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PHOTOTHERMAL EXCITATION OF SUBCUTANEOUS FAT AND DEEP DERMIS, BY CW FILTERED INFRARED RADIATION AND CONTACT COOLING

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Background and Objectives: The depth of photothermal treatments in dermatology has been limited to about 5 mm. In order to overcome this limitation, we developed a device combining a water-filtered broadband lamp, with parallel contact skin cooling. Photothermal treatment of deep dermis and subcutaneous fat was studied.

Study Design/Materials and Methods: Extensive numerical simulations were used to identify a useful range of IR source and cooling parameters, prior to in vitro and in vivo experiments in Yucatan swine. Temperature distribution with tissue depth was measured using thermal imaging. Gross and histological responses were noted after exposure to a range of optical power and exposure time.

Results: Profiles of elevated temperature with maxima as deep as 5–15 mm from the skin surface were both predicted and measured. There was good quantitative correspondence between the predicted and actual thermal profiles. By manipulating treatment exposure parameters of optical power, spectral filtration, cooling and exposure time, the depth for maximum thermal effect was arbitrarily controlled. Histological data revealed similar control over the depth for cell lethality, including conditions in which a region of deep dermis and subcutaneous fat was affected, without apparent injury to the overlying dermis and epidermis.

Conclusions: Photothermal treatment of very deep dermis and/or subcutaneous fat is possible, using appropriate c.w. near-IR sources and contact cooling.