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EFFECT OF COATING MATERIAL ON UPDATE OF ICG LOADED NANOCAPSULES BY PHAGOCYTIC CELLS

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Background and Objectives: Indocyanine green (ICG) is an FDA approved near infrared fluorescent dye used in ophthalmological imaging and assessment of liver and cardiac functions. It is also under investigation as an exogenous chromophore for photothermal therapy of tumors and abnormal vasculature. However, ICG's usage remains quite limited due to its poor photostability, rapid excretion from the vasculature, and almost exclusive uptake by the liver. One approach to overcome these drawbacks is to deliver ICG in an encapsulated form.
Study Design/Materials and Methods: We use polymer-based materials whose surface can be coated with various materials as the encapsulating nanocapsules. In this study, we investigate effect of the coating materials such as Polyethylene Glycol (PEG) and dextran on the uptake of ICG loaded nanocapsules by blood monocytes in-vitro.
Results: Using fluorescent imaging, our preliminary results suggest that encapsulation of ICG within PEG and Dextran coated nanocapsules decreases phagocytosis of ICG by monocytes.
Conclusion: Results of this study provide the basis for appropriate selection of the coating materials that can be used to increase circulation time of ICG within the vasculature while minimizing phagocytic removal for in-vivo applications.
Key Words: Fluorescent imaging, Lasers, Nanoparticles, Phototherapy

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TISSUE-RF INTERACTIONS AND BIOPHYSICS OF SKIN REJUVENATION USING FRACTIONAL RF TECHNOLOGY

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Background: Thermally ablated microscopic zones surrounded by normal dermal tissue promote skin renewal via activation of the healing cascade. We present a novel, fine-tuning RF technology capable of inducing controlled thermal injury in a fractional manner. This particular targeting of the dermal matrix and fibroblasts enables efficient neocollagnesis and dermal enrichment. However, due to a large inter and intra individual variance in patients' electrical characteristics it became extremely difficult to obtain uniform treatment. Our aim was to improve the technology in a way that it will allow consistent results in all patients.
Study: A physical model explaining the relation between RF power and skin resistance has been developed using saline wetted papers. Biophysical modeling was used to adjust on line RF power driving according to skin changes monitoring. Biophysical modeling was tested using In-Vivo experiments.
Results: Biophysical modeling demonstrated that tissue-RF interactions are mainly dictated by patients' physiological characteristics such that the outer most layers of the skin display a higher electrical resistance as opposed to the deeper dermis. Accordingly, preferential heating of the skin surface leads mostly to ablation while wider diffusible heat dissemination into the dermis results mainly in tissue coagulation and/or heat stimulation. Real-time monitoring of skin resistance enabled fine tuning of the degree of ablation/coagulation/heat stimulation.
Conclusion: The mechanism of action is based on confined exposure of the skin to thermal stress leading to modification of connective tissue mainly in the form of heating/coagulation and less ablation. The distinctive features of the technology; precise control of RF power in response to online monitoring of tissue resistance allow the induction of the desired biological responses leading to a more and better organized and "younger" dermal matrix. In addition to optimization of skin rejuvenation in a wide variety of patients' populations, this technology may be used for treatment of various dermatological indications.

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COMPARISON OF LASER INTERACTION MECHANISMS PRODUCED BY VARYING PULSE SHAPE AND PULSE DURATION IN ABLATIVE FRACTIONAL TREATMENT SETTINGS

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Background: CO_2 lasers have been a successful modality in the ablative fractional treatment of skin for wrinkles, dyschromias, and scars. To this end several CO_2 lasers have surfaced providing a varying range of performance. Since these particular lasers are of the same CO_2 wavelength, 10.6 um, the only differences lie in the pulse shape (power or energy), pulse duration, and spot size of the systems. The objective of this study is to discover some of the varying mechanisms in the interaction of these different CO_2 laser delivery modalities by varying the pulse shape and duration while keeping the fluence constant.
Study: Creative laser control technologies allowed the variation of only the pulse shape (pulse power) and thus pulsed duration for fixed energy settings commonly used to produce fluences in CO_2 ablative fractional applications. Imaging with a high speed camera and utilizing Schlieren imaging techniques, we delivered the energy into phantom tissue, a polyacrylamide gel, with a composition of 90% water, providing a target similar to that of the dermis. While keeping the spot size fixed, and the energy delivered constant we can observe the impact of different laser power modalities commonly used in this application.
Results: Significant differences in ablation depth as well as residual thermal damage zones were witnessed by just changing the pulse shape for fixed energy densities. It is these differences that impact the clinical performance of the various CO_2 ablative fractional systems available today. In addition, the mechanisms contributing to the reduction of thermal damage as well as the inefficiencies in ablation depth were observed.
Conclusion: Ultrashort high power pulsed CO_2 lasers leave the least margin of thermal damage and provide the most efficient ablation of the varying pulsed modalities. It is believed that these ultrashort high power pulsed CO_2 lasers ablate and expel the

heated laser plume quicker than the lower power modalities. These lower power, longer pulsed CO_2 lasers modalities have less efficient ablation and a residual superheated plume that contributes to the larger thermal damage zones.

model. Abdominoplasty patients were treated with the RF device during and days before their surgical procedure. Temperatures of cutaneous and subcutaneous tissues were measured during treatment. The immediate and delayed tissue response to heating was assessed by histology.
Results: Cell viability dropped from 88 to 21% when temperature