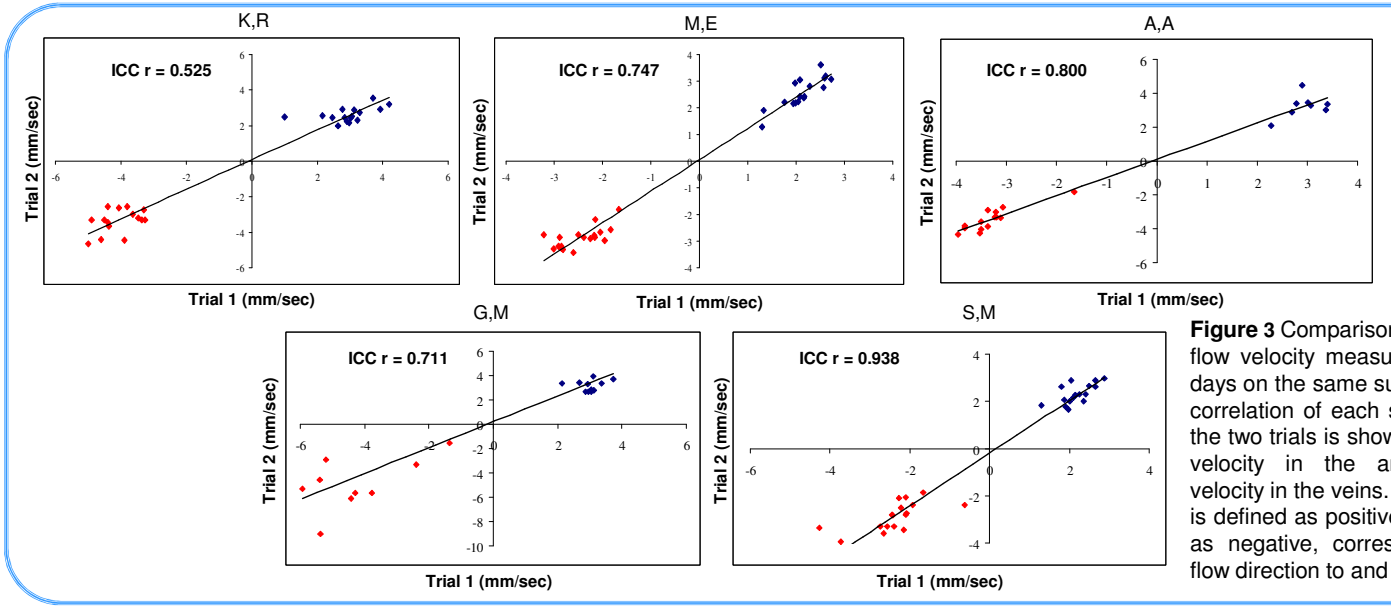


Figure 3 Comparison of retinal blood flow velocity measured on different days on the same subject. Interclass correlation of each subject between the two trials is shown (ICC r).Red – velocity in the arteries, Blue - velocity in the veins. In veins velocity is defined as positive and in arteries as negative, corresponding to the flow direction to and from the heart.

Conclusion

The RFI showed low intra-session and intersession variability in a group of healthy subjects. These highly reproducible measurements might serve as an important tool for assessing both physiological and pathological processes affecting retinal blood flow velocity.

Disclosures

K. Christian, H. Barash, Z. Burgasnky-Eliash, D.A. Nelson - Optical Imaging Ltd., E; A. Grinvald - Optical Imaging Ltd., PI;