

# Improvement Of Tumor Response By Manipulation Of Tumor Oxygenation During Photodynamic Therapy.

*Photochem Photobiol* 2002 Aug;76(2):197-203 (ISSN: 0031-8655)  
Chen Q; Huang Z; Chen H; Shapiro H; Beckers J; Hetzel FW  
Research and Development, HealthONE Alliance, Denver, CO, USA.

Photodynamic therapy (PDT) requires molecular oxygen during light irradiation to generate reactive oxygen species. Tumor hypoxia, either preexisting or induced by PDT, can severely hamper the effectiveness of PDT. Lowering the light irradiation dose rate or fractionating a light dose may improve cell kill of PDT-induced hypoxic cells but will have no effect on preexisting hypoxic cells. In this study hyperoxygenation technique was used during PDT to overcome hypoxia. C3H mice with transplanted mammary carcinoma tumors were injected with 12.5 mg/kg Photofrin and irradiated with 630 nm laser light 24 h later.

Tumor oxygenation was manipulated by subjecting the animals to 3 atp (atmospheric pressure) hyperbaric oxygen or normobaric oxygen during PDT light irradiation.

The results show a significant improvement in tumor response when PDT was delivered during hyperoxygenation. With hyperoxygenation up to 80% of treated tumors showed no regrowth after 60 days. In comparison, when animals breathed room air, only 20% of treated tumors did not regrow. To explore the effect of hyperoxygenation on tumor oxygenation, tumor partial oxygen pressure was measured with microelectrodes positioned in preexisting hypoxic regions before and during the PDT.

The results show that hyperoxygenation may oxygenate preexisting hypoxic cells and compensate for oxygen depletion induced by PDT light irradiation. In conclusion, hyperoxygenation may provide effective ways to improve PDT efficiency by oxygenating both preexisting and treatment-induced cell hypoxia.