

Purpose

Diabetic retinopathy is believed to involve retinal hypoxia. Our previous measurements showed elevated oxygen saturation in retinal vessels in patients with diabetic retinopathy. In this study we measure oxygen saturation in retinal vessels with a new generation of a 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.

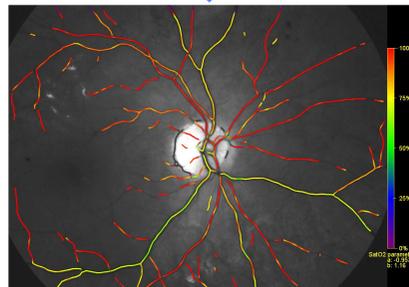
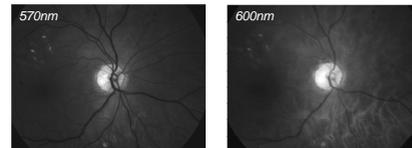


Figure 2. A color-coded map of hemoglobin oxygen saturation is generated automatically from images, taken simultaneously at 570nm and 600nm.

Oxygen saturation was measured in major temporal retinal vessels in 17 healthy individuals and 19 patients with diabetes. ANOVA and Dunnett's post test were used for statistical analysis.

Results

Figure 3 shows retinal oxygen saturation in healthy individuals and subgroups of diabetic patients.

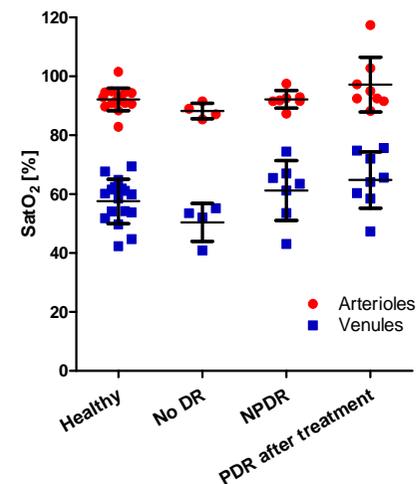


Figure 3. Oxygen saturation in retinal vessels. Each point denotes saturation in one retinal arteriole or venule (one point from each individual).

Saturation values for subgroups are shown in the table. Overall p value was 0.051 for arterioles and 0.048 for venules (ANOVA).

Table. Oxygen saturation in retinal vessels.

	Mean±SD	95% confidence interval (vs. healthy)
Arterioles		
Healthy (n=17)	92±4%	
Diabetes, no retinopathy (n=4)	88±3%	-11 to 3%
Diabetes, proliferative retinopathy after laser (n=7)	92±3%	-6 to 6%
Diabetes, proliferative retinopathy after laser (n=8)	97±9%	-0.6 to 11%
Venules		
Healthy (n=17)	58±8%	
Diabetes, no retinopathy (n=4)	50±6%	-19 to 5%
Diabetes, proliferative retinopathy after laser (n=7)	61±10%	-6 to 13%
Diabetes, proliferative retinopathy after laser (n=8)	65±10%	-2 to 16%

Conclusions

These preliminary data show a trend towards elevated saturation in retinal vessels in proliferative diabetic retinopathy after treatment. This is consistent with results from an earlier oximeter. Possible explanations include shunting of blood through damaged capillary network and decreased oxygen consumption due to laser treatment.