AMERICAN SOCIETY FOR LASER MEDICINE AND SURGERY 30th ANNUAL CONFERENCE PHOENIX, ARIZONA APRIL 16–APRIL 18, 2010 ABSTRACTS

BASIC SCIENCE/ OPTICAL DIAGNOSTICS

#1

OPTIMIZED IPL PHOTOCOAGULATION BY METHAEMOGLOBIN GENERATION FROM WHOLE BLOOD

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Background: Embarrassing or disfiguring cosmetic disorders such at varicose veins, port wine stains, spider nevus can cause serious concerns to a subject. Many commercially available IPL's used for vascular clearance use double or triple pulses without explaining the reason why such pulse patterns produce better results. The purpose of this study is to optimise output parameters to generate safer, less aggressive treatments presenting less adverse reactions, greater patient comfort, and ultimately shorter clearance times.

Study: Glass capillary tubes were filled with oxygenated blood and irradiated with broadband light (530–1100 nm) of various pulse durations and fluence. Absorption spectra was collected using an Ocean Optics (HR2000+, B.V, Duiven, The Netherlands) fibre optic spectrometer optimized for wavelengths between 180–1150 nm and an iPulse i400 IPL system (Energist, Swansea).

Results: Optical properties of haemoglobin changed during irradiation of broadband light due to thermally produced methaemoglobin and a Bathochromic shift to higher wavelengths as a result. Results present optimum fluence and pulse duration for methaemoglobin generation. Such a shift in absorption properties of blood can be taken advantage by a light source which produces a range of wavelengths that covers the spectral range of oxy, deoxy and methaemoglobin.

Conclusion: But intentionally generating methaemoglobin in blood with a pre-treatment pulse, then specifically targeting the methaemoglobin, deeper target structure can be destroyed due to the longer wavelengths used by the IPL system with respect to a 585 nm laser. Such a mechanism also implies a reduction in the total radiant fluence required for treatment when the target chromophore changes from oxy to methaemoglobin, thus a reduction in potential adverse side effects and pain associated with the procedure, a great benefit especially in paediatric cases.

#2

MULTIMODAL WIDE-FIELD FUNCTIONAL IMAGING OF THE MICROVASCULAR RESPONSE TO SELECTIVE LASER INJURY

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Background: Laser therapy has been widely used in the treatment of vascular disorders such as port wine stains (PWS). However, current PWS treatment methods using selective laser injury to the microvasculature remain questionable in its ability to permanently remove the birthmark and may be due to our incomplete understanding of the vascular repair process. This repair response is currently unknown to be dominated by angiogenesis or other mechanisms such as changes of the existing vasculature. We present the use of multimodal wide-field functional imaging to study the microvascular response to selective laser injury.

Study: We utilized transgenic mice that expressed a green fluorescent protein (GFP) to observe the expression of the angiogenic vascular endothelial growth factor (VEGF). A single-platform instrument capable of coregistered fluorescence imaging and laser speckle imaging (LSI), was utilized to monitor vascular endothelial growth factor (VEGF) gene expression and blood flow, respectively.

Results: Fluorescent imaging showed that angiogenesis, as indicated by the presence of GFP/VEGF activity, played a major role in vascular repair. In addition, LSI images showed that there were substantial changes in the existing vasculature.

Conclusion: Our data demonstrate that we can readily observe a microvascular response that involves not only angiogenesis, but also substantial changes to existing vascular blood flow surrounding the irradiated blood vessels.

#3

SAFE AND EFFECTIVE TOPICAL ANTIANGIOGENIC THERAPY FOR INHIBITING REPERFUSION OF PHOTOCOAGULATED BLOOD VESSELS IN AN ANIMAL MODEL

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Published online in Wiley InterScience (www.interscience.wiley.com).
DOI 10.1002/lsm.20916

Background: Reperfusion of photocoagulated blood vessels was observed in animal models 1–2 weeks after laser exposure, which might be the cause of the low therapeutic efficacy of port wine stain laser treatment. Our objective was to investigate the safety and efficacy of topical antiangiogenic therapy on the inhibition of the reperfusion of photocoagulated blood vessels.
Study: Two different topical rapamycin (RPM, an antiangiogenic agent) formulae were tested in this study. Both formulae contained 1% or 2% RPM, solvent (benzyl alcohol) and an FDA-approved skin penetration enhancer. The bases were a water-based cream and an ointment for the first and second formulae, respectively. The animal model was the dorsal skinfold window chamber on hamster. Immediately after laser irradiation of blood vessels in the window, topical RPM of different formulae was applied to the epidermal side of the window daily for 14 days. Color digital photography and laser speckle imaging were used to document structure and flow dynamics of blood vessels.
Results: Both topical RPM formulae reduced the reperfusion rate from nearly 100% for laser irradiation only to less than 50%. For the combined laser and RPM, the first formula caused skin irritation around the laser irradiation sites while no irritation was observed with the second formula. We also observed that the lowest reperfusion rate occurred with the 1% RPM ointment.
Conclusion: Topical RPM can be safely applied onto laser-irradiated skin to inhibit the reperfusion of photocoagulated blood vessels, which implies that combined laser and topical anti-angiogenic therapy might be a safe and effective approach to treat port wine stain and other cutaneous vascular lesions.

#4

NUMERICAL OPTIMIZATION OF SEQUENTIAL CRYOGEN COOLING AND LASER IRRADIATION FOR IMPROVED THERAPY OF PORT WINE STAIN

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Background: Despite application of cryogen spray (CS) precooling, customary treatment of port wine stain (PWS) birthmarks with a single laser pulse (LP) does not result in complete lesion blanching for a majority of patients. One obvious reason is nonselective absorption in epidermal melanin, which limits the maximal safe radiant exposure. Another possible reason for treatment failure is shielding of laser light in large PWS vessels, which prevents uniform heating of the entire vessel lumen. Our aim is to identify parameters of sequential cryogen spraying and laser irradiation that allow optimal photocoagulation of various PWS blood vessels with minimal occurrence of epidermal thermal damage.
Study: Light and heat transport in laser treatment of PWS is simulated using a custom 3D Monte Carlo model and 2D finite element method, respectively. Protein denaturation in blood and skin is calculated using Arrhenius kinetic model with tissue specific coefficients. Simulated PWS vessels with diameters of 20–300 μm are located at depths of 200–600 μm, and shadowing by neighboring PWS vessels is accounted for by considering histology data from literature. For epidermal melanin concentration of 5–15%, we investigate PWS blood vessel coagulation and epidermal thermal damage for different parameter combinations of sequential cryogen cooling and 532 nm irradiation, e.g. by varying the number of pulses in a sequence (2–10), repetition rate (10–100 Hz), and radiant exposure.
Results: Diffuse reflectance, epidermal damage threshold and PWS therapeutic thresholds predicted by our model match the values from literature for a range of skin types and PWS lesions. Simulation results indicate specific cooling/irradiation sequences with higher efficacy and safety as compared to customary single-pulse treatment, across a wide range of PWS structures and skin types.
Conclusion: The identified cooling/irradiation sequences appear promising for improved therapeutic outcome for patients with resistant PWS, especially in darker skin types.

#5

PATIENT SAFETY AND LASER LEGISLATION: AN INTERNATIONAL EXPERIENCE

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Background: Laser and IPL treatments can be performed without quality and safety assurances, which raises concern about patient safety. In Denmark, aesthetic procedures with lasers, IPL systems and related technologies are regulated by legislation since 2007. It was the purpose to improve patient safety.
Study: Several organizations were involved in the process to obtain legislation, including The National Board of Health and the Danish Society of Dermatologist. Politicians and media took actively part in the process as well.
Results: Selected essentials of the legislation are: Dermatologists and doctors with appropriate educational skills can by request obtain permission from the National Board of health to perform cosmetic treatments with laser, IPL and related techniques. Permission is based on i) documented skill to perform laser and IPL procedures, and ii) qualifications to diagnose skin conditions. Licensed physicians are recorded at the National Board of Health. Responsible physicians may delegate treatment procedures of hair removal, vessels treatment and non-ablative rejuvenation to registered, trained and supervised assistants.
Conclusion: Based on two years experience with laser legislation, it is the clear impression that patient safety has been improved.

#6

DESIGN-LEVEL APPROACHES TO SAFETY FEATURES OF HOME-USE LASER BASED DEVICES

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Background: Home-use, laser-based photocosmetic treatment devices are now a reality, but questions of realistic product safety requirements are still under development by safety standards committees, such in IEC Technical Committee TC76. A Class 1C conditional Class 1 is envisioned which would permit skin exposures above Class1 provided that potentially hazardous ocular exposure is prevented. While highly beneficial for the user, the safety and reliability requirements for home-use phototreatment devices are necessarily elevated to an even higher level. In this study, we report how certain safety features can be

designed to essentially eliminate any reasonably foreseeable fault or misuse conditions that could pose ocular hazard risks in such devices intended for use on all skin types. Until Class1C becomes a reality, we show that in certain cases it is also possible to design these products to meet the requirements of the current Class 1.
Study: Several techniques for reducing/eliminating the ocular hazard risks have been evaluated, including: 1) Wavelength selection; 2) Optimization of the angular and/or spatial structure of the output beam; 3) Positive emission control using skin recognition and/or contact sensors. Impact of using these techniques on the hazard level has been evaluated through computer simulations, lab test and measurements, and real-life scenario tests.
Results: Each of the tested techniques decreases ocular hazard risks significantly. When two or more of them are combined in a self-use laser-based product, cumulative effect is adequate to ensure safety and reliability.
Conclusion: Employing passive and active safety features in the consumer-use laser-based devices can mitigate or even completely eliminate risks of ocular hazards.

#7

OPTIMUM PULSE STRUCTURE FOR EFFECTIVE HAIR REMOVAL USING BROADBAND PULSED LIGHT SYSTEMS

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Background: The objective of this work is the investigation of the thermal process during intense pulsed light (IPL) photoepilation using Monte Carlo computer simulation in relation to the output dosimetry used by typical commercial broadband IPL systems. The temporal pulse shape is an important parameter, which may affect the response of biological tissue in respect of efficacy and/or adverse reactions.
Study: This study investigates the effect that IPL pulse structures, namely free discharge, square pulse and pulse stacking, has on hair removal. The relationship between the fluence distribution during the pulse and chromophore heating is explored and modeled for hair follicles and the epidermis using a custom Monte Carlo computer simulation for optimized results.
Results: Consistent square pulse delivery of fluence across the pulse duration is shown to generate the most efficient specific heating of the target chromophore whilst sparing the epidermis compared to free discharge and pulse stacking pulse delivery. Free discharge systems produced the highest epidermal temperature in the model (22% greater than square pulse and pulse stacking techniques).
Conclusion: This study presents thermal data of a buried hair follicle indicating that square pulse IPL technology may be the most efficient and the safest method for photo epilation. The investigation also suggests that square pulse systems are the most efficient as energy is not wasted during pulse exposure or lost through interlude times of stacked pulses.

#8

EFFECT OF COATING MATERIAL ON UPTAKE OF ICG-LOADED NANOCAPSULES BY HUMAN CERVICAL CANCER CELLS IN VITRO

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Background: Indocyanine green (ICG) is an FDA-approved near-infrared (NIR) (650–850 nm) fluorescent dye. However, clinical applications of ICG remain limited due to its short half-life within the vasculature, non-specific binding to plasma proteins, almost exclusive uptake by the liver, and lack of ability to target specific sites. Nanoencapsulated ICG can potentially be used in optical imaging and phototherapy of tumors by appropriate surface coating and functionalization.
Study: To overcome these limitations, we have encapsulated ICG within nanoconstructs composed of poly(allylamine) hydrochloride and disodium hydrogen phosphate salt. In this study, we investigate the effect of various coating materials such as Poly(ethylene glycol), Bovine Serum Albumin (BSA), Poly-L-lysine on the uptake of ICG-NCs by normal and cancerous bronchial epithelial cells and Hela cervical epithelial cancer cells *in-vitro*.
Results: We measured the surface charges of NCs with each coating materials. The surface charges of BSA NC, Polyacrylic acid (PAA) NC, PEG, and Polylysine are −52 mV, −8.7 mV, 11 mV, and 68.7 mV, respectively. Negatively charged BSA coated NCs are highly taken up by Hela cells compare to the other coating materials, while there is no significant difference of the uptake in the normal human bronchial epithelial cells.
Conclusion: Results of these studies will provide important information for subsequent applications of ICG-NCs in optical imaging and phototherapy of tumors.

#9

NANOPARTICLE-MEDIATED PHOTOTHERMAL THERAPY OF TUMORS: A COMPARATIVE STUDY OF PHOTOTHERMAL EFFICIENCY FOR DIFFERENT PARTICLE TYPES

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Background: Metal nanoparticles (NPs) have gained interest as a nanovector with unique optical and molecular properties suitable for combining targeting, imaging, and therapy of cancer. NPs can be designed to accumulate at tumor sites and when irradiated with a NIR laser, produce sufficient heat for tumor ablation. While this NP-mediated photothermal therapy (PTT) is effective for various NPs (e.g. gold/silica nanoshells, GNS, and gold nanorods, GNR), the heating efficiency depends on physical attributes including shape, size, orientation, and NP aggregation. The purpose of this study was to compare the heating efficiency of GNSs and GNRs in a tumor-like environment.
Study: An infrared camera measured the temperature increase after 1 second of heating, dT, in tumor-simulating phantoms containing varying particle concentrations and irradiated with typical PTT fluence rates using an NIR diode laser (? = 800 nm). Two comparative studies were performed: 1) GNSs against GNRs and 2) randomly oriented GNRs irradiated with randomly polarized light against linearly polarized light. The radius of GNSs was 67.5 nm, and the GNRs were 24 nm by 7 nm (Nanospectra, Biosciences Inc.). GNR and GNS extinction cross-

sections were modeled using Discrete Dipole Approximation (DDA) and Mie Theory, respectively.
Results: At the same fluence, GNRs reached an equivalent dT as GNSs at approximately 20 times higher concentration; the dT of GNRs irradiated with randomly polarized light was twice that of GNRs irradiated with linearly polarized light. Through experimentation and confirmation using DDA, the orientation of GNRs was found to significantly affect the extinction cross-section.
Conclusion: Although individual GNRs have high absorption efficiencies, due to orientation in solution, this efficiency needs to be effectively reduced. Therefore on a per particle basis, the GNSs produce more heat than GNRs, primarily due to their larger size. The *in vivo* implication of these studies will depend on the targeting efficiency of each particle.

#10

NOVEL APPLICATION OF RARE-EARTH PARTICLES IN ACTIVATING PHOTOFRIN II THROUGH X-RAY INDUCED VISIBLE LUMINESCENCE: AN IN VITRO STUDY

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Background: Photodynamic agents such as Photofrin II utilized in cancer therapy possess two important properties: (i) to become preferentially retained within the tumors and the tumor's immediate micro-vascular environment and (ii) a long lived meta-stable state enabling interactions with triplet state molecular oxygen. Upon the photo-agent activation through visible light photon absorption, photo-agents exert their cytotoxicity through extensive generation of singlet oxygen $^1O_2$, O_2^-, and H_2O_2 within the intratumoral environment. Unfortunately, the visible light penetration depth in tissue is shallow (~2 mm to 5 mm). In this investigation we formulated a strategy for visible light production into deep seated cancers through diagnostic energy X-rays and engineered particles.
Study: In view the fact that X-ray penetration depths are significantly deeper than visible light, we utilizing diagnostic energy X-ray photons (~100 keV) to induce visible light fluorescence from engineered (lanthanide elements based) rare-earth micron sized particles. Manipulating the ratio of (rare-earth) elements composition of the particles enabled the X-ray induced fluorescence maximum to become approximately coincident with the excitation maximum of Photofrin II. Quantification of reactive oxygen species (ROS) generation was made through the change in absorbance of unoxidized Vitamin C @ 265 nm. Real-time X-ray induced fluorescence spectroscopic measurements from the particles were undertaken through a fiber based spectrophotometer.
Results: Through Vit. C assay, Photofrin II was found to have a significantly greater ROS generation near its excitation peak ~400 nm than the traditional 633 nm laser line utilized in the clinics. Robust ROS generation from Photofrin II was also recorded when X-rays induced particle fluorescence maximum was approximately ~400 nm.
Conclusion: The positive in-vitro findings herein, provide the basis for future in-vitro and in-vivo studies, in determining the potential toxicity and x-ray induced fluorescence quantum yield efficiency of the rare-earth particles.

