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The therapeutic potential of 670nm light in retinal disorders

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Abstract

Irradiation with light wavelengths from the far red (FR) to the near infrared (NIR) spectrum (600nm-1000nm) has been shown to have beneficial effects in mammalian tissues. Its diverse clinical applications include treatment of soft tissue injuries, radiation-induced ulcers and inflammatory conditions, neurodegeneration and retinal diseases. While its mechanism of action remains unclear evidence suggests that red light acts directly on mitochondria and promotes normal cell function. Our laboratory has investigated the efficacy of red light therapy in three animal models of retinal disease. The light damage (LD) model of retinal degeneration, which mimics some aspects of dry AMD; oxygen-induced retinal degeneration (ORD), which models the late stages of retinal dystrophy; and oxygen-induced retinopathy (OIR), a model of retinopathy of prematurity. *In vitro* models are used to examine the direct effects on retinal pigment epithelial cells. Our structural and functional findings show that 670nm light significantly ameliorates retinal damage in all models, and also modulates gene expression patterns. In the LD model, irradiation with 670nm light mitigates the damaging effects of white light in a dose-dependent manner, by reducing oxidative damage to photoreceptors and modifying the downstream inflammatory response. In ORD 670nm light treatment reduces photoreceptor cell death and slows down, but does not inhibit, retinal degeneration. In OIR 670nm light treatment reduces vaso-obliteration and neovascularization, and reduces microhemorrhage in the lungs. *In vitro*, it reduces H2O2–induced oxidative stress in ARPE19 cells. Taken together, our results suggest that 670nm light treatment is a valuable therapeutic tool which acts on signalling pathways that regulate oxidative damage and the inflammatory response, to slow down the progression of retinal degeneration. Because vision impairment presents a significant medical and public health burden, and expensive treatments (such as anti-VEGF agents) are expensive and unavailable to many populations, the use of 670nm light exposure as a preventative measure and/or as part of a broader management strategy may be highly beneficial.

Biography

Rizalyn Albarracin is a final year PhD candidate in the Australian Research Council Centre of Excellence in Vision Science, at the Australian National University (ANU) Canberra. She completed a BSc in Molecular Pathology in Wellington, New Zealand with High Distinction in 2008. In 2009, she obtained a First Class Honours Honour's degree in Neuroscience at the ANU. She also lectures at a paramedic training institute. She has published 3 research papers, presented at 4 international conferences and received several travel grants and awards, including the ANU Vice Chancellor's Excellence Award for Community Outreach as a team leader. She is actively involved in academic and community-based outreach programs. She established a charitable foundation in 2010 that is focussed on healthcare, and community development in the Philippines, and is a member of the executive board of the Shepherds Arms Orphanage.