Photobiomodulation by High Power Pulsed Nd:YAG Laser as a Novel Approach for the Treatment of Colorectal Cancer

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Colorectal (CRC) is a common malignancy, with an annual estimated incidence of 1.8 million newly diagnosed cases and 880,000 deaths globally. Currently, there is a low response rate to 5-Fluororacil, the main chemotherapeutic agent. Hence, there is a compelling need to develop innovative therapeutic strategies that could enhance the outcomes. Although high-intensity laser therapy (HILT) is a clinically approved and effective therapy, little is known about its efficacy in treating CRC. In this research, I used HILT at different doses (9, 120 and 150 joules) against the HT29 and HCT116 human CRC lines. Cell proliferation, cell cycle effects and apoptosis were assessed by flow cytometry. The gene and protein expression of proliferation (survivin and PCNA), cell cycle (CCND1 and p21) and pro-apoptotic (caspase-3 and p53) markers were measured by RT-PCR and immunofluorescence, respectively. The results showed dose-dependent antiproliferative and apoptotic effects with cell cycle arrest in both cell lines ($P<0.05$). Moreover, cells treated with 120 and 150-joules groups demonstrated significantly higher numbers of cells in the sub-G1 phase of cell cycle (10% and 16%, respectively) compared with non-treated cells and 9-joules groups. Additionally, 120 joules and 150-joules protocols induced significant decreases in survivin, PCNA, and CCND1 compared with non-treated cells. Concomitantly, significant upregulations in p21, caspase-3, and p53. In conclusion, HILT could be a novel alternative/complementary CRC therapy by modulating cell cycle progression, proliferation, and induction of apoptosis. Further studies are needed to explore the utility of HILT in the treatment of solid tumors.