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Background: Lipid peroxide and reactive oxygen species (ROS) and, which are produced by ultraviolet and visible light damage skin cells, collagen and elastic fibers in the dermis. Infrared intence pulsed light irradiation are powerful treatments but may lead to generate free radicals. We measured different free radicals generated by light in the skin. Electron spin resonance (ESR) analysis revealed that different free radicals, including hydroxyl radical (OH^*) and superoxide anion radical ($O2^*$), were generated in hairless mice skin with pulsed NIR light device irradiation. ROS damage melanocytes and may induce the production of inflammatory molecules. Further, we determined what kind of radical scavenger suppressed hyperpigmentation in skin after treatment.

Study: Analysis method of free radical signals: 4 types free radical signals were detected on pig skin tissue by spin-trapping agent 20 μl DPPMPO and ESR. The pig skin tissue has been processed several times by rapid repetition rate NIR (800–1400 nm) light device (Sciton, Skintyte, CA, USA) and continuous NIR (1100–1800 nm) light device (Cutera, Titan, CA, USA) with Total 225J/cm3, 3 times respectively. We also compared the pig skin tissue with and without hair.

Results: ESR analysis detected 5 types ROS of OH^*, $O2^*$, hydrogen radical, ascorbic radical and methyl radical generated by light irradiation. OH^* and $O2^*$ have been increased by depending on irradiation energy. After irradiation these radicals kept on increasing for 15 minutes but that was the peak and started to decrease gradually. The amount of the free radical has been measured and compared at the irradiation of rapid repetition NIR and continuous NIR. The comparison has showed that the ESR peak intensity of Hydrogen radical and $O2^*$ has been detected. The intensity of $O2^*$and Hydrogen radical has been detected more when we use and rapid repetition NIR device. The intensity of $O2^*$and Hydrogen radical has been detected more when the skin with hair.

Conclusion: The different light devices generate specific radical species in hairless mice skin. This investigation shows the possibility to reduce pain and side effects during light treatments by inhibition of specific ROS that was induced in each light wavelength.

#10

MODELING AND VALIDATION OF TEMPERATURE VARIATIONS WITHIN A BLOOD VESSEL DURING LASER IRRADIATION

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Background: Numerical modeling can be an effective tool to understand and improve laser therapy of vascular malformations. However, model validation is difficult due to the lack of vascular geometry and temperature measurements during laser-tissue interactions. Using the temperature variations measured with an IR camera during laser irradiation of blood vessels in an animal model, we will be able to validate the numerical models for the purpose of laser treatment parameters optimization.

Study: The depth of a blood vessel in the dorsal window chamber was measured using Doppler optical coherence tomography. The diameter of the blood vessel was measured from a photomicrograph of vasculature in the window. The blood vessel was then irradiated with a 532 nm laser while radiometric temperature was measured simultaneously. The blood vessels geometry and laser parameters were inputted into numerical models which have Monte Carlo light distribution module and finite-element thermal diffusion module. Measured and simulated temperatures were compared with each other.

Results: Blood vessels of various diameters (64–150 m) and depths (66–384 m) were used in the experiments. Numerical simulations indicate that varying blood absorption coefficients within physiological values did not affect the radiometric temperature significantly. However, varying the infrared attenuation coefficient of the tissue did affect the radiometric temperature in medium to deep vessels. Analysis of radiometric temperature measurements in the window chamber revealed that depth influences radiometric temperature while diameter does not. We found good agreement in the initial temperature increase of shallow blood vessels between the simulations and measurements, but discrepancy for deeper vessels.

Conclusion: These findings show numerical models can simulate temperature variation in shallow vessels undergoing laser irradiation accurately. A temperature measurement method that is less affected by tissue thickness is needed to validate the numerical models for the simulation of deeper target.

#11

EVALUATION OF THE LONG-TERM ANTI-AGING EFFECTS OF BROADBAND LIGHT THERAPY

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Background: Continual exposure to ultraviolet light and intrinsic aging result in photodamaged skin. BroadBand Light (BBL) therapy utilizes visible and infrared light to provide a gentle, no downtime treatment for the visual manifestations of skin aging. BBL has successfully provided patients with a decrease in the signs of aging and an increase in clearer, more youthful looking skin. The current study provided a blinded assessment of the long-term, anti-aging effects of BroadBand Light treatment as demonstrated by the delay of visual skin aging. The ages of patient's skin both untreated and BBL treated over a minimum of eight years was estimated by 51 dermatologists, and compared to their actual age.

Study: Eleven subjects were enrolled and treated for overall skin rejuvenation with BroadBand Light (BBL™ Sciton, Inc., Palo Alto, CA). Inclusion criteria included a minimum of one annual treatment over a minimum eight years, and no facial aesthetic throughout the study duration. 51 blinded dermatologist evaluators estimated patient ages based on photographs before and after treatment, and of untreated, sun-protected skin.

Results: The subjects' actual age ranged from 38–65 years prior to treatment, and was accurately estimated by the evaluators. After eight years following the BBL treatment regimen, the evaluators estimated the subjects to be approximately nine years younger than their actual age. The untreated, sun-protected skin was estimated to be the same as the treated skin age.