#11

LASER INJECTION OF MOLECULES AND PARTICLES

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Background and Objective: Laser transcutaneous delivery techniques are currently under intensive investigation with the aim of designing less traumatic delivery systems which may expand the usability of the drug and cosmetic compounds. Recently, we have proposed a method for enhancing skin permeability by fractional ablation using a 2.94 μm-Er:YAG laser. In this paper, we are presenting a variety of technologies for effective delivery of dye molecules in solutions and micro- and nanoparticles in suspensions.
Materials and Methods: Fractional ablation was provided by a modified StarLux/Lux2940 system (Palomar Medical Technologies Inc.) emitting 250 μs pulses. *In vitro* human and porcine skin and *in vivo* human and mini-pig skin were investigated. Clinical photography and quantitative analysis of ablated and treated skin sites using OCT and reflectance spectroscopy were used. To enhance particle redistribution within the treated skin, an ultrasound device Dynatron-125 was employed. For *in vitro* study 10 pig skin sites were investigated. For *in vivo* study, total of 24 skin sites including control of one mini-pig and 20 of one human subject were investigated. Suspensions of PEGylated TiO_2 nanoparticles (100 nm), ZrO_2 (5 μm), and, Al_2O_3 microparticles (27 μm) with concentrations from 5 to 500 mg/ml and hydrocartizone were delivered into the skin. Biopsy and histology was done for *in vivo* mini-pig treated skin sites.
Results: It was found that particles and hydrocortisone molecules can be delivered into epidermis and dermis with fractional Er:YAG laser, application of ultrasound allows for more effective particle delivery within the skin, particles may stay within the skin *in vivo* during a few weeks.
Conclusion: Laser injection has a significant potential as a rapid, complications-free transcutaneous delivery technique.

#12

PHOTOACOUSTIC DETECTION OF NANOPARTICLE TAGGED BREAST CANCER CELLS IN A MOUSE MODEL

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Background: The most important factor in survival of breast cancer patients is early detection of disease. One of the earliest ways to discover metastasis is by detecting circulating breast cancer cells (CBCCs), those cells that begin in the primary breast tumor and are transported through blood and lymph systems as potential seeds for other tumors throughout the body. We have

developed a system for detecting and counting CBCCs in using photoacoustics, or laser induced ultrasound. We used a mouse model as an in vivo system to test our ability to detect breast cancer cells using gold nanoparticles as optical contrast agents.
Study: We used a tunable laser system with a wavelength range of 410–2400 nm to induce photoacoustic waves in nanoparticle tagged breast cancer cells. Gold nanoparticles were labeled using HER-2 antibodies to an MCF-7 breast cancer cell line. These cells were injected into mice that were subsequently exsanguinated at 1, 4, 8, and 24 hour intervals. We injected 100,000, 10,000, and 1000 cells into a total of thirty six mice. Three mice were injected with normal saline as controls. The blood was tested for the presence of tagged breast cancer cells using a photoacoustic flowmeter, in which blood samples were subjected to 450 nm laser light with a 5 ns pulse duration. The flowmeter contained a piezoelectric detector to detect the presence of photoacoustic waves induced in the tagged breast cancer cells.
Results: We detected nanoparticle tagged breast cancer cells. The photoacoustic response was linear with respect to breast cancer cell concentration. We subsequently diluted the cell suspensions to show photoacoustic waves induced in single breast cancer cells with a signal to noise ratio of 4:1.
Conclusion: The photoacoustic flowmeter has the ability to detect single nanoparticle tagged breast cancer cells in blood.

#13

THIN TISSUE POLARIMETRY TO EXAMINE THE COMBINED EFFECTS OF BIREFRINGENCE AND SCATTERING

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Background: Polarimetry in turbid media is being studied as a method of determining tissue composition. One immediate application is for the noninvasive measurement of glucose concentration. The difficulty of performing polarimetry in tissue is the combined effects of scattering, linear birefringence, diattenuation, and chirality. Glucose molecules are chiral and therefore affect the polarization state of light; however, the effects are generally swamped by the effects of scattering. A detailed understanding of the effects of scattering from tissues is needed to fully define the problem of differentiating polarization effects of interest, such as chirality. In this study, the scattering dependence of polarization properties is measured in the limit of single scattering.
Study: A polarimeter was built using a CCD detector to measure polarization effects as a function of scattering angle. Samples with both scattering and other polarization effects, including linear birefringence, were measured. In particular, thin tissue samples of tendon, known to exhibit significant linear birefringence, were measured in transmission in the angular range of $+/-$ 26 degrees.
Results: The scattering pattern of spherical particles, microspheres in solution, was found to be significantly different than scattering from tendon. Due to the fibrous nature of tendon, it exhibits linear birefringence which was found to influence the scattering pattern.
Conclusion: The asymmetric molecular shape of a sample impacts both its polarization properties and its scattering. The results demonstrate that the approximation of Mie Theory, applicable for spheres, does not fully apply to scattering of fibrous tissues. By measuring the scattering dependence of polarization properties in the limit of single scattering for real tissue, the nature of this dependence can be visualized and ultimately extended to bulk tissue.

#14

LIGHT ACTIVATED MICRO-PATTERNED DRUG DELIVERY DEVICE IN IN VIVO RABBIT EYE—FABRICATION, BIOCOMPATIBILITY, AND RELEASE MEASUREMENT

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Background: The primary treatment for wet age-related macular degeneration (ARMD) is periodic injection of a drug such as Lucentis (ranibizumab), in the eye which is painful and causes multiple risks of endophthalmitis. Thus, there is a great need for an improved drug delivery device. The therapeutic efficacy of a drug depends on how the drug is delivered. The limitation of any conventional drug delivery systems such as implants or oral delivery systems is a sharp initial increase in drug concentration to a peak above the therapeutic range, followed by a fast decrease in concentration to a level below the therapeutic range. The time spent in the optimum concentration range for therapeutic effect is therefore very short. The primary goal of this study was to investigate a drug delivery device implanted in the super-chroidal space. Important aspects of the study include the biocompatibility of the device and the laser power that is required to release drug in the *in vivo* rabbit eye. The proposed drug delivery package will provide precise and repeatable dosing of medication to patients based on their needs. The sclera is optically cleared with hyper-osmotic agent (100% anhydrous glycerol) and a pulsed Nd-YAG laser is used to release the drug.
Study: We developed a drug delivery device with $3 \times 6 \times 1.5$ mm^3 dimensions (width $\times$ length $\times$ depth) that was fabricated (Zhang Research Group) from ultraviolet (UV) cured biocompatible polyurethane, a form of poly-methyl methacrylate (PMMA), under sterile condition. The device had a 0.06–0.07 mm thick clear cap made from a transparent bio compatible polymer. The device consisted of two 2.6 mm of diameter reservoirs containing 1% Na fluorescence USP sterile dye. Once the reservoirs were filled with the dye the cap was bonded to the device using oxygen plasma. The device was then implanted in the super-choroidal space of rabbit's eye ($n = 7$) by making a 4.0 mm incision at the sclera (0.5 mm from the cornea) where the cap of the device was facing toward the exterior of the eye and two surgical sutures 10-1 with 0.025 mm diameter were connected to the end of the device for fixation. This implant surgery was performed under general anesthesia based on an approved protocol. Once the drug delivery devices were implanted into the eyes, the rabbits were placed under observation in the Animal Resource Center (ARC) facility for 3–4 weeks until the eyes completely recovered from the implant surgery. At this time we checked any leak from the device. To check the leak we dilated the pupil of the rabbits with 3 drops of 5% Homatropine every 1 and 1/2 minutes for 5 minutes. Once the pupil dilated, a linear fiber optic based probe of a noninvasive fluorescence spectral system was used to measure the intensity of 1% Na fluorescence in the aqueous and vitreous. In the spectral system one light source, a pulsed nitrogen laser to excite NADH and collagen fluorescence was used. The linear fiber optic probe had a source-detector separation of 740 μm which optimized the sampling at 2.4 mm depths. Once the animals recovered from the

surgery, a 27G1/2 needle was used to deliver a hyper-osmotic agent such as 100% anhydrous glycerol to optically clear the sclera and Nd:YAG laser was used to deliver the fluorescence dye. Measurements were made of the concentration of the fluorescence dye over a two-week period. Once the experiment was over the animals were euthanized according to an approved protocol and the eye tissues were collected for histology.
Results: Preliminary results illustrated that none of the devices leaked in the sub-choridal space during the two months observation. The ablation threshold of the drug delivery device was found to be at 6.5 mJ of power to release the fluorescence dye from the reservoirs. The histology of the eye tissue is still under investigation.
Conclusion: This study established that the drug delivery device retained its fluidic content intact until it may activate. In future, the study will be further extended by measuring the half-life of the drug in the eye.

#15

TARGETED DELIVERY OF GOLD-COATED PLASMON RESONANT LIPOSOMES TO CANCER CELLS

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Background: One of the main requirements of successful medical intervention on the cellular scale is directing various diagnostic or therapeutic agents to desired targets on cells. In this work, we show that release of encapsulated agents can be controlled by varying the spectral position of the plasmon resonance band of gold-coated liposomes. When illuminated with laser light at the wavelength matching the resonance band, gold-coated thermosensitive liposomes rapidly release their content. We also demonstrate that these liposomes can be targeted and delivered to cells via folate receptor, a membrane protein overexpressed in many cancers.
Study: Liposomes were constructed from saturated lipids, DPPC and DSPE-PEG2K-folate, via freeze-thaw and extrusion. Plasmon resonant coating was generated by reducing gold onto the surface of these liposomes. Spectrally-selective release was demonstrated by exposing gold-coated liposomes to bursts of 1064 nm laser light generated by an Nd:YAG laser. Folate receptor-expressing ovarian cancer cells, OVCAR-3, were used to demonstrate cellular delivery of content. Fluorescent dye was encapsulated within the liposomes to both monitor content release through fluorescence dequenching and observe interaction with cells using a fluorescence microscope.
Results: We showed spectrally-selective photothermal release of fluorescein dye from gold-coated plasmon resonant liposomes in vitro. Full release at a rate of 5% per second was achieved using laser light at 1064 nm, the wavelength matching their plasmon resonance. Using fluorescence imaging, we then demonstrated the delivery of the gold-coated liposomes to OVCAR-3 cells.
Conclusion: Laser-induced content release allows for spatially and temporally controlled delivery of an encapsulated agent upon exposure to infrared light. By targeting specific molecular markers, these liposomes can be delivered to cancer cells. When fully developed, these plasmon resonant gold-coated liposomes will enable content release within targeted cells, greatly improving efficacy of many therapies, such as delivery of siRNA.

#16

PHOTODYNAMIC INACTIVATION OF BACTERIA USING POLYETHYLENIMINE—CHLORIN E6 CONJUGATES. EFFECT OF POLYMER MOLECULAR WEIGHT, SUBSTITUTION RATIO OF CHLORIN E6 AND PH

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Background: Antimicrobial photodynamic therapy (PDT) is a novel technique to treat local infections Previously we discovered that the conjugation of chlorin(e6) (ce6) to polyethyleneimine (PEI) chain is an effective way to improve ce6 photodynamic activity against gram-negative bacteria. For example conjugate 9 (molecular weight of PEI = 10000, substitutional ratio of ce6 = 1) kills 99.999 % of *E.coli* K12 in PDT. The aim of this work is to explore how do polymer molecular weight, substitutional ratio of ce6 and pH value affect the PDT efficacy?
Study: In order to answer to these questions we have synthesized conjugate 10 (molecular weight of PEI = 60000, substitutional ratio of ce6 = 1) and conjugate 11 (molecular weight of PEI = 60000, substitutional ratio of ce6 = 5). We have also tested the photodynamic efficacy of these new compounds against E.coli at three different pH values (5.0, 7.4, 10.0). All synthesized conjugates were purified by gel-chromatography and dialysis and characterized by 2,4,6-trinitrobenzene sulfonic acid analysis (TNBS), thin layer chromatography and gel-electrophoresis methods.
Results: Conjugate 10 was more effective than conjugate 9 but this difference can be explained by the fact that conjugate 10's polymer cargo is more dark toxic than the conjugate 9's cargo. Conjugate 11 photodynamic activity is dramatically worse than conjugate 10's activity which is probably connected to the fact that ce6 molecules are self-quenched within the conjugate 11 molecule. The ce6 quenching within conjugate 11 molecule was proved by analyzing fluorescence and absorbance spectra of all conjugates at three different pH values and in presence or absence of Triton X-100 detergent. All three conjugates were had much higher PDT killing at higher pH values.
Conclusion: Conjugate 9 and 10 are most active in the process of Gram-negative bacterial PDT treatment, however, conjugate 10 exhibits some dark toxicity. Conjugate 11 (substitutional ratio of ce6 = 5) is less active than conjugate 9 and 10 due to the ce6 intermolecular self-quenching.

#17

THE EFFECT OF METHYLENE BLUE PHOTODYNAMIC THERAPY ON HUMAN MELANOCYTE VIABILITY

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Background: Giant congenital nevi are melanocytic birthmarks that can occupy greater than 30% of the cutaneous surface area and carry a 4.5–10% lifetime risk of transformation to melanoma. It is believed that reducing the number of melanocytes in these lesions can potentially reduce the risk of melanoma. Current standards of treatment ranging from surgical excision to pigment-targeting lasers all suffer from frequent recurrence. This preliminary study investigates the in-vitro efficacy of methylene

blue (MB) photodynamic therapy (PDT) for the destruction of cultured human foreskin melanocytes (HM).
Study: Human melanocytes and human fibroblasts were treated with MB concentrations ranging from 1 nM to 10 uM for 1 hour. MB incorporation in both cell types was visualized by confocal microscopy with excitation at 665 nm and emission at 680 nm. These cells were subsequently treated with Omnilux red light (632 nm) at a fluence of 10 mJ/cm^2. 48 hours post-treatment, cells were photographed and viability was determined using MTT assay.
Results: For melanocytes, light and dark survival ratios appear similar for MB concentrations ranging from 0 to 0.1 uM; at 1 uM, the survival ratio for melanocytes treated with MB plus light was 0.05, compared to a ratio of 1.08 for cells treated with MB but not exposed to light. At 100 uM MB, light and dark survival begin to converge, and by 1 mM MB, cell survival in both light and dark conditions were 0.04 and 0.13, respectively. A similar trend was also observed for fibroblasts.
Conclusion: These results suggest that MB can induce light-activated cytotoxicity in human melanocytes at a wavelength outside of ultraviolet (UV). Drug and light dosages will be further investigated to delineate selectivity for cell-types and thresholds for dark toxicity.

