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Effects of sulfonated zinc phthalocyanine and low intensity laser irradiation in inducing photodynamic damage in breast cancer cells

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Organ systems need to be properly regulated and protected from detrimental invasion. Many mechanisms work together to maintain the mammalian integrity, however, some entities can bypass these mechanisms leading to damage and sometimes death. Cancer is an unregulated cell growth condition that can spread and invade surrounding normal cells and tissues. Cancer escapes defense and control mechanisms, causes cellular damage and loss of cellular activity. More than 90% of cancer-related deaths occur by spreading malignant cells to vital organs, a process called metastasis. Photodynamic cancer therapy (PDT) uses non-toxic photochemotherapeutic agents, Photosensitizer (PS), to initiate a light dependent reactive oxygen species (ROS) related to cell damage. ROS are associated with oxidative stress and consequent cytodamage induced by oxidizing and degrading cell components. ROS are also involved in immune responses where they stabilize and activate hypoxia inducible and phagocytic factors. Phthalocyanines (Pc) are stable PSs with improved photochemical abilities and a sulfonated Zinc Pc(ZnPcSmix) was used to investigate photodynamic effects in a breast cancer cell line in vitro using a 680 nm diode laser at a fluence of 10 J/cm2. Flow cytometry using Annexin V- fluorescein isothiocyanate (FITC), a cell death immunosorbent assay (ELISA) and gene expression analysis following ZnPcSmix mediated PDT were performed to determine the induced cell death pathways. ZnPcSmix localized in critical cellular organelles and apoptotic cells abounded after the treatment. Nuclear fragmentation was seen as oligonucleosomal degradation and increased expression of the Bcl-2, DFFA1 and CASP-2 genes, indicated that apoptosis is the main induced mode of cell death.

Biography

Ivan Mfouo-Tynga (Bachelor of Sciences in Human Physiology and Biochemistry, Bachelor of Technology in Biotechnology, Master of Technology in Biomedical Sciences, University of Johannesburg, South Africa) is at present a Doctorate candidate at the Laser Research Center, Faculty of Health Sciences, University of Johannesburg. His current work focuses on the development of a photochemical and anti-cancer compound, the mechanisms that accompanied cell damage and understanding of diverse mode of cell death. He has previously published his works in accredited journals, presented at several international conferences and is the laureate of two merit awards.

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