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The power of LIGHT in dry AMD

HOW PHOTOBIOMODULATION IMPROVES VISION

Harnessing the power of light in dry age-related macular degeneration

Photobiomodulation is a non-invasive treatment which offers improved vision

By Drs Roberto Pinelli, Miorica Bertelli and Elena Scaffidi

Dr Pinelli

Photobiomodulation (PBM) is the application of monochromatic light to the body with the aim of repairing tissues and reducing inflammation, oedema and pain.[1] It has been used for 20 years for the treatment of musculoskeletal pain, injury and dysfunction; to aid wound healing; to improve acute muscle performance and reduce muscle damage after exercise;[1] and for neuropathic pain, lymphoedema and oral mucositis.[2–4]

Several studies in the past 5 years have shown encouraging results using PBM to treat eye diseases including age-related macular degeneration (AMD),[5,6] retinopathy of prematurity and diabetic macular oedema.[1,7–9] PBM does not worsen the disease, has no side effects and is completely non-invasive.[10,11]

There is no currently approved treatment or cure for the dry form of AMD, which affects 80% of individuals with AMD and tends to progress more slowly than the wet type.[10]

Light waves

PBM is not a heat therapy but is more akin to photosynthesis in plants, in that light, in the far red and near-infrared spectral range, can stimulate cells and lead to a cascade of photochemical reactions.

What happens first is that the low-powered light is absorbed locally by cytochrome c oxidase. Mitochondrial energy is then produced by releasing oxygen, which results in increased ATP concentration and reduced oxidative stress.

This photochemical reaction activates enzymes and second messengers, which lead to a cellular and, indirectly, a systemic response in tissues that have not absorbed photons.[5,12,13] Mitochondrial dysfunction and oxidative stress play a key role in many macular diseases, so PBM is of use in acute and chronic eye diseases.[1,5,10]

We offer nine PBM therapy cycles within approximately 1 month. During the procedure, a medical device with light-emitting diodes stimulate cellular function and improve energy production.

Each cycle of therapy delivers wavelengths in the range of 590–850 nm for 4 minutes per eye. Clinical outcomes are determined immediately after the final cycle, after 3 months and after 6 months, using optical coherence tomography (OCT) imaging, the Amsler grid, the Pelli-Robson chart, a Snellen chart and a Jaeger chart.

Case study

Nine PBM cycles were administered over 1 month to a patient with dry AMD, after which OCT showed reduced drusen and the patient obtained subjectively improved vision (see Figure 1). The patient also experienced less eye strain, more colour contrast, higher definition and better far and near uncorrected visual acuity.

Contrast sensitivity improved from 1.8 to 2.0 log units. Outcomes remained stable at the 6-month follow-up (see Figure 2).

This case demonstrated a successful non-invasive treatment with improved quality of vision in dry AMD. Irradiation could therefore offer a new non-invasive, adverse-effect-free means of stimulating retinal stem cells to regenerate.