#18

PHOTODYNAMIC DIAGNOSIS UTILIZING METHYL AMINOLEVULINATE PRIOR TO MOHS MICROGRAPHIC SURGERY

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Background: Photodynamic therapy (PDT) is an efficacious treatment modality for actinic keratoses and superficial basal cell and squamous cell carcinomas. With topical PDT treatment, photosensitizers are preferentially absorbed by premalignant and malignant keratinocytes, and are converted to protoporphyrin IX. Protoporphyrin IX selectively sensitizes the tumor cells to light through the production of free radicals and singlet oxygen. Only two prior case reports in the literature have utilized fluorescent diagnosis, with aminolevulinic acid, to define tumor margins. Given these reports of preliminary efficacy, we set out to perform a clinical trial to evaluate if fluorescent diagnosis utilizing methyl aminolevulinate (MAL) correlated with margins after Mohs micrographic surgery (MMS).
Study: 20 patients with BCCs of the head, neck and upper extremities were enrolled in this prospective trial. MAL (Metvix, Galderma Laboratories) was applied overnight (mean of 13.3 hours) prior to fluorescence measurements of tumor size utilizing a clinical Wood's lamp examination. Clinical and fluorescence measurements were compared with the defect size after MMS.
Results: The mean tumor sizes were 263.0 mm^2 (post MMS defect), 239.1 mm^2 (fluorescent examination of MAL under Wood's lamp) and 65.8 mm^2 (clinical size). The difference between tumor size assessments were 164.9 mm^2 (mean difference between MMS and clinical exam) and 23.9 mm^2 (mean difference between MMS and fluorescent exam). Using interclass correlation coefficients, a high degree of consistency as well as absolute agreement between post MMS defect size and fluorescent examination size was identified (interclass correlation coefficient of .962). This correlation was significantly higher than that between post MMS defect size and clinical examination (.703) and that between fluorescent and clinical examination (.651).
Conclusion: PDT represents a novel diagnostic modality for non melanoma skin cancer. The use of topical MAL as a photosensitizer in conjunction with a Wood's lamp examination is a simple and inexpensive investigation which can be used prior to MMS to delineate the margins of ill defined tumors. This technique has the potential for increasing the efficiency of the MMS procedure, as well as to assist with screening for tumors with extensive infiltration and/or skip areas, which may be particularly amenable to treatment with the MMS technique.

#19

A COMPARATIVE STUDY BETWEEN 5-AMINOLAEVULINIC ACID AND METHYL AMINOLEVULINATE PHOTODYNAMIC THERAPY: ASSESSMENT OF FLUORESCENCE, PAIN AND EFFICACY

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Background: Topical photodynamic therapy (PDT) is a cancer treatment that employs the use of photosensitiser pro-drugs. This study investigated the characteristics of protoporphyrin IX (PPIX) fluorescence in carcinoma in-situ (Bowen's disease, BD) and superficial basal cell carcinoma (sBCC) following application of 5-aminolaevulinic acid (5-ALA) or its methylester (MAL) before, during and after PDT. Photosensitiser penetration can limit PDT efficacy and understanding the characteristics of PPIX fluorescence may improve knowledge of photosensitiser delivery.
Study: Thirty one patients were included in the study. Prior to PDT, MAL (16% w/v, $n = 10$) or 5-ALA (20% w/v, $n = 5$) was applied to lesions of sBCC for 3 or 6 hours, respectively. In a further 16 patients, MAL ($n = 7$, 3 h) or 5-ALA ($n = 9$, 4 h) was applied to lesions of BD. PPIX fluorescence measurements were recorded *in vivo* from all lesions at four time points: prior to cream application, immediately before, mid-way through and immediately after PDT. An optical biopsy fluorescence spectroscopy system comprised of a 400 nm LED was used to measure fluorescence. Pain during PDT was also recorded using a novel pain logger. The ratio of peak PPIX fluorescence (635 nm) to autofluorescence (495 nm) was examined in each lesion at each time point.
Results: *In vivo* peak PPIX fluorescence was reduced as photobleaching occurred. No significant difference was found between 5-ALA- or MAL-induced PPIX fluorescence in sBCC and BD lesions ($p > 0.05$) at all time-points. In addition, no significant difference was found between pain experienced during either 5-ALA- or MAL-PDT ($p > 0.05$).
Conclusion: These data show that this technique can be used to monitor *in vivo* fluorescence kinetics during topical PDT. The preliminary results showed no significant differences between 5-ALA or MAL-induced PPIX fluorescence and further studies of treatment parameters are warranted.

#20

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

#22

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.

#23

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.

#24

CONTROLLING THE SIZE OF THE HEATING VOLUME OF SUBCUTANEOUS ADIPOSE TISSUE USING A NOVEL RADIOFREQUENCY TECHNOLOGY

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Background: The objective of the present study was to demonstrate the feasibility of varying the size of the heating volume of subcutaneous adipose tissue by controlling the dlivered energy distribution on the skin surface.

Study: Changes in the distribution of the electric potential at the skin surface due to operational frequency adjustment were experimentally characterized in vivo. These measurements were used to model RF-induced electric fields and power absorption in cutaneous and subcutaneous tissues. Thermal measurements during and after RF exposure of ex vivo animal tissue models were subsequently used to complement the initial mathematical modeling.

Results: At 500 kHz the electric potential on the skin surface was nearly constant across the RF-applicator surface. At 4 MHz the electric potential dropped 30% from the center to the edge of the RF-applicator. Modeling shows that within a 3 cm subcutaneous fat layer the absorbed power at the bottom layer was 40% less than that at the top for 500 kHz. The absorbed power decreased 80% for 4 MHz. Cross-sectional radiometric temperature maps show a larger heated tissue cross-section using 500 kHz as opposed to 4 MHz.

Conclusion: As the frequency increases (i) the difference between the power absorbed at the top and bottom of the subcutaneous fat layer increases; (ii) the difference between the power absorbed at the center and the periphery of the exposed subcutaneous fat volume also increases; and, consequently, (iii) the size of the heated subcutaneous fat volume is controllable.

#25

HYPERTHERMIC INJURY TO ADIPOCYTE CELLS BY SELECTIVE HEATING OF SUBCUTANEOUS FAT WITH A NOVEL RADIOFREQUENCY DEVICE

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Background: The objective of the study is to demonstrate the feasibility of utilizing a novel non-invasive radiofrequency (RF) device to induce lethal thermal damage to subcutaneous adipose tissue only by establishing a controlled electric field that heats up fat preferentially.

Study: *In vitro*, adipocyte cells were subjected to hyperthermic conditions. Cell viability was assessed 72 hours after exposure. The shortest thermal exposure that resulted in significant loss of cell viability was used as the therapeutic thermal exposure in subsequent clinical studies. RF parameters required to deliver therapeutic dosages were determined with a validated numerical 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 increased from 45 to 50°C during 1 min exposures. *In vivo*, the temperature of adipose tissue at 7–12 mm depth from the surface increased to 50°C while the temperature of cutaneous tissues was less than 30°C during exposure. Acute and longitudinal histology evaluations show normal epidermal and dermal layers. Subcutaneous tissues were also normal acutely. Subcutaneous vascular alterations, starting at day 4, and fat necrosis, starting at day 9, were consistently observed within 4.5–19 mm depth from the skin surface up to day 24.

Conclusion: *In vitro* adipocyte cells are heat sensitive to thermal exposures of 50°C on the order of minutes (>1 min). Thermal exposures of this order result in a delayed cellular death response in *in vivo* adipocytes. The novel RF device presented herein effectively delivers therapeutic thermal exposures to subcutaneous adipose tissues while protecting epidermal and dermal layers.

#26

MEASUREMENT OF INCREASED LIGHT TRANSMISSION AND STRAIN AS A FUNCTION OF MECHANICAL COMPRESSION IN EX VIVO PORCINE SKIN

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Background: Tissue turbidity, owing to light scattering and absorption, restricts the efficacy of laser-based imaging techniques and therapeutic treatments by limiting the delivery of light to internal tissue structures. "Tissue optical clearing" increases penetration depth of near-collimated light in tissue and can lead to increased energy delivery at a targeted region. This study investigated the effects of localized mechanical loading on the enhancement of light delivery to deep tissue structures of the skin.

Study: A 3 mm diameter sapphire rod with a hemispherical tip was used to compress 1 mm thick *ex-vivo* porcine skin samples while simultaneously delivering 670 nm laser irradiation. A BOSE ElectroForce® mechanical testing system was used to ramp load from 0 N to maximum (1 N, 2 N, and 4 N) at a rate of 0.5 N/s and sustain load at the maximum for 120 seconds while measuring tissue strain. Optical power transmission through the porcine specimen was concurrently measured by a Newport® Optical Power Meter (Model #1830).

Results: Increase in light transmission through the tissue is highly correlated with the tissue strain. An approximately 2.0 fold increase in light transmission resulted from a -30% strain and corresponding applied load of 1 N. An approximately 3.5 fold increase in light transmission resulted from a -55% strain and corresponding applied load of 4 N. Further increase in optical transmission (and strain) occurred after the load was held constant.

Conclusion: Localized mechanical compression proved to be an effective technique for increasing the delivery of light to internal skin structures. Based on these results, a compression technique and device may enable delivery of more selective laser therapy and enhanced light-based diagnostics.

#27

TRANSCRANIAL NEAR INFRARED AND RED LIGHT TRANSMISSION IN A CADAVERIC MODEL

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Background: Several in vitro, animal and human models have demonstrated the beneficial effects of red light and near infrared light. Clinical applications are varied, including myocardial infarction, stroke, wound healing, pain reduction, injured peripheral nerves, spinal cord injury, acne, rhytids and hair growth. One study in particular demonstrated improved durable functional outcomes status post stroke in patients treated with near infrared low level light therapy compared to sham treatment. To our knowledge, no data exists that directly measures near infrared and red light transmission in a human model.
Study: We measured the transmission of near infrared light energy, using red light for purposes of comparison, through cadaver skull bones, intact cadaver skull bones and soft tissue and brain using a commercial handheld LED device at 830 nm in the near infrared spectrum and 633 nm in the red light spectrum.
Results: Our results demonstrate that near infrared measurably penetrates soft tissue, bone and brain parenchyma in the formalin preserved cadaveric model, in comparison to negligible red light transmission in the same conditions.
Conclusion: These findings indicate that near infrared light can penetrate formalin fixed soft tissue, bone and brain and implicate that benefits observed in clinical studies are related to direct action of near infrared light on neural tissue.

#28

TRANSDERMAL LIGHT DELIVERY USING FIBEROPTIC MICRONEEDLES

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Background: Laser-based therapeutic and diagnostic applications, such as hair removal or OCT imaging, are limited due to the poor penetration depth of light into the tissue. Focused or near-collimated light only travels a few millimeters into tissue due to the combined effects of scattering and absorption. Minimally invasive fiberoptic microneedles provide a means to mechanically penetrate tissue and deliver light directly into the target area.
Study: Microneedles with 3 mm length and varying average diameter (40–125 μm) were manufactured using a novel melt-drawing procedure. Force and displacement were measured while inserting these microneedles into *ex vivo* pig skin samples. A hand-held microneedle injection device was developed for practical handling of microneedles in a clinical setting. Laser irradiation (1064 nm) was delivered into sodium-alginate tissue phantoms via these fiberoptic microneedles, and temperature distribution was measured using infrared thermal imaging (FLIR Thermovision A20M).
Results: Microneedles that were 3 mm in length and 82–125 μm in diameter were found to be strong enough to penetrate through 2 mm of *ex vivo* pig skin. The tip diameter was found to be critical in lowering the force needed to penetrate through the skin. Researchers delivered 1 W of 1064 nm laser irradiation for 10 s without evidence of damage to the microneedles .The shape of the microneedle was modified to deliver laser light over different lengths (up to 2 mm) from the fiber tip. Interaction with the surrounding tissue phantom generated a region of temperature elevation ($T > 330$ K) 3 mm in length and 2 mm in diameter.
Conclusion: Fiberoptic microneedle probes allow minimally-invasive delivery of optical radiation several millimeters beneath the skin surface which may prove to be a useful tool for increasing the capabilities of many current and emerging therapeutic and diagnostic laser applications.

#29

ANALYSIS OF AESTHETIC PROCEDURES USING PULSED LASERS, RF AND IPL

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Background: Various light sources have been used for aesthetic and dermatology applications. Techniques combining laser and cooling was also used in many commercial products. However, systematic studies of the roles of light parameters have not been presented. This paper will present unified scaling law for aesthetic procedures using various lasers (visible to IR) and pulse width (0.5 ms to cw) and other heating sources of radio frequency (RF) and intensed pulse light (IPL).
Study: Using heat diffusion equation for laser volume heating of tissues, the surface (Ts) and volume temperature of the treated area is calculated numerically. Scaling law is developed in relating Ts and laser parameters of pulse width, fluency (F), energy (E), and tissue optical property (absorption coefficient, A, thermal conductivity, K). We also present the advantages of pulse train technique together with the dynamic cooling effects. The theory will be used to analyze various procedures including: diode laser (at 1450-nm) for acne treatment; diode laser at 810-nm for hair removal; CO2 and Er:YAG laser resurfacing; combined RF and IPL for resurfacing.; and the new procedure called UVA-LED (at 365 nm) for corneal cross-link.
Results: The scaling law is characterized by the product of (AE/K), where K is the thermal conductivity, E, the energy of the heating sources (laser, RF or IPL), and A is the absorption coefficient (of laser) or averaged value for the case of broadband IPL. To achieve maximum penetration depth and avoid the super surface overheating, pulse-train combining with surface pulsed cooling may be used.
Conclusion: Optimal clinical outcomes may be theoretically predicted via scaling of the light sources parameters and the tissue properties in many thermal processes. The scaling law may also provide the guidance for the development of new devices.

#30

COLORIMETRIC ANALYSIS OF SEASONAL, DAILY, AND ACUTE VARIATIONS OF SKIN COLOR

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Background: Colorimetric measurements are sometimes used for objective evaluation of therapeutic outcome in aesthetic laser procedures, either in clinical or investigational protocols. Our aim was to analyze seasonal, daily and acute variations of perceived color in healthy skin and assess their potential influence on the above mentioned application.
Study: Color of healthy skin on the forehead and upper arm (inner and outer side) was measured using a tristimulus (CIE

XYZ) colorimeter. Seasonal changes of color were determined from weekly measurements in 14 consenting volunteers (12 of Central European descent, 2 of mixed ethnic origin) between June and October. Variations within a week (Monday through Friday) were measured in two subjects for four weeks. Variations within a day were monitored in only one subject. All measurements were acquired by a personal computer, averaged, and converted to CIE L*a*b* color system for further analysis.
Results: In the seasonal color variations, attributable to epidermal melanin, the increase of redness is highly correlated with reduction of brightness in all 14 subjects ($R = 0.84$). The characteristic ratio ($\Delta L^*/\Delta a^* = -2.1 \pm 0.4$) differs from that determined by Takiwaki et al. (Skin Res. Technol. 2002) for Japanese subjects. Correlation between ΔL^* and Δb^* is not as strong. Color variations within the week match the expected pattern of erythema due to sun exposure over the weekend, followed by gradual melanin production. Variations within a single day were minor.
Conclusion: Color variations within the day are minimal and should not interfere with above described application of colorimetry, as long as all patients are cooled and rested, and have a dry skin. Correlation between ΔL^* and Δa^* due to melanin variation offers a chance to computationally reduce the influence of the latter on colorimetric monitoring of laser procedures that extend over longer time periods.

#31

BLOOD FLOW ASSESSMENT WITH MRI AFTER 1.9μM DIODE LASER ASSISTED MICROVASCULAR VEIN ANASTOMOSIS: AN ISSUE FOR FREE FLAPS VENOUS CONGESTION?

