



297 Increased Oxygen Saturation after Laser Treatment in Human BRVO

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Purpose

Earlier animal studies have indicated that branch retinal vein occlusion (BRVO) leads to retinal hypoxia and that the hypoxia may be reversed by laser treatment [Pournaras CJ et al. Ophthalmology 1990;97(10):1329-33]. In this study we measured the hemoglobin oxygen saturation (SatO₂) in retinal venules in patients with BRVO before and after scatter laser photocoagulation.

Methods

Our automatic retinal oximeter yields fundus images non-invasively with 4 wavelengths of light simultaneously.

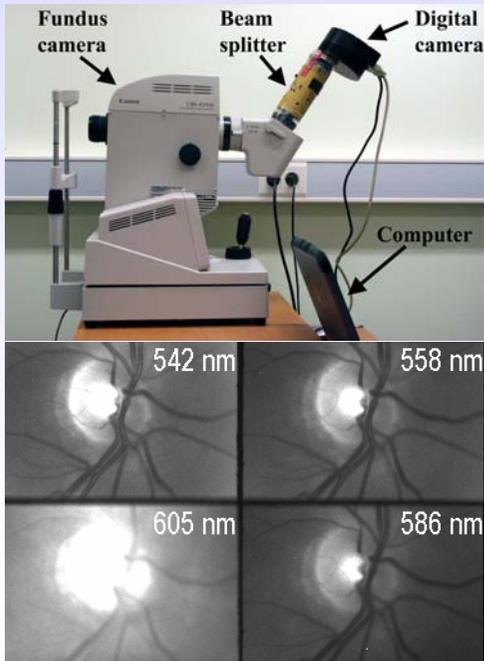


Figure 1. The retinal oximeter. Above: Components. Below: A typical output.

Specialized software automatically selects points on vessels and adjacent fundus for calculation of optical density ratios (ODRs). ODRs have an approximately linear inverse relationship with hemoglobin oxygen saturation (SatO₂) [Beach JM et al. J Appl Physiol 1999;86(2):748-58].

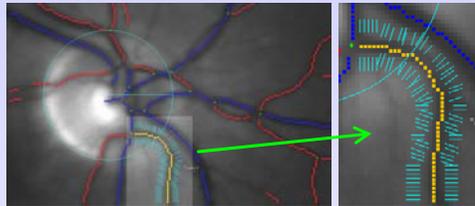


Figure 2. Automatic selection of measurement points.

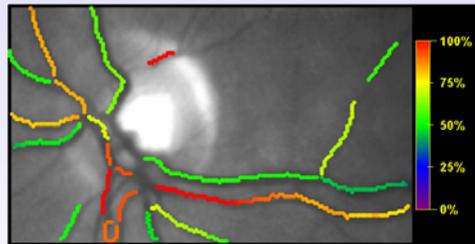


Figure 3. An example of a color-coded map of hemoglobin oxygen saturation. The map is generated automatically by the oximeter. This patient had diabetes but no retinopathy.

We performed oximetry in 13 patients with BRVO. Measurements were made before and after laser treatment in 5 patients. Other patients were either measured only before treatment (some did not receive treatment) or only after treatment.

The venules measured were divided into three categories: (1) Venules in the healthy fellow eye, (2) venules in the healthy area of the affected retina and (3) venules in the affected area of the retina. The venules in the third category (affected area) were either occluded themselves or received blood (partly) from an occluded venule. The downstream venules were measured when the occluded venules were obscured by extravascular blood.

Results

Figure 4 shows measurements from 5 BRVO eyes in which the affected venules were measured both before and after laser treatment. The SatO₂ rose from 45±10% to 53±6% (mean±SD; p=0.04, paired t-test).

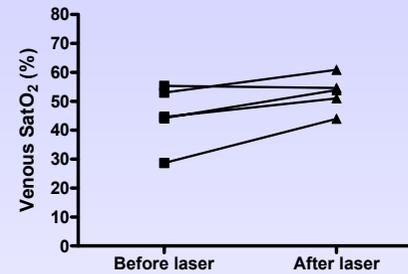


Figure 4. Five venules affected by BRVO measured before and after laser treatment.

Figure 5 shows all measurements, made on the 13 BRVO patients.

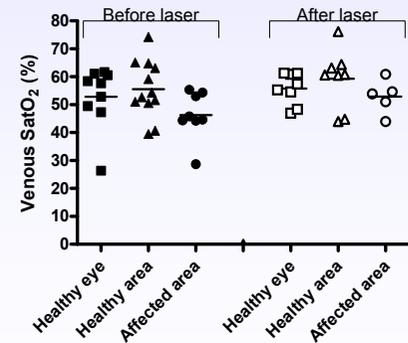


Figure 5. All measurements made on 13 BRVO patients. Closed symbols denote measurements before laser treatment and open symbols after laser. Some patients were measured both before and after laser treatment, some only before or only after laser.

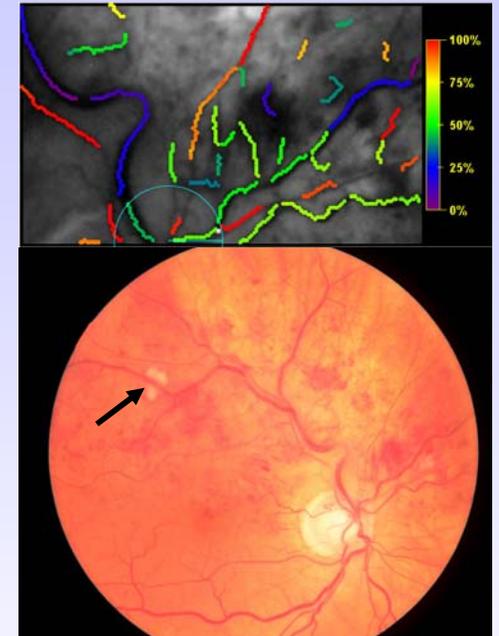


Figure 6. Above: A color-coded map of a fundus, affected by BRVO. The map indicates hypoxia in a venule. Below: A color image of the same fundus. The arrow points to cotton-wool spots.

Conclusions

The retinal oximeter measures an increase in hemoglobin oxygen saturation following laser treatment in patients with BRVO. This is in agreement with earlier studies on animals. With further development the oximeter may become a valuable clinical tool.

Commercial relationship: S.H. Hardarson, Oxymap ehf., I. Oxymap ehf., P. R.A. Karlsson, Oxymap ehf., I. Oxymap ehf., E. Oxymap ehf., P. G.H. Halldorsson, Oxymap ehf., I. Oxymap ehf., E. Oxymap ehf., P. S. Basit, None, T. Eysteinnsson, Oxymap ehf., I. Oxymap ehf., P. J.A. Benediktsson, Oxymap ehf., I. Oxymap ehf., P. J.M. Beach, Oxymap ehf., I. Oxymap ehf., P. A. Harris, Oxymap ehf., I. E. Stefansson, Oxymap ehf., I. Oxymap ehf., P.

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