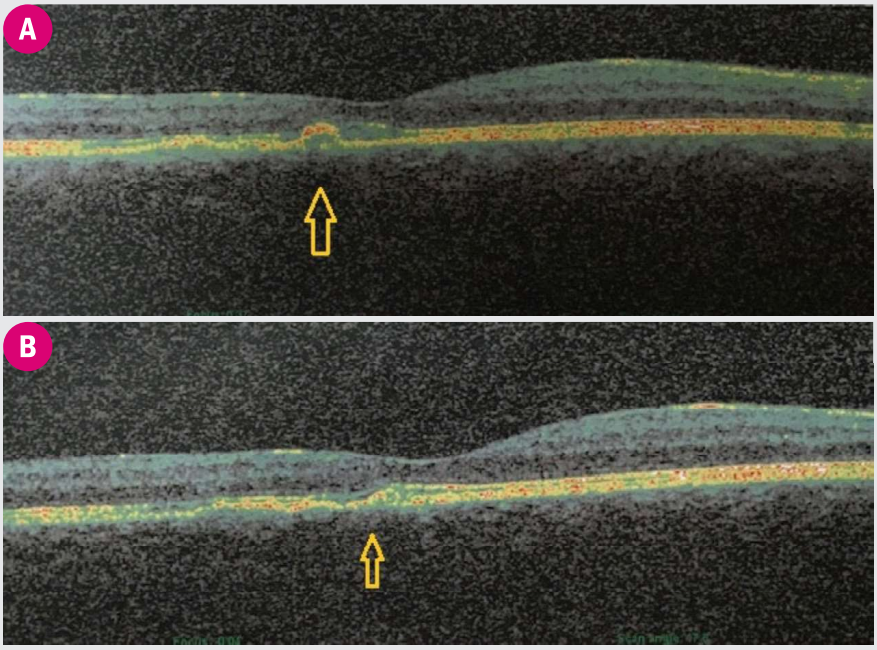
Conclusion

To date, there are no approved treatments for many retinal diseases. With its ability to promote cellular regeneration using light waves, PBM has resulted in better visual acuity, contrast sensitivity and a less-damaged macular profile in several patients with dry AMD.

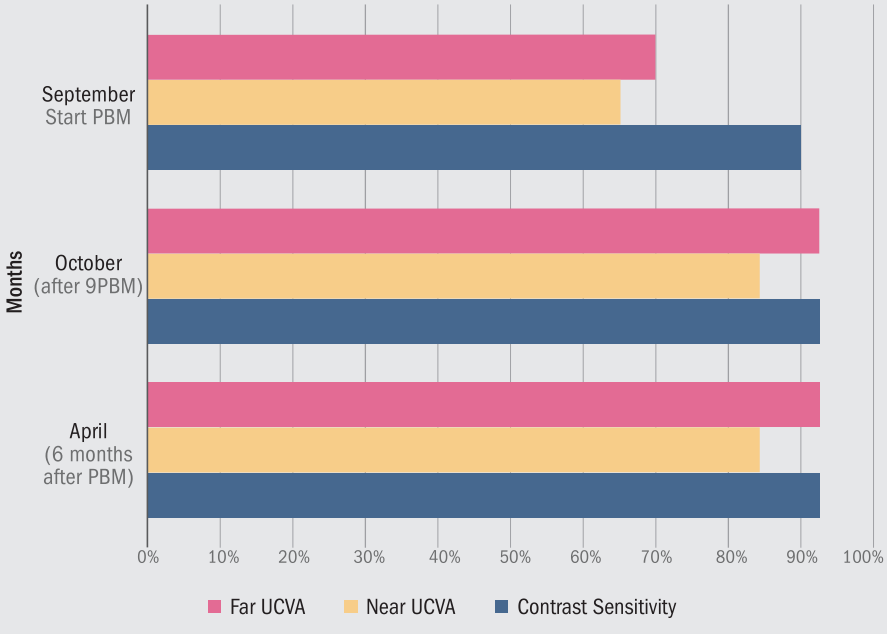
Overall, these results are encouraging. Our protocol seems to offer an extremely promising approach to prevent visual acuity from worsening and to promote tissue repair in dry AMD. Moreover, this method has the advantage of being entirely non-invasive.

IN SHORT

- ***Photobiomodulation has been demonstrated to improve quality of vision in several patients suffering from dry AMD.***



(FIGURE 1) Macula before treatment (A) and 6 months after treatment (B).



(FIGURE 2) Far and near uncorrected visual acuity (UCVA) and contrast sensitivity before treatment and 6 months later. *(Images courtesy of Dr Pinelli)*

According to this hypothesis, irradiation at certain wavelengths can regenerate retinal cells. Thus, modulated light can offer a novel valid therapeutic approach for dry AMD, which has the potential to facilitate the repair of damaged tissues in the retina and promote survival and functions of epithelial cells within the retinal pigmented epithelium.[14]

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ROBERTO PINELLI, MD, MIORICA BERTELLI, OD AND ELENA SCAFFIDI, MA

E: *pinelli@seri-lugano.ch*

Drs Pinelli, Bertelli and Scaffidi are based at the Switzerland Eye Research Institute, Lugano. They have no financial disclosures to reveal.