LETTER TO EDITOR

LLLT AND PDT

R. Lubart and H. Friedmann

Departments of Chemistry and Physics, Bar-Ilan University, Ramat-Gan 52900, Israel

This Letter relates to the paper of Yuichi Miyamoto et al., “EFFECT OF 630-NM PULSED LASER IRRADIATION ON THE PROLIFERATION OF HeLa CELLS IN PHOTOFRIN®-MEDIATED PHOTODYNAMIC THERAPY” published recently in Vol. 20 (2). The authors investigated changes in cell proliferation following PDT using 630nm laser irradiation which was clinically found to induce no remarkable cell injury. They found that the viability of irradiated HeLa cells was greater than that of non-irradiated cells, i.e. an LLLT effect. They derived the conclusion that in PDT when light doses become remarkably low (deep within the tissue), pronounced LLLT effects and no cytotoxic effects are obtained.

We would like to draw the attention of the readers to an old paper of us1) where we found that the proliferation rate of fibroblasts enriched with small amounts of hematoporphyrin derivatives (HPD) was increased following low intensity HeNe laser irradiation. PDT and LLLT are two edges of the same sword. In PDT, exogenous photosensitizers are introduced into the cells and then irradiated with wavelengths of visible or near infra-red (NIR) light to produce high amounts of ROS that are lethal to the cells. In LLLT, light is absorbed by endogenous cellular photosensitizers such as cytochromes, flavins, porphyrins and NADH. 2) Since the amount of endogenous cellular photosensitizers is relatively small, low concentrations of ROS are generated. It is well established that ROS in minute concentrations stimulate cellular functions like proliferation. 3) The fact that exogenous porphyrins combined with very low energy visible light enhance proliferation must be taken into account when using PDT. Cancerous cells enriched with small amounts of photosensitizers (like those at the border of a malignant tumor) may proliferate better after irradiation. For the same reason, LLLT should be avoided in the presence of cancerous cells. 4)

LLLT and PDT can be viewed as different zones of the well-known Arndt-Schultz (A-S) curve, (see e.g. Fig. 10 in the review of T. Ohshiro5)). Zone 1, ascending part of the A-S curve: weak to moderate light doses and endogenous photosensitizers, or very weak light doses adding exogenous photosensitizers, or moderate light doses adding minute amounts of exogenous photosensitizers lead to stimulation as in LLLT. Zone 2, the A-S curve descends back to the baseline: in this Zone, strong light doses and endogenous photosensitizers or moderate light doses adding small amounts of exogenous photosensitizers lead to neutralizing the stimulation obtained in Zone 1. Zone 3, the A-S curve descends below the baseline: in Zone 3, a further increase of the combined light and exogenous photosensitizer stimuli dosage leads to PDT.

References


Address for Correspondence:
Rachel Lubart, Department of Chemistry and Physics Bar-Ilan University, Ramat Gan 52900 Israel
E-mail: lubartr@mail.biu.ac.il