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Background: Microvascular surgery involves intricate surgical techniques to join tiny blood vessels and helps to transfer large amount of tissues. Venous anastomosis remains one of the major difficulties for its success because of the low blood flow correlated to a major risk of free flaps venous congestion and thrombosis. This study was aimed to assess blood flow after conventional venous anastomosis and Laser Assisted Microvascular Anastomosis (LAMA) using a 1.9 μm diode Laser.
Study: LAMA was performed on a series of 10 external jugular veins on Wistar rats. Two stay sutures and a standard laser tissue welding technique (?1.9 μm - power: 140 mw) were used. Similarly, a series of 10 conventional venous anastomosis were performed. For the two groups, contralateral non operated jugular veins were used as control. Besides patency assessment and aneurysm formation, blood flow inside the jugular vein was measured using Magnetic Resonance Imaging (MRI). A T2 sequence and a Flow-MRI sequence were performed one day after operation and then after 1, 4, and 12 weeks.
Results: No thrombosis was observed after surgery for both the conventional and laser operated groups. The venous patency rate was 100%. The mean clamping time was 7.9 min compared to 9.4 min in the control group. For each period of observation, blood flow features with Flow-MRI reveal no significant difference between the venous flow in the LAMA side compared to the non operated side. Conversely a 20% reduction of blood flow was observed on average in the conventionally operated side when compared to the non operated side for each period of observation. Moreover, 3 thrombosis cases of venous anastomosis performed with the conventional technique were observed.
Conclusion: The Flow-MRI emphasizes that 1.9 μm diode laser assisted microvascular anastomosis appears to be a consistent, reliable and reproducible technique, able to improve the blood flow in veins when compared to the conventional surgical technique.

#32

OPTICAL CHARACTERIZATION OF PIGMENTED SKIN LESIONS IN THE NEAR-INFRARED

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Background: Current melanoma screening methods rely on qualitative, visual assessments of pigmented lesions and subsequent invasive biopsies. A relatively high percentage of unnecessary biopsies are taken. To address this lack of specificity, we have developed a non-invasive optical technology that is capable of quantifying chemical and structural constituents within superficial volumes of skin. Diffuse optical spectroscopy can determine the optical properties of tissue as well as quantitative concentrations of melanin, oxy and deoxy-hemoglobin, water, fat and cellular structure using near-infrared light. While traditional diffusion based methods perform optimally when the tissue region of interest is 1–2 cm deep, we have developed a specialized approach that enables us to characterize *in-vivo* tissue at depths less than *1–2 mm*, the domain that is relevant for interrogating suspicious pigmented nevi. While the ultimate goal is to develop a quantitative method for the early detection of melanoma, the objective of this initial investigation is to optically characterize benign and malignant skin lesions.
Study: A broad range of skin lesions were measured from 40 subjects, ranging from typical nevi to malignant melanoma. Non-pigmented lesions including angiomas and seborrehic keratoses were also included. For this initial investigation, we have used our technology to characterize each lesion category in terms of concentration of melanin, oxy- and deoxy-hemoglobin, fat, water and optical scattering detected within the volume of tissue probed.
Results: Melanoma displays relatively low scattering characteristics. Complimentary chromophore concentration information will further refine distinction among benign lesion categories.
Conclusion: Preliminary results indicate that this technique provides quantitative, non-invasive assessments which can characterize lesions based on physiologic parameters that are inaccessible to clinicians. These measurements may discriminate between different types of pigmented lesions, but also describe variances present within each clinically derived category.

#34

LASER PRECONDITIONING FOR WOUND HEALING: A RAMAN SPECTROSCOPY ANALYSIS

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Background: Laser preconditioning augments incisional wound healing by reducing scar tissue and increasing maximum tensile load. While the mechanism of this therapy is largely unknown, recent studies have optimized treatments or confirmed results using HSP70 as a biomarker. Under the hypothesis that HSP70 plays an active role in reported results and to better understand

the downstream effects of laser preconditioning, this study utilized a probe-based Raman spectroscopy system to achieve a non-invasive, in-vivo, spatio-temporal biochemical analysis of murine skin incisional wounds as a function of laser pretreatment and the presence of HSP70.
Study: Two contralateral 1 cm full-thickness linear incisions were made on the dorsum of 19 depilated adult female C57B6 mice (10 WT and 9 HSP70 KO). Twelve hours prior to incision, one of the two wound sites was preconditioned (? = 1.85 μm, $H_o = \sim 7.64$ mJ/cm^2, spot diam. = 5 mm, Rep. rate = 50 Hz, 2 ms pulse, 10 min. exposure). Raman scans (? = 785 nm) were acquired for 3 s on wounded and adjacent normal skin prior to preconditioning, after surgery, and daily until culled for histology at days 4, 7, and 10.
Results: Raman spectra yielded significant differences (t-test; a = .05) in several significant biochemical peaks between WT and KO mice on wounds and in adjacent tissue early in the wound healing process. Analysis of peak ratios indicated 1) an increase in protein configuration on and surrounding the wound, and 2) increased cellularity that was prolonged in WT mice due to laser treatment. Polarization microscopy confirmed that treated WT mice showed increased heterogeneity in collagen orientation.
Conclusion: HSP70 is active in protein configuration and cellularity of early wound healing. Laser preconditioning prolongs its effects in ways consistent with findings of previous studies. Raman spectroscopy proved a convenient non-invasive method of obtaining information for evaluating these effects and efficacy of wound healing laser treatment.

#35

EFFECTS OF TEMPERATURE ON FLUORESCENCE IN HUMAN TISSUE

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Background: The fluorescence properties of human tissue are known to be temperature dependent. The most apparent effect of this dependence is the inverse relationship between fluorescence intensity and temperature. In this study, we used fluorescence and diffuse-reflectance spectroscopy to investigate the effects of temperature on fluorescence, thermal coagulation, and tissue optical properties.
Study: Human tissue from the breast and abdomen were examined *in vitro*, and human skin was examined *in vivo* using a fluorescence and diffuse-reflectance system to observe the effects of temperature on fluorescence and optical properties. Fluorescence measurements were carried out using a pulsed nitrogen laser at 337 nm for excitation and a thermal camera for temperature measurements. Thermal variation of the specimens was provided by a saline bath for the *in vitro* experiments and an ice pack and heat pack for the *in vivo* experiments. *In vitro* temperatures were varied from −20°C to 70°C and *in vivo* temperatures ranged from 15°C to 40°C. Optical property measurements and Monte Carlo simulations were carried out on the *in vitro* samples for different levels of thermal exposure.
Results: Results of both the *in vivo* and *in vitro* experiments showed an overall decrease in fluorescence with increased temperature. Some of these effects were found to be reversible before a certain temperature threshold, while some effects of coagulation on fluorescence and optical properties were not reversible.
Conclusion: These results indicate that optical properties of human tissue change at high temperatures, but may not be the only mechanism. In addition, the activation energy of certain internal processes may have contributed to a decrease in fluorescence with increasing temperature.

#36

PLASMA-SPARK ASSISTED TISSUE SURGERY

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Background: Invasive methods such as subcision™ have been used to perform sub-surface cutting of tissue. There is a need for minimally invasive methods to perform such cutting to reduce downtime and simplify the procedure. Toward this, high voltage plasma spark assisted surgery has been developed with several potential applications.
Study: A system that delivers high-voltage pulses of sub-microsecond pulse durations has been developed in combination with needle array of 27 G partially insulated needles with separation as high as 10 mm. This was tested in ex vivo and in vivo porcine adipose tissue. Gross examination and histological microscopic analysis of treated tissue samples were performed. Non-invasive MR imaging was also performed.
Results: The plasma formation was characterized by the expected high current through the tissue. The plasma sparks and its cutting effects were localized in the tissue between the uninsulated portions of the needles. The cut was approximately linear with minimal collateral damage outside the cut. The cutting of both adipose tissue and elements with high electrical conductivity, such as collageneous septae was observed.
Conclusion: A plasma spark assisted surgical approach has been developed that leads to sharp cuts without collateral damage.

#37

THERMAL INJURY PRODUCES REACTIVE OXYGEN SPECIES EFFECTING SURROUNDING NON-HEATED CELLS

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Background: Recently, we described the active thermal bystander effect (ATBE), where after heat exposure DNA damage and cell death can be seen in surrounding, non-heated cells.The ATBE is an active process induced by heated but still viable cells. The purpose of this study was to investigate the involvement of reactive oxygen species (ROS).
Study: Human foreskin fibroblasts (HFF1) were heat exposed at different temperatures (37–54 C) for 10 min, and co-cultured for up to 72 h with non-heated cells. Any cell-to-cell contact and heat diffusion was excluded by the experimental set up (transwell system). Cell viability was measured by MTT assay, DNA damage and apoptosis were analyzed morphologically after fluorescence staining of the DNA with DAPI. ROS levels were quantified either by PeroXOquant assay (for medium) or by fluorescence probe DCFDA (for intercellular cytoplasm).
Results: The ATBE was induced by fibroblasts exposed to a temperature range of 44 to 54°C with a maximum at 48°C. The ROS level was increased in both heated (2fold) and non-heated, bystander cells (2.5 fold). The ROS level in heated cells peaked 30 min after heat exposure at 48°C. Bystander (unheated) fibroblasts showed an increase ROS level with a maximum at 46°C

1 h after heat exposure applied to the stimulating cells. ROS level in the medium was also maximum at around 46°C 1 h after heat exposure. In both cell subpopulations as well as in the medium, the ROS level returned to background level 3 h after heat exposure.
Conclusion: Our data suggest that heat-induced ROS formation plays a key role in the ATBE effect, and may be a direct mediator. As the ATBE is expected to have a role in (fractional) laser treatment, burn trauma and cancer treatment, further research is warranted related to ROS and ATBE *in vivo*.

#38

FIBER DELIVERY SYSTEM FOR ABLATION OF HARD AND SOFT TISSUES USING NEAR-INFRARED FEMTOSECOND LASER PULSES

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Background: Near-infrared femtosecond lasers have recently received much attention as pulsed laser ablation causes minimal thermal and mechanical collateral damage. Despite these advantages, fiber delivered applications of femtosecond lasers are limited due to availability of few fiber waveguides and requirement of focusing lens. We demonstrate a fiber waveguide delivery system for both transmitting and focusing high energy femtosecond laser pulses.
Study: Light emitted from a femtosecond laser (Coherent Hidra 10) was coupled into a one-meter long metal coated hollow waveguide optimized for near-infrared femtosecond laser transmission. The hollow waveguide was end-capped with a 1 mm diameter sapphire hemisphere lens. Planar surface of the sapphire hemisphere was attached to the distal end of the hollow waveguide, allowing focus of femtosecond light only after the beam had passed through the curved hemispherical air-sapphire surface. The system was tested for transmission efficiency with both straight and bent (bending radius: 25 cm) hollow waveguides and applied to ablate *ex vivo* soft (skin) and solid tissues (stape and tooth). Each tissue was irradiated with multiple pulses in a raster scanning mode to create a rectangular ablation area. Images of ablation sites were recorded by optical microscopy and optical coherence tomography.
Results: Femtosecond laser pulses up to 200 uJ/pulse were transmitted by the fiber delivery system with no damage to the fiber and the hemisphere lens. The transmission efficiency of the system was above 85%. Precise ablation was observed on both soft and solid tissues. The square-shaped ablated region was over 100 um deep and 1000 um in width in tested tissues. Edges of the ablated area ended abruptly with no damage to the surrounding area.
Conclusion: The fiber delivery system can transmit and focus near-infrared femtosecond laser pulses for the purpose of tissue ablation. Precise ablation was achieved on both soft and solid tissues with sharp edges and minimal surrounding damage.

#39

DIFFUSE OPTICAL SPECTROSCOPY FOR NON-INVASIVE DIAGNOSIS OF SKIN CANCER: AN OPTIMIZED LOOKUP TABLE-BASED MODEL FOR DETERMINING TISSUE OPTICAL PROPERTIES

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Background: Approximately a million new cases of non-melanoma skin cancer in the United States every year. Diffuse optical spectroscopy (DOS) may offer a means to non-invasively characterize tissue properties and avoid several unnecessary biopsies. We recently developed a look-up table (LUT)-based model for determining tissue optical properties that is accurate at short source-detector separations and in highly absorbing tissue. The LUT was developed from reflectance measurements on 24 calibration standards of known optical properties ($\mu_s' =$ 2.2–71 cm^{-1}; $\mu_a =$ 0–53.3 cm^{-1}). The objective of this study was to develop an optimized LUT based on the minimum number of standards that spanned the same range and demonstrate its use for the analysis of clinical spectra acquired from basal cell carcinoma (BCC). Such an optimized model could potentially be adapted to any probe geometry for DOS-based studies.
Study: We measured the spectrally resolved diffuse reflectance of calibration standards that contained polystyrene beads and red ink to simulate scattering and absorption, respectively. These reflectance measurements were mapped to their respective scattering [μ_s'(?)] and absorption [μ_a(?)] parameters to create a LUT of reflectance values. We validated the LUT using tissue-simulating phantoms containing polystyrene beads and hemoglobin. We also used the LUT in an *in vivo* clinical study on 14 patients with BCC to extract skin optical properties.
Results: We fabricated a LUT with only 5 calibration standards that span a physiologically relevant range of optical properties. The optimized LUT demonstrated a high level of accuracy in extracting the optical properties of tissue phantoms (error $< 5\%$). Our *in vivo* clinical analysis shows that DOS can differentiate between normal skin and BCC with a sensitivity and specificity of 92 and 91%, respectively.
Conclusion: We have developed an optimized and accurate LUT-based model based on only 5 calibration standards. We have also demonstrated the use of the model for non-invasive diagnosis of skin cancer.

#40

THIRD-DEGREE BURN TREATMENT WITH ULTRASHORT PULSE LASER DEBRIDEMENT

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Background: The burn is a tissue injury resulting from thermal, electrical, chemical or radioactive trauma. The treatment prognosis for burn victim requires knowledge of extension burned surface area, depth and location of lesion and/or chronic diseases and age of the patient. Significant improvements in burn treatments have reduced the mortality and morbidity related to burn injuries. Good burn care includes cleansing, debridement and prevention of sepsis. The aim of this study is to propose a debridement method with ultrashort pulses laser.
Study: Three male adult Wistar rats were subjected to three third-degree burns on dorsum with 7 mm of diameter. At 5 day post-exposure, one lesion of each rat was irradiated with

Ti:Sapphire laser pulses, without overlapping, centered at 800 nm, with pulse width of 30 fs and intensities in range of 200 to 300 J/cm^2. The optical coherence tomography (OCT) images were obtained before and after each burn irradiation. Punch biopsy of lesion was excised at 0, 1, 2, 7 and 10 days post-irradiation and analyzed by histology and micro-ATR-FTIR spectroscopy.
Results: Histological evaluation of the skin biopsies revealed third-degree burns and micro-ATR-FTIR analysis demonstrated changing at Amides I and II bands indicating collagen degradation. At maximum intensity the OCT images indicated that skin ablation depth reached 230 μm ± 18, removing whole burn eschar until pinpoint red dots appear, causing bleeding that may promote rapid wound healing.
Conclusion: The results presented herein may represent an alternative debridement method which more *in vivo* studies being carried out. Support by: FAPESP CEPID (05/51689-2), CAPES/Procad (0349/05-4), Rede de Nanofotônica—MCT/CNPq (555170/2005-5), FAPEAM—RH-POSGRAD Program.

#41

EFFECT OF TEMPERATURE ON FLUORESCENCE: AN ANIMAL STUDY

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Background: The fluorescence yield of a tissue sample depends on the temperature of the sample. We studied the effect of temperature on the fluorescence properties of enucleated porcine eyes, excised porcine cornea, and rat skin.
Study: We used a dual-excitation system to collect fluorescence and diffuse-reflectance spectra from the samples. A thermal camera was used to determine the temperature of the tissue at the time of fluorescence measurement. The samples were mounted in a saline bath and measurements were made as the tissue temperature was increased from −20°C to 70°C.
Results: Results indicate that temperature affects several fluorescence spectra characteristics. The peak height decreased as temperature increased and at temperatures above 60°C and the peak position shifted to lower wavelengths. Heating and cooling experiments of the cornea indicated that the process is reversible with heating to 50°C but irreversible past 60°C. The diffuse reflectance spectra indicated a change in optical properties past 60°C, but prior to the denaturation temperature for collagen at 57°C, no change in optical properties was observed.
Conclusion: Our results suggest that the fluorescence decrease as tissue temperature is increased is due to both optical property changes and a change in fluorescence properties.

