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Relationship between Retinal Blood Flow and Arterial Oxygen.

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Abstract

Retinal blood flow (RBF) increases in response to a reduction in oxygen (hypoxia), but decreases in response to increased oxygen (hyperoxia). However, the relationship between blood flow and the arterial partial pressure of oxygen has not been quantified and modeled in the retina in particular the vascular reserve and resting tonus of the vessels. The objective of this study was to determine the limitations of the retinal vasculature by modeling the relationship between RBF and oxygen. Retinal vascular responses were measured in 13 subjects for 8 different blood gas conditions, with the end-tidal partial pressure of oxygen ($P_{ET}O_2$) ranging from 40-500 mmHg. Retinal vascular response measurements were repeated twice; using the Canon Laser Blood Flowmeter (CLBF) during the first visit, and using Doppler Spectral Domain Optical Coherence Tomography (Doppler SD-OCT, RTVue) during the second visit. We determined that the relationship between RBF and PaO_2 can be modeled as a combination of hyperbolic and linear functions. We concluded that RBF compensated for decreases in arterial oxygen content for all stages of hypoxia used in this study, but can no longer compensate below a $P_{ET}O_2$ of 32-37 mmHg. These vessels have a great vascular range of adjustment, increasing diameter (8.5% arteriolar and 21% total venous area) with hypoxia (40 mmHg $P_{ET}O_2$; $p<0.001$) and decreasing diameter (6.9% arteriolar and 23% total venous area) with hyperoxia (500 mmHg $P_{ET}O_2$; $p<0.001$) to the same extent; indicating that the resting tonus is near the midpoint of the adjustment ranges at resting PaO_2 where sensitivity is maximum. This article is protected by copyright. All rights reserved.

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