Retinal photocoagulation and oxygenation

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Purpose The clinical role of photocoagulation for the treatment of hypoxia related complications of retinal ischemic microangiopathies is well established.

Methods Measurements of the partial pressure of oxygen (PO2) distribution within the the retina in various animal species using oxygen sensitive microelectrodes and evaluation of the retinal vessels reactivity by laser doppler velocimetry gave additional insights concerning photocoagulation mechanisms.
The PO2 within the vitreo-retinal interface is heterogeneous. Preretinal and trans-retinal PO2 profiles indicate that the preretinal PO2 far away from vessels remain constant in all retinal areas.
Intervascular intraretinal PO2 gradually decreases from both the vitreo-retinal interface and the choroid towards the mid-retina. Close to the pigment epithelium, it is significantly higher than at the vitreoretinal interface due to the much higher O2 supply provided by choroidal compaires to retinal circulation.

Results Laser photocoagulation reduces the outer retina O2 consumption and allows O2 diffusion into the inner retina from the choroid raising the PO2 in the inner healthy retinal layers and in the preretinal intervascular normal areas. In this way laser treatment relieves retinal hypoxia in experimental branch vein occlusion (BRVO). In patients with diabetic retinopathy (DR), the retinal PO2 is higher in areas previously treated with laser.
Following photocoagulation, the resulting reversal of hypoxia, the retinal vasculature constriction and the improvement of the regulatory response to hyperoxia all affect favorably both the retinal neovascularisation and macular edema.

Conclusions Photocoagulation induces an increase of the inner retinal oxygenation reversing the retinal hypoxia and improving the regulatory response of the retinal vessels