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Hyperbaric oxygen preconditioning protects Skin from UV-A damage

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Abstract

Hyperbaric oxygen therapy (HBOT) is used for a number of applications, including the treatment of diabetic foot ulcers and CO poisoning. However, we and others have shown that HBOT can mobilize cellular antioxidant defenses, suggesting that it may also be useful under circumstances in which tissue protection from oxidative damage is desired. To test the protective properties of hyperbaric oxygen (HBOT) on a tissue level, we evaluated the ability of a preconditioning treatment regimen to protect cutaneous tissue from UV-A-induced oxidative damage. Three groups of hairless SKH1-E mice were exposed to UV-A 3 days per week for 22 weeks, with two of these groups receiving an HBO pretreatment either two or four times per week. UV-A exposure increased apoptosis and proliferation of the skin tissue, indicating elevated levels of epithelial damage and repair.

Pretreatment with HBOT significantly reduced UV-A-induced apoptosis and proliferation. A morphometric analysis of microscopic tissue folds also showed a significant increase in skin creasing following UV-A exposure, which was prevented by HBOT pretreatment. Likewise, skin elasticity was found to be greatest in the group treated with HBOT four times per week. The effects of HBOT were also apparent systemically as reductions in caspase-3 activity and expression were observed in the liver. Our findings support a protective function of HBOT pretreatment from a direct oxidative challenge of UV-A to skin tissue. Similar protection of other tissues may likewise be achievable.