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# Photobiomodulation with 808-nm diode laser light promotes wound healing of human endothelial cells through increased reactive oxygen species production stimulating mitochondrial oxidative phosphorylation

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## Abstract

Photobiomodulation of cells using near-infrared (NIR) monochromatic light can affect cell functions such as proliferation, viability, and metabolism in a range of cell types. Evidence for the effects of near-infrared light on endothelial cells has been reported, but the studies were mainly performed using VIS light emitted by low-energy lasers, because NIR wavelengths seemed negatively stimulate

these cells. Cell viability, free radical-induced oxidative stress, NF- $\kappa$ B activation, nitric oxide release, mitochondrial respiration, and wound healing repair were assessed in human endothelial cells (HECV) irradiated with 808-nm diode laser light (laser setup = 1 W/cm<sup>2</sup>, 60 s, 60 J/cm<sup>2</sup>, CW vs measured energy parameter = 0.95 W/cm<sup>2</sup>, 60 s, 57 J/cm<sup>2</sup>, mode CW) emitted by an handpiece with flat-top profile. No difference in viability was detected between controls and HECV cells irradiated with 808-nm diode laser light for 60 s. Irradiated cells demonstrated higher proliferation rate and increased migration ability associated to moderate increase in ROS production without a significant increase in oxidative stress and oxidative stress-activated processes. Near-infrared light stimulated mitochondrial oxygen consumption and ATP synthesis in HECV cells. Short near-infrared irradiation did not affect viability of HECV cells, rather led to a stimulation of wound healing rate, likely sustained by ROS-mediated stimulation of mitochondrial activity. Our results demonstrating that near-infrared led to a shift from anaerobic to aerobic metabolism provide new insight into the possible molecular mechanisms by which photobiomodulation with 808-nm diode laser light protects against inflammation-induced endothelial dysfunction, seemingly promising to enhance their therapeutic properties.

**Keywords:** Human endothelial cells (HECV); Mitochondrial respiration; NIR-diode laser; Photobiomodulation (PBM); Wound regeneration.

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