#42

A NOVEL DIAGNOSTIC ULTRASOUND TOOL FOR OPTIMAL BODY CONTOURING TREATMENT

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Background: As the demand for body contouring continues to rise, the search also continues for new technologies offering improved non-invasive therapies. The combination of bi-polar RF and optical energies delivered directly to the dermis/hypodermis via tissue manipulation has been long considered to be an efficient modality for reshaping. As the thermal modification of both connective and adipose tissues is temperature and time dependent, monitoring tissue temperature at different layers being treated is important. Particularly when a high power combined radiofrequency, optical and mechanical manipulation platform is being used, real-time regulation of tissue temperature during and following body contouring treatments becomes imperative.
Study: We developed a novel ultrasound diagnostic tool for real-time measurement of tissue temperature at different layers that is based on the variation in sound velocity during and after the treatment and its linear correlation with temperature alteration.
Results: We found significant differences in the speed of sound between different tissue layers (dermis ~1750 m/s, muscle ~1580 m/s and hypodermis ~1460 m/s), therefore enabling accurate determination and classification of the tissue layer that is in the treatment volume. Moreover, spectral analysis allows us to evaluate changes in tissue composition in response to treatment. Quantitative data is shown for the temperature change profile at different layers during treatment and up to few hours later, thereby providing objective assessment of treatment efficacy.
Conclusion: Controlled thermal modification of both connective tissue architecture and adipose tissue volume by means of enhanced lipids turnover, neocollagenesis and angiogeneisis are temperature dependent. Therefore, the unique features of the technology; online monitoring of tissue temperature and composition and the precise control on the layer being treated may be used to optimize treatment of a wide variety of patients via the induction of the desired biological responses achieving a more aesthetically ideal body shape.

#43 Late Breaking

KTP LASER TISSUE ABLATION: DEVELOPMENT AND EXPERIMENTAL VALIDATION OF A NEW NUMERICAL MODEL

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Background: Increasingly KTP lasers are used to perform prostatectomy in patients with benign prostatic hypertrophy (BPH). Optimal outcomes maximize the ablated tissue volume while minimizing the coagulation within the remaining tissue. Here we present a new computational model that can quickly test and optimize surgical parameters for KTP and other laser ablation treatments.
Study: Laser ablation was modeled as an explosive water vaporization process. The energy of ablation (E_{ab}) of the tissue (rat hindlimb muscle) was calculated based on tensile strength and water content. Light propagation and energy deposition was calculated using a Monte Carlo simulation. The moving boundary phase change problem was calculated using an explicit multi-dimensional finite-difference-method (FDM). The code was validated against a 1D analytical solution. Laser ablation was conducted using a Green Light KTP laser system operating at 80 W and 532 nm (AMS, Minnetonka, MN). Rat hind limb muscle tissue was ablated via optical fiber held at a specific working distance (WD) above the tissue (0–5 mm) while scanning (SS) at 0.5 to 4 mm/s. Outcomes of ablation rate (AR) and therapeutic index (TI = ablated/coagulated tissue volumes) were measured.
Results: Experimentally a maximum AR of 7.7 ± 1.34 (SD) mm^3/s and TI of 0.51 ± 0.09 (SD) were obtained for SS of 1 mm/s. These

results were in excellent agreement with the numerical code (AR = 8.4 mm^3/s and TI = 0.6 for SS of 1 mm/s; R^2~0.86–0.9 for 0–2 mm WD) using no adjustable parameters. The agreement between the model and experiments improved for lower WD and higher SS.
Conclusion: A new multi-dimensional high power laser tissue ablation model is presented that successively identifies optimal parameters for KTP laser operation. This model will be a useful tool in guiding further enhancement of KTP and other high power laser ablation modalities.

#44 Late Breaking

COMBINED PULSED DYE LASER AND TOPICAL RAPAMYCIN TREATMENT INHIBITS CUTANEOUS PATHOLOGICAL ANGIOGENESIS

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Background: Port wine stains (PWS) are common congenital cutaneous vascular malformations. Pulsed dye laser (PDL) is the treatment of choice for PWS. However, in many cases complete PWS clearance cannot be achieved and some lesions remain resistant to laser treatment. The low therapeutic efficacy might be caused by revascularization of photocoagulated blood vessels due to angiogenesis associated with the normal wound healing response. Rapamycin, an inhibitor of mammalian target of rapamycin, effectively inhibits the growth of pathological blood vessels. Our objective is to investigate whether topical rapamycin can inhibit reperfusion of PDL-photocoagulated blood vessels in an animal model of pathological angiogenesis.
Study: We developed a transgenic mouse model of pathological angiogenesis with inducible overexpression of activated Akt in endothelial cells (myrAkt mice). Pathological vessels in the skin of myrAkt mice were photocoagulated with laser pulses. One day following laser treatment, animals were treated once a day with 5% topical DMSO or 5% topical rapamycin for up to 22 days, at which time they were sacrificed for analysis by histology and immunofluorescent stains for CD31 (blood vessels) and CD45 (leukocytes).
Results: Treatment of myrAkt-induced pathological blood vessels with laser pulses plus topical DMSO resulted in the reformation of abnormal vessels 22 days post laser treatment. However, treatment with laser plus topical rapamycin completely blocked the reformation of the abnormal vessels after laser ablation as seen on H&E and CD31 stains. Rapamycin caused a delay in wound healing, but there was no significant change in the degree of leukocyte infiltrate in the wound area in DMSO vs. rapamycin treatment.
Conclusion: Topical rapamycin effectively inhibits revascularization of cutaneous pathological blood vessels following laser treatment, suggesting that combined laser and topical anti-angiogenic therapy might be a promising approach to improve the treatment efficacy of PWS.

#45 Late Breaking

NOVEL TEMPERATURE MONITORING DURING LASER-ASSISTED LIPOLYSIS

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Background: Skin safety requires real-time measurement of the dermal and hypodermal temperatures during laser-assisted lipolysis. Current technologies employ thermocouple probes near the laser fiber or IR measurements of the skin. The former method provides temperatures at unspecified depths and the latter method provides temperatures at the surface of the skin. This report describes a method for monitoring real-time temperatures at multiple depths.
Study: Thermocouples were integrated into 27 gauge needles of lengths 3, 6 and 10 mm. The needles are contained in a low-profile housing for use in the sterile field during the LAL procedure. Continuous monitoring is possible with the temperature rise graphed at each depth utilizing USB connections.
Abdominoplasty candidates were treated under IRB protocol prior to surgery with 924/975 nm using a 1.5 mm or 2 mm diameter tip and power ranging from 10 to 35 W. Biopsies were taken to evaluate thermal injury.
Results: Real-time temperature monitoring allowed a doubling of fluence delivery as compared to earlier treatments without temperature monitoring. Additionally, a clear relationship of temperatures at different depths was demonstrated. Total fluence of 120 J/cm^2 could be safely delivered in a low BMI patient to achieve 50C at 6 mm simultaneously showing 44C at 3 mm. The amount of fluence needed to raise the tissue 1°C was easily calculated to determine total required energy and relationship to safe skin temperature by biopsy was shown. As a result, 50% more fluence was safely delivered to one side of the abdomen with multi-depth simultaneous monitoring as compared to the contralateral non-monitored side.
Conclusion: The potential for improved clinical outcome and increased safety is realized with a needle-probe temperature monitoring technology that provides real-time measurements at precise depths.

#46

RESOLUTION LIMITS OF SPATIAL SPECTRAL VOLUME HOLOGRAPHIC IMAGING SYSTEMS

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Background: Instruments for spectroscopic and microscopic imaging are essential tools in the biological and medical sciences. Among those instruments, Confocal Florescence Microscopy (CFM) plays an important role in medical imaging due to its depth and spectral discrimination. However, CFMs have several disadvantages. For example, in order to obtain spatial and spectral information, CFMs use mechanical scanning, which significantly increases image acquisition time and the complexity of the system. Also, important quality parameters such as depth resolution and dynamic range depend on pinhole size. Both disadvantages can be overcome using a spectral-spatial volume holographic imaging system (S2-VHIS). The S2-VHI system uses unique properties of volume holograms, including high angular wavelength sensitivity and the ability to diffract light matched to a particular wavefront shape, to resolve different depths and spectral response within a tissue sample. Our objective is to implement of the S2-VHIS using an inexpensive doped polymer and to study its resolution limits.

Study: We present a design-demonstration study of the S2-VHIS which includes: evaluation of the state- of- the-art technology, design and fabrication of S2-VHIS, demonstration of its imaging capabilities and evaluation of its resolution limits. Methodologies for the modeling are based on Kogelnik theory and ray tracing algorithms.
Results: Our S2-VHIS using holograms recorded in Phenanthrenequinone Polymethylmethacrylate (PQ-PMMA) (instead of the more expensive LiNbO3 crystal reported previously) obtained up to five simultaneous images of different depths each separated by 50 μm. The lateral resolution of the images was 4.5 μm.
Conclusion: Modeling results indicate that theoretical resolution limits of this system have not yet achieved. It is shown that both lateral and axial resolution can be further improved by including additional optical elements or by changing key construction parameters of the hologram.

#47

MEASUREMENT OF BIREFRINGENCE OF THE RETINAL NERVE FIBER LAYER USING SWEPT SOURCE POLARIZATION SENSITIVE OPTICAL COHERENCE TOMOGRAPHY (1 UM)

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Background: Glaucoma is the second leading cause of blindness in the world and is characterized by progressive degeneration and eventual loss of retinal ganglion cells (RGCs) and their axons in the retinal nerve fiber layer (RNFL). Glaucomatous nerve damage usually progresses gradually from the periphery to the central visual field. Since peripheral vision is lost first and symptoms like pain or blurred vision are usually not present; glaucoma is often not diagnosed until a significant vision loss is noticed subjectively by the patient. Since pharmacologic/surgical interventions that slow or stop progressive axon degeneration in the RNFL and prevent additional vision loss are available early diagnosis becomes critical. Swept source polarization sensitive OCT (SS-PSOCT) can measure viability of the RNFL and possibly serve as an early indicator of Glaucoma.
Study: A fiber-based SS-PSOCT and line scan laser ophthalmoscope (LSLO) imaging system was constructed. The system uses a 34 KHz, 60 nm swept source centered at 1060 nm. The axial resolution is about 10 nm with average incident power on the cornea (425 □W) below the ANSI maximum exposure level. Five normal volunteers aged 29 to 63 were imaged. An automatic boundary detection and nonlinear fitting algorithm were used to measure RNFL birefringence from the acquired horizontal and vertical fringes. RNFL maps were recorded as ten concentric rings around the optic disk with radii uniformly distributed from 1 mm to 2.5 mm. Registration between RNFL maps was provided by the high contrast vascular fingerprint visualized in the LSLO fundus image acquired simultaneously with SS-PSOCT data.
Results: Three sets of peripapillary RNFL thickness, retardation, and birefringence maps of both eyes of the five volunteers were acquired.
Conclusion: Changes in birefringence measured by SS-PSOCT has the potential for clinical use as an early diagnostic indicator of glaucoma.

#49

REFRACTIVE INDICES OF HUMAN AND MOUSE SKIN CANCERS IN TERAHERTZ WAVELENGTH RANGE

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Background: Continuous wave terahertz imaging has the potential to offer a safe, non-invasive, and comparatively inexpensive technique for imaging skin cancers. The goal of this study was to determine and compare the refractive indices of normal and cancerous skin.
Study: CO_2 laser pumped far-infrared gas lasers were used as the terahertz sources for the experiments. The terahertz beam paths were co-aligned and focused down to a spot size of 0.5 mm. The samples were scanned across the focal plane using a two axis motion controlled stage. Human and mouse samples of cancerous and normal skin were collected. The specimens were cut to a thickness of 120 μm and mounted in a holder with z-cut quartz windows for imaging. The images were collected at 1.4 and 1.6 THz in reflection and transmission modes using liquid helium cooled silicon bolometers. The normal and cancerous regions were delineated in the terahertz images using H&E histopathology processed from the same tissue block. The refractive indices of cancerous and normal tissue were determined using a layer model with the Fresnel equations and a Levenberg-Marquardt fitting routine.
Results: The results indicate that there exist significant differences in the refractive indices between normal and cancerous tissues.
Conclusion: These differences in the refractive indices may be used for cancer detection and delineation of cancer boundaries during surgery.

#50

COMBINED RAMAN SPECTROSCOPY-OPTICAL COHERENCE TOMOGRAPHY FOR THE DETECTION OF SKIN CANCERS

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Background: Skin cancer is the most common cancer in the United States, with an incidence rate that continues to rise. Fortunately, it can be highly curable if detected at an early stage. Best clinical practices require physicians to screen large areas of skin, identify suspicious lesions, perform biopsies, and await the results for disease diagnosis. This paradigm is not ideal. Identification of lesions can be subjective, biopsy is invasive, and pathological analysis is time consuming and costly. The potential of novel optical techniques such as Raman spectroscopy (RS) and optical coherence tomography (OCT) to perform rapid, non-invasive "optical biopsy" has been widely touted; however these methods suffer unique limitations. The biochemical sensitivity of RS facilitates classification of lesions with high accuracy; however it is unable to relate lesion microstructure. Conversely, OCT can

image tissue microstructure but lacks molecular specificity. The two methods are thus well-suited for combination into a single instrument to meet the challenge optical biopsy presents.
Study: We demonstrate the ability of RS-OCT to perform both image guided acquisition of Raman spectra and biochemical identification of features in OCT images. The RS-OCT instrument utilizes independent RS and OCT system backbones with integrated sampling optics. We will report the design, characterization, and performance of a clinical system and probe for performing RS-OCT of the skin *in vivo*, as well as the results of an ongoing pilot study demonstrating the feasibility of RS-OCT.
Results: OCT images acquired at >1 frame/second with sensitivity of <-100 dB. Raman spectra are acquired with 30 second integration times. Images and spectra acquired from cancerous and non-cancerous skin lesions using the clinical RS-OCT instrument will be presented.
Conclusion: We report development of the novel technique of combined RS-OCT, the design of a clinical instrument, and initial demonstration of feasibility for characterization skin cancers.

#51

3-DIMENSIONAL SURFACE IMAGING FOR MEASURING SKIN TIGHTENING AND BODY CIRCUMFERENCE

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Background: The body contouring field is evolving rapidly, and numerous devices have obtained or are seeking FDA clearance. Device efficacy is largely based upon qualitative photographic comparisons and measurable changes in patient circumference. The current standard for measuring circumference in clinical trials is the measuring tape. These measurements introduce human error and may incorrectly support or refute a device's efficacy. No standard quantitative method of measuring skin tightening exists, and, currently, tightening assessments rely on qualitative photographic evaluations. A promising alternative to manual measurements and qualitative comparisons is 3-Dimensional (3D) photography. This technology allows precise circumference and skin tightening measurements to be performed on 3D images. We compare the precision and reproducibility of manual versus 3D photographic measurements of body circumference, and we validate a quantitative technique for measuring abdominal skin tightening.
Study: After IRB approval, thirty subjects' thighs and abdomen were measured twice by each of two blinded investigators and twice by the 3D system. For each subject, 2 nevi on the abdomen were identified as landmarks. Two blinded investigators then measured the surface distance between the 2 landmarks on two consecutive 3D images.
Results: For thigh circumference, the variance of the replication errors [measurement 1-measurement 2] for the investigators was 20.5% larger than the 3D system's variance. For abdominal circumference, the variance for the investigators was 231.3% larger than the 3D system's variance. For skin tightening measurements, the average replication error was 0.99 mm (range 0–3 mm) and 1.00 mm (range 0–2.9 mm) for investigator 1 and 2, respectfully.
Conclusion: 3D photography enables investigators to reliably detect and quantify minute changes in body shape; consequently, 3D photography enhances the statistical power of clinical studies. For studies involving abdominal circumference, 3D photography reduces the number of subjects needed by 1/2 to 2/3. Additionally, we have clinically validated a novel method to precisely and reproducibly measure abdominal skin tightening.

