

Photobiomodulated differentiation of adipose-derived mesenchymal stem cells into osteoblasts

Ms Daniella Da Silva, Dr Anine Crous and Professor Heidi Abrahamse*

Laser Research Centre, Faculty of Health Sciences, University of Johannesburg, P.O. Box 17011, Doornfontein, Johannesburg, South Africa, 2028

*Corresponding author Prof Heidi Abrahamse; Tel: +27 11 559-6550; Email: habrahamse@uj.ac.za

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Ethical approval This work has been registered (REC 241112-035) and received ethics approval from the Faculty of Health Sciences, University of Johannesburg's Research Ethics Committee (REC-01-471-2020).

Osteoporosis is a progressive, metabolic bone disease affecting millions across the globe. Stem cell regenerative therapy has demonstrated potential in treating osteoporosis, particularly when using Adipose-derived Mesenchymal Stem Cells (ADMSCs).

Photobiomodulation (PBM) has gained international momentum due to its ability to aid in the proliferation and differentiation of stem cells. Additionally, PBM when combined with differentiation growth factors has revealed enhanced proliferation and ADMSC differentiation into osteoblasts. This *in vitro* study combined the use of osteogenic differentiation inducers, particularly dexamethasone, ascorbic acid and beta-glycerol diphosphate sodium, and PBM at a near-infrared (NIR) wavelength of 825 nm, a green wavelength of 525 nm and their combination of wavelengths (825 nm + 525 nm) using a single fluence of 5 J/cm² to determine the proliferation and differentiation effectivity of ADMSCs into osteoblasts. The cells were characterised via the use of flow cytometry.

Morphology was investigated and biochemical assays performed including proliferation, viability, and ROS. The successful outcome of this study provides relevant scientific knowledge and a standardization for osteogenic differentiation *in vitro* using PBM.

Keywords Photobiomodulation; Adipose-derived Mesenchymal Stem Cells; Differentiation; Proliferation; Osteoblasts.