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Evaluation of Pheophorbide a Phototoxicity in Melanoma Cells Grown as Three-Dimensional Multicellular Tumour Spheroids

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Melanoma is the deadliest form of skin cancer, with a rapidly increasing incidence and a poor prognosis for patients diagnosed at advanced stages. Despite several available treatments, including surgical excision, chemotherapy, radiation therapy, and immunotherapy, resistance to these therapies remains a significant challenge, particularly when the tumour has metastasised. Photodynamic therapy (PDT) is a promising modality for the treatment of cancer because it is non-invasive and selectively damages the cancerous tissue, minimizing damage to adjacent healthy tissues. Currently, most PDT experiments are still conducted on two-dimensional (2-D) monocultures, which fail to accurately mimic native three-dimensional (3-D) tissue architecture. Therefore, 3-D cell cultures serve as excellent models to resemble tumour tissue in terms of structural and functional properties. Commercially purchased A375 melanoma cells used in this study were cultured as 3-D tumour spheroids and treated with pheophorbide-a at varying doses (1-40 ⊠M) and irradiated at a fluency of 10 J/cm2 with a 660 nm diode laser. Post-irradiation cellular changes were observed using microscopy, adenosine 5′-triphosphate (ATP), and lactate dehydrogenase (LDH) assays. Photoactivated pheophorbide a led to a significant dose-dependent response to PDT, demonstrating notable morphologic changes, increased cytotoxicity, and reduced cell viability. The study indicated that PDT with pheophorbide-a is an effective treatment method for eradicating melanoma cancer cells in vitro.

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