#52

DETERMINATION OF DEATH THRESHOLDS AND IDENTIFICATION OF TERAHERTZ (THZ)-SPECIFIC GENE EXPRESSION SIGNATURES

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Background: Terahertz (THz) radiation is increasingly being used for various imaging applications; however, the potential impact that this radiation has on biological systems is not well characterized. In addition, no empirically validated safety guidelines (e.g. cellular and tissue damage thresholds) exist for this range. The goal of this study is to quantify the impact that THz radiation has on mammalian cells.
Study: In this study, we determined both the necrotic and apoptotic thresholds (ED_{50}) for several human cell lines using MTS viability assays, flow cytometry, and confocal LSM techniques. In addition, we used transcriptomic and genomic analysis techniques to identify THz-specific expression signatures.
Results: For the THz frequencies tested, we found that the cell death thresholds were both frequency and cell type-dependent. We also found that each cell type exhibited THz-specific gene expression signatures. Both the specific genes and magnitude of expression were markedly different from those responses induced by judiciously selected positive-stress controls (e.g. genotoxic and hyperthermic stress).
Conclusion: These results provide evidence for the specific effects that THz radiation has on human cells, and these results may contribute to the development of empirically-based safety guidelines. We speculate that the identified gene markers may also serve as excellent candidate biomarkers for THz exposures.

#53

DETERMINATION OF THE OPTICAL PROPERTIES OF SKIN IN THE TERAHERTZ WAVELENGTH RANGE USING TIME-DOMAIN SPECTROSCOPIC TECHNIQUES

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Background: Terahertz (THz) radiation is the part of the electromagnetic spectrum ranging in frequency from 0.1 to 10 THz or wavelengths from 30 to 3000 μm. The optical properties of biological tissues are well-characterized in neighboring spectral regions; however, few studies have been conducted to determine their properties in the THz range. In this study, we developed a THz time-domain spectroscopic (TDS) unit for the measurement of the optical properties of skin and other biological tissues.
Study: The THz TDS unit was used to measure the optical properties of excised biological tissues. Spectra was measured for acute (~2 h post-excision), fresh (~15 h post-excision), and

frozen (~2 d post excision) samples. The THz-TDS techniques was used to directly measure the effect that each sample has on both the amplitude and phase of the THz waveform. After applying a Fourier transform to extract the frequency spectrum from the time-domain data, we then used these waveforms to determine the sample's index of refraction (n) and absorption coefficient (μ_a).
Results: For all tissue samples tested, we found that the μa increased with frequency. For instance, at 0.5 THz fresh skin has an μa of 150 cm^{-1} whereas at 2.5 THz it increases to 400 cm^{-1}. In addition, the refractive index was comprabable for all tissues tested, and ranged from 1.8 to 3.8.
Conclusion: We used THz TDS techniques to measure the optical properties of biological tissues. The values we measured agreed well with the values we previously recorded using pulsed photothermal-radiometric techniques.

#54

IMAGING BRAIN TUMORS USING WIDE-FIELD HIGH-RESOLUTION OPTICAL SYSTEM

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Background: There is accumulating evidence that total resection of primary brain tumors is associated with improved survival. In this study we have tested dye-enhanced wide-field high-resolution imaging for accurate brain tumor detection.
Study: Seven discarded fresh thick specimens of brain tumors including glioblastoma (n = 5) and low-grade oligoastrocytoma (n = 2) were obtained from surgeries. Five cancer specimens (four glioblastomas and one oligoastrocytoma) were stained in 1 mg/ml aqueous tetracycline solution (TCN). The remaining tissues were stained in 0.25 mg/ml aqueous methylene blue solution (MB). Reflectance co- and cross- polarized macro images of the tissues were acquired at 390, 577, 640 and 750 nm. Fluorescence polarization images of TCN stained tumors were acquired using 390 nm excitation and 430 nm long pass filter, whereas fluorescence of MB stained specimens was excited at 620 nm and registered in the wavelength range from 660 to 750 nm. The suspicious areas on the tissues revealed by macro imaging were examined using high resolution reflectance and fluorescence imaging at 658 and 785 nm. Resulting images were compared to the corresponding H&E histopathology.
Results: Optical images correlated with histology for all the tissues imaged so far.
Conclusion: Wide-field high-resolution imaging shows promise as a guidance tool for the intraoperative brain cancer detection.

#55

COMPARATIVE EVALUATION OF SQUAMOUS CELL CARCINOMA MOUSE MODELS USED FOR TESTING MULTIMODAL OPTICAL IMAGER

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Background: Animal testing often serves as the first step in validating novel imaging techniques and equipment. In this contribution we discuss comparative advantages and disadvantages of two squamous cell carcinoma (SCC) mouse models used for evaluation of multimodal optical imager.
Study: In total 14 animals were used for the experiments, including 7 BALB/c nude mice and 7 SENCAR mice. 6–8 weeks old male BALB/c nude mice were inoculated with 350,000 cells of mouse SCCVII. 11–16 days after inoculation, when the tumors reached a diameter of 10–14 mm, the mice were ready for imaging. In SENCAR mice, the tumors were induced using 7,12-dimethylbenz[a]anthracene as initiator and 12-O-tetradecanoylphorbol-13-acetate as promoter. After 20–25 weeks of promotion all mice developed multiple papiloma and SCC lesions. Prior to imaging all mice were anesthetized. 0.25 mg/ml aqueous MB was injected around cancerous areas. Reflectance images were acquired at 658 and 785 nm Fluorescence images were excited at 658 nm and registered between 690 and 710 nm. Resulting images were compared to the corresponding H&E histopathology.
Results: Images of both tumor models correlated well with histopathology. Optical images acquired from the SENCAR mice exhibited patterns closer to those of human SCC as compared BALB/c mice.
Conclusion: Therefore, SENCAR model should be preferred. However, considering much higher labor and time consumption of SENCAR model, BALB/c mice inoculated with SCC cells can be used for preliminary tests.

#56

THREE-DIMENSIONAL PHOTOTHERMAL WAVE IMAGING OF NANOROSE IN ATHEROSCLEROTIC PLAQUE AND A TISSUE PHANTOM

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Background: Atherosclerosis in combination with rupture of vulnerable plaques is the leading cause of deaths worldwide, surpassing both infectious diseases and cancer. In atherosclerosis, macrophages infiltrate plaques which are characterized by a thin fibrous cap and a lipid core. Photothermal wave imaging is based on the periodic thermal modulation of a sample using intensity modulated light. The intensity modulated light is absorbed by target chromophores (nanorose in this study) and generates a periodic thermal modulation.
Study: We report use of photothermal wave imaging to visualize three-dimensional distribution of nanorose in atherosclerotic plaque in ex vivo atherosclerotic tissues taken from a rabbit model (nanoroses are taken up by macrophages via endocytosis) and a phantom mimicking atherosclerotic tissue. The excitation wavelength of 800 nm was selected to target nanorose. Two samples (the atherosclerotic plaque and tissue phantom) were irradiated (800 nm) at modulation frequencies ranging from 0.04 Hz to 5 Hz to generate photothermal waves. The radiometric temperature at the sample surface was recorded by an infrared (IR) camera over a 200 second time period at the frame rate of 12.8 Hz. Extraction of amplitude and phase images (256×256 pixels) at selected frequencies was performed by computing a Fourier transform of the time-dependent radiometric emission at each pixel.
Results: Amplitude and phase images were obtained at each modulation frequency and related to depth of nanorose in the

samples. Photothermal wave images recorded from the atherosclerotic plaque and the tissue phantom suggest that three-dimensional distribution of nanorose can be identified by analysis of amplitude and phase images at selected modulation frequencies.
Conclusion: Observation of high concentration of nanoroses in atherosclerotic plaque confirms that nanoroses taken up by macrophages are present at locations associated with lipid deposits.

CUTANEOUS LASER SURGERY

#58

IMPROVEMENT IN SADDLEBAG SUBCUTANEOUS FAT DEPOSITS AND CELLULITE USING A BIPOLAR RADIOFREQUENCY, INFRARED, VACUUM AND MECHANICAL MASSAGE DEVICE

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Background: Fat deposition along with laxity and cellulite in the saddle-bag area is a common concern for cosmetic patients. Liposuction has been a long- established procedure for fat removal and circumference reduction; however its effects on skin laxity and texture have not been wholly satisfactory. This spawned the arena of non invasive body contouring devices to address both issues concomitantly. A device combining infrared (IR) light and conducted bipolar radiofrequency (RF) energies with mechanical massage and vacuum (Velashape, Syneron Medical Ltd) has demonstrated improvement in thigh, arm, abdominal and flank circumference. This study was designed to more closely evaluate and quantify the efficacy and safety profile of Velashape for the saddlebag area.
Study: A prospective study enrolling 30 female subjects (29–59 years old) was performed. Subjects were randomly assigned to one of three treatment groups. 30 subjects underwent 5 treatments in total: once weekly, twice weekly or once every two weeks, depending on their randomized group allocation. Treatments were performed using the combined IR, bipolar RF, massage and vacuum device. Circumference measurements, photographs (2 and 3 Dimensional) and subject weights were performed at baseline, prior to each treatment and at 1, 3 and 6 month follow up visits. Subjects also completed treatment satisfaction evaluations.
Results: Overall mean reduction in thigh circumference of all 30 subjects across all 3 groups, by manual tape measurement from baseline to 1 month follow up was 0.194 cm. At 3 month follow up was 0.08 cm and at 6 month follow up was 0.738 cm. follow up there was a mean 0.387 cm circumference reduction. At 3 months follow up a mean loss of 0.475 cm and at 6 month follow a mean reduction of 0.795 cm. For the 10 subjects treated twice weekly, at 1 month follow up there was 0.171 cm mean loss, at 3 month follow up there were no changes from baseline and at 6 months there was a mean 1.382 cm reduction. For those 10 subjects treated once every other week at 1 month follow up had a mean loss of 0.16 cm in circumference. At 3 months follow up had a 0.225 cm mean increase from baseline and at 6 months follow up there was a mean loss of 0.24 cm. Of the 10 randomly selected subjects whose results were followed by validated 3 Dimensional photography (Vectra, Canfield Imaging), there was a mean reduction of 2.58 cm at 3 months post-treatment (standard deviation 0.59 cm). There was reported overall patient satisfaction of 79.3% at 3 month follow up.
Conclusion: This study demonstrates progressive reduction in thigh circumference over time and sustained reduction up to 6 months after initial treatment. There was objective and subjectively reported improvement in skin texture and the appearance of cellulite following treatment with Velashape.

#59

MULTI-CENTER STUDY OF SMOOTHSHAPES SYSTEM FOR REDUCTION OF THIGH CIRCUMFERENCE

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Background: The SmoothShapes® device incorporates laser and light wavelengths with mechanical manipulation and is a proven technology for the treatment of cellulite. Previous findings using the device prompted further investigation into the resulting decrease of subcutaneous fat. The study was undertaken to evaluate the effectiveness, reproducibility and longevity of the SmoothShapes System for the treatment of thigh circumferential reduction.
Study: Six clinical sites in the US and Europe participated in the multi-center, IRB approved, single-blinded clinical study where female subjects between the ages of 21–66, skin type I to VI , with various BMI's ranging from normal BMI to overweight, were randomly assigned to have one thigh treated and the other serve as control. Weight, digital photographs and thigh circumference was recorded pre -treatment, during treatments and at 1 month and 3 month follow-up visits. Both thighs had 3 measurements taken, by a blinded investigator, at each of three locations on the thigh: upper, mid and lower. Treatment regimen consisted of 8, twice-a-week, 30 minutes treatments of the entire thigh.
Results: Eighty-three (83) subjects who completed one month follow up and had no data points missing throughout the study were included in the final one month data analysis. At one month post treatment, when comparing the treated and control thighs, the circumference reduction was statistically significant ($p < 0.001$, Student's t-test) with positive responding subjects recording a combined average loss of 3.5 cm ranging from -0.2 cm to -8.7 cm. Seventy-two (72) subjects who completed 3 month follow up were included in the final 3 month data analysis. When comparing the treated and control thighs, the circumference reduction was statistically significant ($p < 0.001$, Student's t-test) with positive responding subjects recording a combined average loss of 2.9 cm ranging from -0.1 cm to -8.7 cm.
Conclusion: SmoothShapes system was highly effective in producing thigh circumferential reduction at one month and three month follow-up visits. The treatment protocol consisting of eight, twice-a-week, 30 minutes treatments proves to be an effective treatment protocol for the efficacy and longevity of thigh circumferential reduction.

#60

RADIOFREQUENCY ASSISTED LIPOSUCTION FOR CONTOURING AND TIGHTENING OF THE UPPER ARMS

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Background: Traditional liposuction has been a challenge for patients with much greater volumes of fat and skin laxity due to the inherent postoperative risk of inadequate soft tissue, loose skin, and compromised cosmetic appearance. Non-invasive, trans-epidermal adipose contouring and skin tightening technology, although helpful, often requires multiple treatments, has not proven to provide long term improvements. An ideal treatment would include fat removal as well as soft tissue retraction and tightening with long lasting sculpting results. In this study, a new one stage, simultaneous coagulation-aspiration, bipolar radiofrequency assisted liposuction (RFAL) system (Bodytite, Yokneam, Israel) was used to perform adipose coagulation, aspiration and reduction with sculpting and tightening effects of the upper arms. We look at the efficacy of this technology on skin tightening using objective 3D photography measurements (VECTRA) and biomechanical tissue characterization (BTC).

Study: 7 subjects, 21–58 years old, skin type I–IV, underwent one treatment of both the upper arms; 16 lipoplasty zones. Treatments were performed using the RFAL device (Invasix Ltd). Following tumescent infiltration, each zone was treated at deeper followed by superficial layers of fat by adjusting handpiece pre-determined set depths ranging from 5–50 mm. Treatment RF energy ranged from 20–35 watts. Treatments were performed to loss of mechanical resistance and target epidermal temperature of 38–40 C at both depths, in each zone. Total energy per zone was 20.7–30.4 KJ. Continuous skin temperature was monitored via thermistors embedded in the external electrode of the handpiece with negative feedback loop designed to shut off energy at target temperature and to deliver energy when the epidermis fell below the target temperature. Clinical efficacy was demonstrated by quantifiable data including total volume change, photographic analysis, measurement of linear and areas changes and circumferential measurement change via the Vectra 3-D Canfield Imaging systems and biomechanical tissue characterization (BTC) measurements of treatment skin. Weights were taken prior to treatment and at 1 week, 3 week 6 week and 3 month follow ups.

Results: Significant contouring and tightening were achieved in all treated upper arms with no significant adverse events. Clinical results achieved at 3 month follow up showed aesthetic lipocontouring changes with a significant average area contraction. Using validated 3 Dimensional photography measurements, the mean upper arm circumference in treated subjects decreased by 2.66 cm at 6 week follow up and by 4.25 cm at 3 month follow up. Skin tightening was also observed on both 3D imaging and biomechanical tissue characterization. Long term clinical follow up will be presented including soft tissue contracture, circumferential reduction and volume change.

Conclusion: This study demonstrates the efficacy and safety in reduction of fat deposits and skin laxity when performed with bipolar radiofrequency assisted liposuction device. RFAL appears to represent a new frontier in lipocontouring with significant non-excisional control of soft tissue contraction and the subsequent aesthetic contour.

