INTERNATIONAL CONFERENCE ON CELL SCIENCE AND REGENERATIVE MEDICINE

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Photobiomodulation Speeds Up Wound Healing via the JAK/STAT and PI3K/AKT Signalling Pathway

Abstract: Signal transduction pathways control basic cellular processes like cell division, migration, proliferation, and survival. Photobiomodulation (PBM) is a non-invasive approach that harnesses the therapeutic properties of light to promote healing, reduce inflammation, and relieve pain for the benefit of patients. Despite the medical advancement and increasing acceptance of PBM, the underlying cellular and molecular mechanisms are still not fully understood. This in vitro study aimed to determine the effect of PBM at 660 nm with 5 J/cm2 on the JAK/STAT and PI3K/AKT/mTOR pathway. Proteins involved in these pathways were assessed by ELISA, western blotting, and immunofluorescence. Post-PBM, epidermal growth factor (EGF) was increased, as well as phosphorylated (p-)EGFR, p-JAK2, p-STAT1, and p-STAT5. In addition vascular endothelial growth factor (VEGF), p-PI3K, p-AKT1, p-mTOR, FOXO1, and p-GSK3β were also increased. Activation of the JAK/STAT and PI3K/AKT signalling pathways post-PBM at 660 nm accelerated biological processes like cell migration and proliferation. This study demonstrates that PBM mediates its effects by activating signal transduction pathways, including JAK/STAT and PI3K/AKT, allowing for the enhancement of wound healing, particularly under pathological conditions such as diabetes.

Keywords: Photobiomodulation, Signal transduction, Wound healing.

Biography: Nicolette Houreld (D.Tech (UJ) Biomedical Technology) is a Research Professor at the Laser Research Centre, within the Faculty of Health Sciences at the University of Johannesburg in South Africa. Her research interests lie in the areas of photobiomodulation and diabetic wound healing, where she investigates the molecular and cellular effects of photobiomodulation and laser tissue interaction. Prof Houreld is a NRF C1 rated scientist with a Scopus h-index of 33. She is the president of the World Association for Phortobiomodulation Therapy (WALT) and serves on several research related committees.

ISBN: 978-1-0685851-4-2