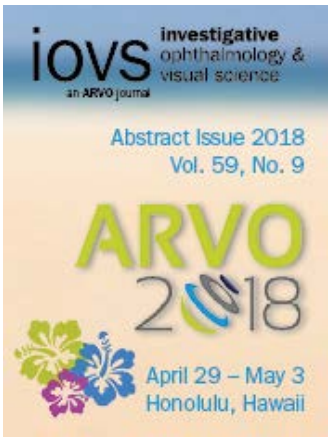

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Wireless Oxygen Generator to Treat Retinal Ischemia

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Abstract

Purpose : It is well known that retinal hypoxia plays an important role in the diabetic retinopathy (DR) pathophysiology. Current treatments of DR are focused on reducing retinal oxygen demand and controlling angiogenesis through intravitreal injections. Previous publications suggest that supplementing intravitreal oxygen might improve outcomes for retinal ischemia. A microelectronic and bio micro-electro-

mechanical system oxygenator implant has been designed to transport oxygen from the sub-conjunctival space to the proximity of the inner retina. The main objective of this study is to determine safety, efficacy and therapeutic levels of vitreous cavity oxygenation needed to support the retina by electrolysis-based oxygen generation implant.

Methods : The study was performed with local IACUC approval and in accordance with the ARVO guidelines on animal use. Three eyes of healthy pigmented rabbits (2-3kgs) were included in the study. With the animal anesthetized, the oxygenator was implanted and affixed onto the sclera. Electrolysis and intraocular measurements of partial pressure of oxygen (pO_2) were performed prior to suturing the conjunctiva back to the limbus. An oxygen probe (Oxford Optronix, London, UK) was placed intravitreal via pars plana and positioned next to the diffuser without touching adjacent structures. Baseline pO_2 measurements were recorded with the device off and no electrolysis. The device was then turned on for at least 3 minutes and electrolysis was confirmed by direct visualization of bubbles. Continuous measurement of pO_2 levels next to the device were performed during electrolysis. The relationship between electrolysis and pO_2 was analyzed.

Results : Oxygenator devices were successfully implanted. Intraocular pO_2 levels increased progressively to 79.1mmHg +5.52mmHg, 121.7mmHg +8.91mmHg and over 200mmHg after 2, 5 and 15 minutes of electrolysis, respectively (see Figure 1). Oxygen levels decreased exponentially as the probe was moved away from the device as predicted by computational models thereby minimizing oxygen toxicity to surrounding tissues. The Oxygenator implantation procedure was followed up for 7 days without presence of ocular complications.

Conclusions : Our study demonstrates that intraocular oxygen levels can be elevated following implantation and activation of the oxygenator device. Further experiments will be conducted in a long-term period.

This is an abstract that was submitted for the 2018 ARVO Annual

Meeting, held in Honolulu, Hawaii, April 29 - May 3, 2018.

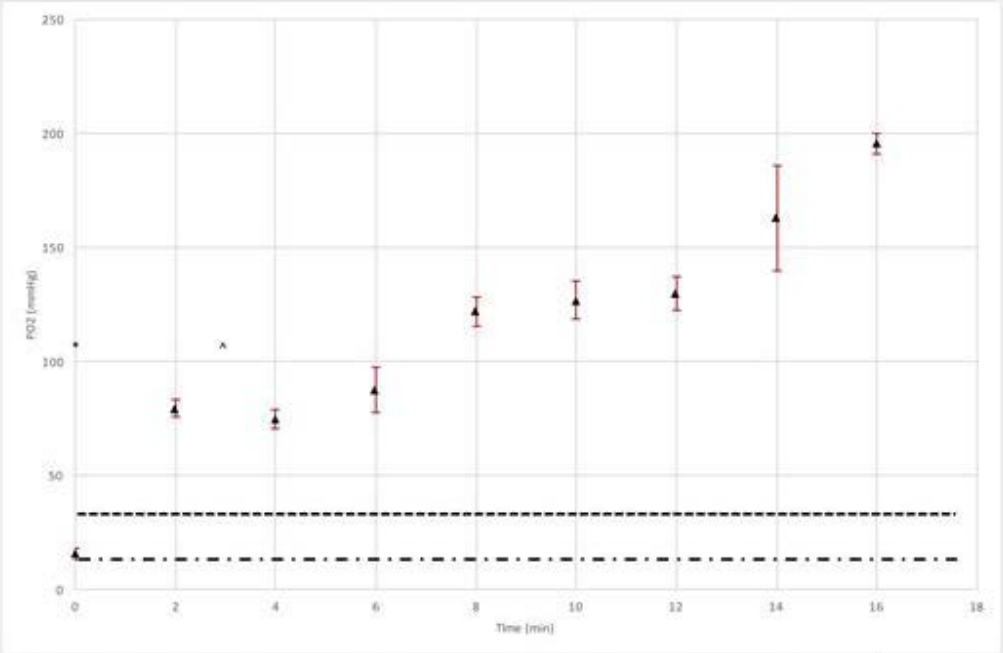

Figure 1 – Intraocular measurements of pO_2 after implantation. Dotted and dash/dot lines show pO_2 level nearby retinal vessels and mid-vitreous on healthy eyes (non-treated eyes) respectively. (*) Electrolysis on, (^) Electrolysis off.

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