#61

CORRELATION OF FAT LAYER THICKNESS AND CIRCUMFERENCE REDUCTION: A GEOMETRIC MODEL

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Background: Assessing the efficacy of non-invasive fat removal relies on measurements subject to error and subjective comparisons. Even the integrity of photographic comparisons, an accepted assessment tool, is difficult to control. With the emergence of non-invasive fat reduction technologies, there is a greater need for standardized assessments of efficacy.

Study: A geometric model is described to correlate circumference and fat layer changes following non-invasive body contouring procedures. Abdominal measurements were taken with and without an artificial fat pad in place with 1) a tape measure, 2) ultrasound and 3) micrometer to validate the geometric model. The model was then used to analyze fat layer reduction and circumference changes following non-invasive body contouring procedures as reported in the literature.

Results: While there was a high correlation ($R^2 = 0.9335$) between our ultrasound method and the model with 6 subjects, the correlation between the tape measure method and the model was low ($R^2 = 0.0007$).

Conclusion: Our results underscore the need for a highly accurate and standardized method for fat measurement. When comparing data from the literature to the model-predicted values, there is a significant discrepancy. The efficacy in previous studies that had been assessed by tape measure in combination with ultrasound or computed tomography (CT) imaging does not conform to the model prediction. According to the model, the reported average fat layer reduction of 4.5 mm should have resulted in a circumferential change of 0.94 cm; however, the average circumference change reported by the studies was 3.2 mm, a discrepancy of 3.4X. Assessment of efficacy after non-invasive body contouring procedures can be validated with a geometric model. Studies reporting efficacy should use such a model to ensure consistency between various technologies and to accommodate factors such as weight change and measurement technique.

#62

NON-INVASIVE CRYOLYPOYSIS FOR BODY CONTOURING IN CHINESE—A FIRST COMMERCIAL EXPERIENCE

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Background: The objective of this study is to determine the patient satisfaction and clinical efficacy of a novel cryolipolysis device (Zeltiq^{TM}) for body contouring in Chinese patients in a pioneer commercial setting.

Study: 22 patients with "discrete bulges" were recruited for this procedure at their own cost. All patients received one single treatment using the Zeltiq Breeze System using treatment parameters of CIF 41.6 (-73 milliwatts/cm^2) for 60 minutes at the desired anatomical region. The areas treated were flank, back and

abdomen. At baseline visit, their weight was measured and caliper measurement was used at the maximum area of fat when standing. Standard photographs were taken with the Vectra Canfield System®. They were followed up two months after the treatment and were assessed by the physician. Thereafter, they had their weight, subcutaneous fat by caliper and photographs taken. Subjective assessments were evaluated by means of a patient questionnaire. Any adverse effects were documented.
Results: The preliminary data generated by 21 follow-ups, all reported that the treatment was tolerable. 13 of them thought the treatment length was just right and 8 thought it was too long. 70% of the subjects felt satisfied to very satisfied. 17 out of 21 subjects (81%) reported noticeable difference in the area treated. 18 of them would recommend the treatment to family and friends, while 3 of them were unsure. Physician assessment showed good to very good improvement in 17 out of 21 (81%) subjects. Objective assessment by caliper showed a statistically significant improvement as compared with control ($p = 0.001$).
Conclusion: For patients desiring a localized fat layer reduction, cryolipolysis offers a non-invasive, no-downtime procedure with high patient satisfaction and clinical efficacy.

#63

ANALYSIS OF SIDE EFFECTS OF NONINVASIVE CRYOLIPOLYSIS FOR SUBCUTANEOUS FAT LAYER REDUCTION—INTERIM REPORT FROM CONTROLLED CLINICAL TRIALS

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Background: Animal and controlled human studies have demonstrated that cryolipolysis (cold-induced apoptotic fat cell death) is safe, well tolerated, and can reduce subcutaneous fat without damaging overlying skin or associated structures. Examine side effects of cryolipolysis for fat layer reduction in the flanks and back fat pads.
Study: Data from two multi-center, prospective, IRB-approved clinical studies are examined for safety and efficacy. A total of 16 centers treated 341 subjects on their love handles or back fat using a clinical prototype of the Zeltiq Breeze System with vacuum applicator, which is equivalent to the device currently in commercial use. For 288 subjects, one side was treated, leaving the contralateral side as an untreated control. The remaining 53 were treated on both sides. Subjects were adult males and females with clearly visible fat on the flank or back. Efficacy was evaluated by ultrasound measurement of fat layer reduction, comparison of pre- and post-treatment photographs and physician assessment.
Results: There were no reports of serious adverse effects, and all side effects were transient. Notably, there were no reports of skin damage or pigment changes. Most common side effects included transient bruising, minor pain, reduced sensation, erythema and edema. All side effects resolved spontaneously, most within days post procedure. In rare cases, mild reduced sensation was reported up to 2 months post procedure. Ultrasound measurements were available for 41 of the love handle subjects and demonstrated a fat layer reduction in 100% of subjects, with an average reduction of 17.6%.
Conclusion: Selective cryolipolysis is a very low risk, no downtime procedure that produces consistent observations of modest, gradual fat layer reductions in properly selected patients. This indicates a favorable risk/benefit ratio for patients who want to avoid riskier and more invasive procedures.

#64

LONG TERM EXPERIENCE WITH 924 nm FOR LASER ASSISTED LIPOLYSIS

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Background: We previously reported 3 month results of 924 nm fat-selective laser wavelength delivered via a specially designed tip of 1.5 mm diameter to facilitate the removal of fat during tumescent liposuction. This report describes long term side effects, patient satisfaction and duration and quality of results to 1.5 years following treatment.
Study: Eighty-eight patients were treated with a 924 nm laser (SlimLipo™, Palomar Medical Technologies, Inc., Burlington, MA) beginning April 2008 and followed for a maximum of 1.5 years. The procedure involves up to 3 repetitions of a laser pass to melt fat and heat connective tissue followed by suction. Data was obtained from follow-up visits at 1.5, 6 , 12 and 18 months. Patient areas treated (some patients had 2 areas) included abdomen ($N = 27$), flanks/waist ($N = 31$), thighs ($N = 14$), arms ($N = 10$), submental ($N = 12$) and knees ($N = 7$).
Results: Average fluence delivered was 28.6 KJoules during the first pass. Overall patient satisfaction was high with $N = 86$(98%) very satisfied with results. Investigator assessment correlated with patient ratings as 88% showed marked improvement at 6 and 12 months. Side effects included mild bruising in 39% lasting for an average of 4 days. No skin burns were observed. Duration of drainage of tumescent fluid was 12–24 hours with median of 14 hours. Post-operative pain was rated as mild with only 5 (6%) requiring more than NSAIDs for pain control. No contour irregularities were noted and curved surfaces remained smooth without depressions. Results achieved at 6 months were sustained for longest follow-up at 1.5 years.
Conclusion: Long-term results with a 924 nm laser-assisted lipolysis device were excellent with high patient and physician satisfaction and few short-term side effects.

#65

1444 nm Nd :YAG LIPOLYSIS LASER ASSISTED FACIAL CONTOURING—A NEW PARADIGM FOR FACIAL SCULPTING AND REJUVENATION

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Background: The 1444 nm neodymium doped lipolysis laser (Lutronic, Inc) exhibits characteristics (high selectivity for fat and water and thermal confinement) that favor use for facial contouring. This study is the first clinical report of Laser Assisted Facial Contouring (LAFC) of the mid- and lower face.
Study: 276 patients (mean age 52 years, range 21–81) underwent LAFC of 748 treatment sites including midface and melolabial fold (319 treatment sites) and jawline and jowl (429 treatment sites) areas. Laser energy delivery preceded optional manual aspiration of treated fat. Along with clinical assessment study parameters evaluated included laser power, pulse energy and total energy delivery as well as volume of fat aspirated at each treatment site.
Results: Laser power (2.0–5.5 W), pulse energy (100–190 mJ) and total energy (100–600 J per treatment site) ranges generally increased over the 12 month study. Fat volumes removed via manual aspiration ranged from 0.5 to 3.0 cc per melolabial fold and 1.0 to 4.0 cc for jawline and jowl areas. Complications included overcorrection (4 sites), infection (1 site), minor entry site thermal wound (2 sites). The authors noted substantial clinical benefit (including skin tightening and volumetric reduction) among the majority of patients; however, LAFC clinical efficacy was formerly assessed in the most recent 20 patients treated for which sufficient data was available. Using a 4 point improvement scale (1 = 0–25%; 2 = 25–50%; 3 = 50–75%; 4 = 75–100%) independent physician review of standardized before and after patient photographs revealed average improvement of 2.3 for the midface and 3.2 for the jawline.
Conclusion: 1444 nm Nd YAG lipolysis laser assisted facial contouring is a safe and effective novel treatment modality that gives surgeons the additional option of selective tissue removal for greater precision in three dimensional contouring of the face.

#66

A PILOT STUDY OF VERTEPORFIN PHOTODYNAMIC THERAPY (PDT) DELIVERED TO ADIPOSE TISSUE

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Background: Verteporfin is a light activated drug delivered treat neovascularization in macular degeneration. We tested the hypothesis that verteporfin photodynamic therapy could affect adipose tissue.
Study: A porcine model was used (3 light skinned pigs). Ten cc of Verteprofin solutions in water or normal saline, ranging from 0.05–26 ug/cc concentration, were injected into test sites and allowed to incubate for 15 minutes to 120 minutes. After incubation, test sites were exposed with a 690 nm laser (courtesy of Candela Corporation, Wayland, MA) at 180 J/cm^2 in 5 cm diameter exposures delivered in 360 seconds. Gross and microscopic observations of response were made at 2 days and 1 month after treatment, in test and control sites. Tissue was processed with H&E staining.
Results: Two days after light exposure, there was fat necrosis with overlying dermal injury and/or inflammation in sites injected with Verteporfin. The depth of placement of the verteporfin influenced dermal involvement. There was a trend for higher Verteporfin concentration to cause increased degree of dermal and fat damage after PDT. There was focal and minimal fat necrosis at control sites injected with normal saline solution, but control sites injected with water showed more prominent fat necrosis 2 days after injection. Inflammation of adipose tissue was also seen 30 days after PDT, and after water injection. In this pilot study, we did not clearly separate the combined influences of PDT and water injection.
Conclusion: Verteporfin PDT causes fat necrosis in a concentration-dependent fashion, and the degree of fat damage depends on depth of Verteporfin injection. The long term effect of PDT on adipose tissue is unknown.

#67

CONCOMITANT USE OF INFRARED FRACTIONAL LASER WITH LOW DOSE ISOTRETINOIN

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Background: Isotretinoin is an effective medicine used for the moderate to severe acne treatment. There are some reports that the use of skin resurfacing laser in oral isotretinoin taking patients can cause hypertrophic scar. Unlike pulsed CO2 laser resurfacing, infrared fractional lasers are widely used for the skin resurfacing without ablation and significant downtime. The objective of this study is evaluate the safety of infrared fractional laser when is treated in low dose isotretinoin users.
Study: 35 patients (Fitzpatrick skin type II–V) with acne scar or wide pores, who has been taken low dose isotretinoin, were treated with infrared fractional laser (1550 nm Fraxel re:store^{TM} laser). Ranging in age from 16–48 years (mean 27.8) received 2–7 treatments (mean 3.1). In most of the patients (94%), applied MTZ were reduced. They are controlled to 50–75% of conventional densities. The patients had taken 10 mg isotretinoin a day more than 1 month before starting fractional laser treatment. Side effects or discomforts were recorded on the medical record. The investigators and patients assessed the clinical results with photographs (rating scale 1–5, 1 = no effect, 5 = excellent). Photographs were documented pre and post-treatment.
Results: There was no hypertrophic scar or keloid, but one case of mild acneiform eruption and three cases of scaly itchy foci was noted. The itching could be related to sebum reduction effect of isotretinoin. 80% of subjects demonstrated moderate to excellent improvement. In 20% of patients demonstrated the result was some improvement or no effect.
Conclusion: Within this study, there was no hypertrophic scar in the treatments that concomitant use of infrared fractional laser with low dose isotretinoin. It is probably due to fast epidermal healing response after fractional laser. Even though treated with reduced MTZ density, the clinical effect was significant in general.

#68

SAFETY AND EFFICACY OF A 1927 nm NONABLATIVE FRACTIONAL LASER FOR THE FACIAL AND NONFACIAL RESURFACING IN SKIN TYPES I TO V

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Background: Superficial ablative CO_2 laser treatments carry risks of hypopigmentation, infection and scarring and have limitations in darker skin types. A 1927 nm nonablative fractional laser has been developed to overcome these risks while maximizing resurfacing efficacy in all skin types. This study examined safety and efficacy of the 1927 nm fractional laser in 55 patients on facial and nonfacial skin.
Study: 55 patients ages 27 to 73, Fitzpatrick skin types I to V, were enrolled in a prospective study to examine safety and efficacy of a 1927 nm Thulium fractional laser for facial and nonfacial resurfacing. Subjects received a single treatment at 5 to 20 mJ, and coverages of 25–75%. Treatment settings were selected based on anatomic location and skin type. Investigator assessments were conducted at 1, 3 and 6 months.Histological evaluation of wound healing was assessed from biopsies collected at various intervals post-treatment using hematoxylin and eosin (H&E), Fontana-Masson staining and anti-procollagen I immunostaining.
Results: Procedures were well-tolerated with minimal edema or erythema, and mean desquamation at 3 and 10 days for face and off face, respectively. Photodamage at 1 month showed a mean investigator score of 1.7 with 25% of subjects as marked and 23% as moderate improvement. Pigmentation showed a mean investigator score of 1.8 with 23% of subjects as marked and 34% as moderate improvement. Histological results confirmed rapid healing with a minimal to mild inflammatory response. Melanin elimination via MEND structures resulted in reduced epidermal melanin. Active fibroblasts observed in the upper dermis were associated with increased collagen.
Conclusion: The optimized dosimetry, greater water absorption and fractional mode of delivery make the 1927 nm Thulium wavelength a safe and effective treatment for facial and nonfacial photodamage and pigmentation in skin types I–V with a single treatment.

#69

COMBINED THERAPY FOR NECK REJUVENATION: FRACTIONAL NON-ABLATIVE LASER AND STABILIZED HYALURONIC ACID BASED GEL OF NON-ANIMAL ORIGIN: A CLINICOPATHOLOGIC STUDY WITH ESPECIAL ATTENTION GIVEN TO THE HISTOLOGY

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Background: The laser Affirm™ (Cynosure, Inc., Westford, MA) (LA) is a microthermal non-ablative fractional laser used for skin rejuvenation. Restylane Vital™ Light-Injector (Restylane, Q-Medical AB, Uppsala, Sweden) (RV) is a stabilized hyaluronic acid of non-animal origin indicated to treat delicate areas such as neck. The objectives are to study the histological changes into the skin after the interaction between the laser and the fillers into the human skin, to prove that the use of LA after the injection of RV does not alter the properties of RV and to evaluate the clinical changes.
Study: Nine female patients (42–62 y/o) received 4 sessions of RV and immediately after LA. A photo and a biopsy were taken before, after the 4th session and 1 month later. The tissue was stained with H&E, Masson, VVG and Ki-67(MIB-1) to assess the morphology, collagen and elastic fibers as well as the proliferative activity.
Results: Histologically, structural changes in the aged skin towards the normal skin were observed. The epidermis was more trophic with better polarization of keratinocytes, even surface and basket-weave pattern of the stratum corneum. A loose appearance with fine woven network with delicate collagen was seen at the papillary dermis. An increase in number and thickness of collagen fibers as well as in number, length and orientation of elastic fibers, at both papillary and mainly reticular dermis, were present. The columns of microthermal damage measured 400 μ in depth and 10 μ in width and the keratinocytes showed changes consisting with apoptosis and the papillary and reticular dermis, changes similar to a coagulation effect surrounded by a deeper inflammatory reaction (1000 μ). The hyaluronic acid was present at the mid-deep dermis (1000–1500 μ) and was unaffected by the laser treatment. The proliferative activity was 40% at the basal and parabasal keratinocytes and 20% at the dermal fibroblasts and endothelial cells. Clinically, an improvement in fine wrinkles, tightness and more hydrated skin were observed in all patients.
Conclusion: LA and RV reduced wrinkles and laxity and improved hydration, tone, texture as well as collagen and elastic fibers. LA contributed mainly to the epidermal and superficial dermal changes whereas the RV had a main role at the mid-deep dermis, thus together treating the full thickness of the skin.The RV product was unaffected by the LA. The combined LA and RV therapy was an effective and safe treatment as well as easy to perform.

