5663 Reliability of Vessel Diameter Measurements with a Retinal Oximeter

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Purpose

Measurements of retinal vessel diameter can complement measurements of retinal vessel oxygen saturation in the study of various diseases.

The purpose of the study was to test the reliability of vessel diameter measurements with a newly developed retinal oximeter.

Methods

The retinal oximeter (Oxymap ehf., Reykjavik, Iceland) is composed of a fundus camera, beam splitting optics and two digital cameras.

Figure 1. *The retinal oximeter.*

The oximeter simultaneously yields two images of the same area of the fundus, one with 570nm light and one with 600nm. Calculated light absorbance is used to estimate hemoglobin oxygen saturation.

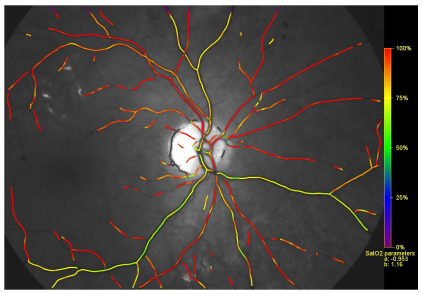

Figure 2. *A color-coded map of hemoglobin oxygen saturation is generated automatically from images, taken simultaneously at 570nm and 600nm.*

Twelve healthy individuals participated in the study. Retinal images were taken with the Oxymap Retinal Oximeter (Oxymap ehf. Reykjavik, Iceland). Diameters of retinal vessels were measured automatically with the Oxymap Analyzer software. Repeated measurements on the same vessel segments were compared.

The automatic measurements were also compared with semi-automatic measurements with an add-on to the ImageJ software, see *Fischer MJ et al. (2010) Measurement of meningeal blood vessel diameter in vivo with a plug-in for ImageJ. Microvasc Res 80:258-266.*

Results

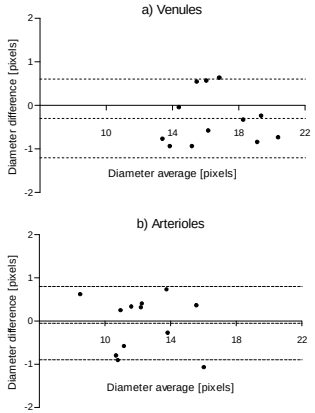

Figure 3. *Repeatability of diameter measurements. Each point shows the difference between two measurements of the same first degree temporal vessel. The broken lines show the mean ± 2SD.*

Table 1. *Repeatability of vessel diameter measurements. Each vessel segment measured twice. Values in pixels or %*

	Mean±SD	95% limits of agreement (Bland-Altman)	Variance coefficient
Venule (n=12)			
1st degree	16.5±2.3	-1.20 to 0.60	2.8%
2nd degree	15.0±1.8	-1.18 to 1.16	4.0%
Arteriole (n=12)			
1st degree	12.3±2.2	-0.90 to 0.80	3.5%
2nd degree	12.0±1.7	-1.17 to 1.37	5.4%

Table 2: *Comparison of vessel diameter measurements with Oxymap and ImageJ. Each vessel segment measured with the two programs and the results compared. All values are in pixels.*

	Oxymap Mean±SD	ImageJ Mean±SD	95% limits of agreement (Bland-Altman)
Venule (n=12)			
1st degree	16.3±2.7	21.4 ± 3.7	0.8 to 9.4
2nd degree	14.1±2.6	16.9 ± 2.5	0.2 to 5.5
3rd degree	10.9±3.0	13.6 ± 3.2	-0.3 to 5.8
Arteriole (n=12)			
1st degree	12.7±1.7	15.8 ± 1.8	0.7 to 5.5
2nd degree	10.9 ± 2.2	13.6 ± 2.3	0.8 to 4.5
3rd degree	8.6 ± 2.3	11.5 ± 2.4	0.2 to 5.6

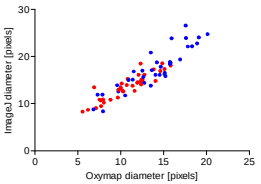

Figure 4. *Vessel diameters measured with Oxymap and ImageJ. Each point denotes one vessel. (venules are blue and arterioles red). One first, second and third degree arteriole and venule measured in each eye (36 arterioles and 36 venules in total).*

Conclusions

Vessel diameter measurements with the oximeter are repeatable and comparison with an established method demonstrates a relatively stable offset. Different definitions of vessel borders may be the reason for this offset.

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