#70

DEEP-DERMIS NON-ABLATIVE FRACTIONAL TREATMENT WITH ADVANCED SKIN COMPRESSION TECHNIQUE

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Background: The mechanism of the "optical clearing" of tissue as a result of compression and its implications for clinical practice are not fully understood. Objective of this study was to investigate the role of tissue compression in non-ablative fractional treatment.
Study: A specially designed point-array compression tip (XD Optics, Palomar Medical Technologies, Inc.) was used with either 1440 nm or 1540 nm fractional lasers. The study comprised three parts: 1) measurements of optical transmittance dynamics under compression in skin in vivo; 2) histological ex vivo evaluation of columns of microdamage obtained under compression; and 3) pilot clinical tests with emphasis on treatment of scars and striae.
Results: Duration of the compression plays a significant role in the resulting increase in tissue transmittance. Up to 10-fold increase in transmittance was observed after 20 s compression. 2) The depth of the columns produced under compression in pig skin ex vivo reached 1.3 mm with three stacked pulses of 1440 nm laser (70 mJ/mcb) and 2 mm with three stacked pulses of 1540 nm laser (150 mJ/mcb). 3) Clinically, the response to treatment was assessed by comparing pre- and post-treatment standardized photography. Significant improvement from baseline was observed routinely. Skin biopsies revealed that the average epidermal and dermal thickness was increased.
Conclusion: Advanced compression tip design in combination with optimized application protocol allows substantial increase in the depth of columns produced by non-ablative fractional lasers, without increase in incident energy.

#71

NEW METHOD FOR FRACTIONAL LASER SKIN REJUVENATION RESULTING IN NEW COLLAGEN III FORMATION AND INTACT EPIDERMIS

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Background: A new technique for fractional laser skin rejuvenation with minimal side-effects is being developed in which localized lesions are created inside human dermis without affecting the overlaying epidermal layers. The method is based on creating lesions by means of laser induced optical breakdown inside the target tissue. In previous studies we already demonstrated that this method is effective in triggering localized collagen III formation, however, some individuals reported pain during treatment and some cases of point bleeding were also observed. For this purpose a new prototype has been developed and tested in a number of subjects to assess the immediate, intermediate and long-term skin responses with respect to treatment together with subject perceived sensation.
Study: Five healthy subjects (skin type II–III, 2 male, 3 female) were enrolled in the study. Areas on the buttocks were marked and treated with various lesion densities (2.5%, 5%, 10%, 20%), perception was recorded and biopsies were taken at one lesion density per subject at time intervals before, immediately after and at 3, 7, 30, and 180 days post treatment. Histological evaluation of the biopsies has been performed by means of H&E and collagen III staining.
Results: Treatment was well accepted by all subjects without need for topical anesthetics. No severe side-effects or bleeding were observed. The histological analysis of the lesions demonstrated successful lesion creation immediately post treatment. At 3, 7, and 30 days evidence of a healing response involving increased collagen III formation was found in all subjects.
Conclusion: We have demonstrated that the new prototype device based on laser induced optical breakdown for fractional skin treatment is effective in creating lesions below skin level while leaving the epidermis intact. Histology demonstrated that the process induced the formation of new collagen III, indicating potential skin rejuvenation. The treatment was well accepted by the subjects.

#72

TREATMENT OF PERIORAL RHYTIDES WITH A NEW FRACTIONATED ABLATIVE ER:YSGG (2790 nm) LASER

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Background: Fractionated ablative CO_2 (10,600 nm) and Er:YAG (2940 nm) lasers have been successfully used for the treatment of photodamage and rhytides. Perioral rhytides have been uniquely resistant to treatment. A new fractionated 2790-nm erbium:yttrium-scandium-gallium-garnet (Er:YSGG) laser system has a water absorption coefficient between that of CO_2 and Er:YAG lasers. In this study we evaluated the use of this new laser in the treatment of facial photodamage with an emphasis on perioral rhytides.
Study: Ten female subjects with Fitzpatrick skin types II–III were enrolled in a pilot trial of a new fractionated 2790 nm laser. All subjects underwent a two pass full face treatment for rhytides at 160 mJ and an 8% density. For perioral rhytides, subjects were treated with a 160 mJ first pass, and a second and third pass of 200 mJ with a 12% density. Patients underwent photographic and clinical assessment at 1 week, 2 weeks, 4 weeks, 3 and 6 months. Clinical endpoints included changes in pigment dyschromias, wrinkles, and skin tone. Potential complications were noted.
Results: Clinically significant improvement in pigment dyschromia, wrinkle, and skin tone was noted on the basis of both physician and patient assessments. Based on the Fitzpatrick Scoring System for wrinkles at baseline and at final follow-up, a statistically significant mean reduction of 1.25 ($+/-$ SD 0.71) was observed in overall wrinkle score (reduction from 5.88 to 4.63, p value 0.002) and perioral wrinkle score (reduction from 5.63 to 4.38, p value 0.002). No scarring, post inflammatory pigmentary changes, or infections were observed.
Conclusion: A new fractionated ablative 2790-nm Er:YSGG laser can safely and effectively treat photodamage and perioral rhytides.

#73

VARIABLE PULSE WIDTH Er:YAG PERIORBITAL RESURFACING: FULL FIELD vs FRACTIONAL TECHNIQUE

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Background: Lower eyelid skin laxity and wrinkles are a common manifestation of photoaging often appearing earlier or more profoundly than on adjacent facial skin. Fitzpatrick described the efficacy of CO_2 laser resurfacing for this indication and developed a 9 point grading scale for evaluating results. Variable pulse Er:Yag laser technology allows the modulated addition of thermal effect to the laser\'s ablative effect and widens its application to include tissue contraction. This study examines the effect of this technology applied to periorbital rejuvenation.
Study: Seven patients presenting for lower eyelid rejuvenation were treated in a split face design with each eye treated with either full field variable pulse width Er:Yag laser (Contour-TRL Sciton, Palo Alto, CA) or fractional technique(ProFractional-XC). Clinical photographs were obtained pre-op and at four weeks post-op, they were graded by observers using the Fitzpatick wrinkle scale (1–9) blinded to whether the photographs were pre or post-op and to which treatment was utilized.
Results: Both treatments resulted in significant (both statistical and clinical) improvement. Wrinkle scores from full field technique improved from $5.7+/-1.5$ to $3.4+/-0.9$, $p=.006$ and from $5.7+/-1.4$ to $3.9+/-1.8$, $p=.018$ with the fractional technique. 6/7 eyes treated with full field and 4/7 treated with fractional technique improved more than 1.5 Fitzpatrick grades. Time to resolution of edema ($4.4+/-1.8$ vs. $6.4+/-2.9$ days) and time to resolution of erythema/flaking ($4.9+/-1.6$ vs. $11.2+/-3.6$ days) favored the fractional technique. There was no significant difference in scores for patient satisfaction or pain experienced during the proceedure.
Conclusion: Both full field and fractional variable pulse Er:Yag laser treatment for periorbtal rejuvenation result in improvement

in wrinkle scores in the same range as reported for full field and fractional CO_2. Recovery time for full field Er:Yag resufacing was less than reported for full field CO_2 and in the same range as fractional CO_2. The recovery time for variable pulse Er:Yag fractional treament was less than reported for fractional CO_2 laser with no decrease in efficacy.

#74

2790 nm CUTANEOUS LASER RESURFACING FOR CHEST PHOTODAMAGE

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Background: Chest photodamage is a common cosmetic complaint. Laser treatment of the chest may be higher risk than other areas. Primary objective was to assess the safety and efficacy of 2790 nm chest resurfacing for photodamage. Secondary objective was to assess safety and efficacy of market/industry standard occlusive dressing (Aquaphor) versus another product.
Study: 10 patients with Fitzpatrick skin types I-III were enrolled in this university IRB approved study. A test spot with the 2790 nm resurfacing laser was performed on the chest. Patients who did not have adverse effects from the test spot went on to have a full chest resurfacing procedure. Patients were instructed on standardized aftercare, including sunscreen. Investigators were blinded as to which side was treated with the market standard occlusive dressing or the other product. A 5 point healing and photodamage improvement scale was used to rate improvement-separately on both right and left sides by both investigators and the patients. Both baseline as well as photodocumentation and the improvement scale were obtained at 2 weeks, 1 month , 2 months and 3 months.
Results: One pass chest treatment with the 2790 nm resurfacing laser at fluences greater than or equal to 3.0 mJ with 10% overlap lead to unacceptable rates of hyperpigmentation. Double pass chest treatment at fluences less than or equal to 2.5 mj with 10% overlap lead to mild improvement in chest photodamage parameters without adverse effects. The market/industry standard occlusive dressing (Aquaphor) created less irritation than the tested product.
Conclusion: Laser treatment of aging/photodamaged chest skin remains a challenge due to the thinness and delicacy of chest skin. Mild improvement may be obtained with double pass resurfacing with the 2790 nm wavelength. The market/industry standard occlusive dressing (Aquaphor) is best for chest resurfacing.

#75

FRACTIONAL CARBON DIOXIDE LASER RESULTS IN TYPE 4, 5, 6 SKIN—FIRST 50 PATIENTS

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Background: Fractional carbon dioxide (CO_2) laser is based on the principle of ablative fractional photothermolysis, with shorter recovery periods and lesser side effects seen as compared to traditional CO_2 laser resurfacing. However, there is fear of using this relatively new technology in darker skin. PURPOSE: To examine efficacy and safety of Fractional CO_2 laser for melasma, acne scarring, post acne pigmentation, post surgical scarring, striae distensae, and deep rhytides in skin types 4–6.
Study: Fifty subjects, with Fitzpatrick skin types 4–6, aged 18–75 years, with any of the above mentioned indications, underwent three treatments at monthly intervals, with an FDA approved fractional CO_2 laser. Treatment parameters ranged from 10–30 Watts, dwell time 400–900 μs and dot spacing of 800–1500 μ. Strict sun protection was mandatory. Photographs were taken at every visit. The dermatologist evaluated clinical improvement 3 months post the third treatment using a quartile grading scale.
Results: 92% subjects with acne scars sustained moderate to good improvement (26–75%) at 3 months. 42.86% with striae had moderate and 28.57% had mild (= 25%) improvement. All subjects with wrinkles, surgical scars and post acne hyperpigmentation improved. 50% cases with melasma had mild and 33% had moderate improvement. Post acne scars and hyperpigmentation, and wrinkles responded best. Mean duration of post-therapy crusting was 6 ± 3 days, and erythema lasted 2 ± 4 days. Three patients developed post laser hyperpigmentation which resolved uneventfully in 4–6 weeks.
Conclusion: Fractional CO_2 laser is relatively safe and effective in type 4–6 skin, if parameters are chosen conservatively, though increased number of treatment sessions may be needed for good results.

#76

ANALYSIS OF COMPLICATIONS OF ABLATIVE FRACTIONAL LASER RESURFACING

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Background: Ablative fractional laser resurfacing has been promoted as a safe and effective modality for facial and non facial resurfacing. This study is a retrospective analysis of complications seen with a variety of ablative fractional laser resurfacing devices.
Study: 52 cases of complications from ablative fractional laser resurfacing which were referred to the Bay Area Laser Institute were analyzed based on device settings, anatomic location, type of complication and duration of complication.
Results: The majority of complications were present off the face, with the neck having the greatest number of complications. Deep fractional laser resurfacing produced greater complications than superficial fractional laser resurfacing. Hypertrophic scarring was the most common complication, followed by hypopigmentation and infection.
Conclusion: Ablative fractional laser resurfacing may produce hypertrophic scarring and hypopigmentation, with the greatest incidence noticed off face. Deeper settings with higher fluencies, leading to bulk heating and almost traditional laser resurfacing produced the greatest number of complications.

#77

COMPARISON OF FOUR ABLATIVE FRACTIONAL DEVICES IN THE TREATMENT OF PHOTOAGING

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Background: Ablative fractional skin resurfacing has emerged as a popular mechanism of treating challenging dermatological problems, including rhytides and dyschromia associated with photoaging. By delivering closely spaced vertical columns of

energy to the epidermis and dermis while sparing intervening skin, fractional ablation enables more rapid healing than traditional CO_2 resurfacing. The relative efficacy of different ablative devices in improving photoaging has not been previously studied.
Study: Twelve patients with moderate to severe sun damage between the ages of 30 and 65 and of Fitzpatrick skin types I–IV were treated to four quadrants of the face using three different ablative fractional CO_2 devices and one fractional erbium device. Lasers selected were the Fraxel re:pair (Solta Medical, Inc., Hayward CA), Active and Deep FX (Lumenis, Santa Clara, CA), Quadralase (Candela Corporation, Wayland, MA) and Pearl Fractional (Cutera, Brisbane, CA.) Clinically effective settings for each device were selected and the choice of laser used in each quadrant was determined via randomization. Blinded evaluators assessed patients at one month, three months and six months post-treatment to evaluate changes in skin texture, lentigenes, pore size and rhytides. Evaluations were based on full-screen digital photographs taken of the frontal, oblique and lateral face using a Canfield system. Improvement was recorded based on a five-point scale (0 = no improvement; 1 = 1–25% improvement; 2 = 26–50% improvement; 3 = 51–75% improvement; and 4 = > 75% improvement.)
Results: One- and three-month follow-up data showed improvement in photoaging in all patients studied across all quadrants. No differences have been observed to date among the four devices studied. Statistical analysis of six-month follow-up data will be presented.
Conclusion: Ablative fractional devices can improve photoaging of the skin. Each of four lasers studied improved rhytides, dyschromia, skin texture and pore size in patients, but no single device appears to be superior to the others. The most useful parameters for laser selection may be patient tolerability, ease of use, and prior clinical experience.

#78

DEEP DERMIS REMODELATION WITH A MICRO ABLATIVE FRACTIONAL CARBON DIOXIDE LASER IN A VECTORIAL PASS TECHNIQUE

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Background: Recently the concept of deep dermis micro ablation (DDMA) with a high power , high speed , pulsed fractional CO_2 laser was introduced delivering deep columns of 80 to 120 micron , up to 2 mm depth penetration. This report evaluates a vectorial ascendant technique (VAT) with this new CO(2) laser for the resurfacing of photo damage, wrinkles, acne scars , pigment disorders and laxity, of the first 200 Brazilian patients (Fitzpatrick II to VI) with at least 12 month of follow up.
Study: 200 patients phototype II–VI, with acne scarring and photoaging skin were treated with Deep FX. They all underwent to topical anesthesia, and took medicines against viral, fungal and bacterial infections. Each patient was treated with 1 single pass with DEEP FX device exactly over the scars, rhytides and a second full face VAT pass over the lax skin. Patients were followed up to 1-year. Responses and side effects were recorded with VECTRA 3D, and evaluated by patients and physicians on a quartile assessment.
Results: After 12 months all patients are satisfied with the treatment and are still being followed up. Significant improvement IV (more than 75%) on the appearance was noticed in 80% of a quartile scale of improvement. Everyone experienced erythema only for a maximum period of 72 hs and edema for 24 hs. Only 5% of them had mild and transient PIH;2% pinpoint purpura after the use of AINH, none intense PIH , late hypocromia or scarring.We also relate two cases of improvement hypocromia on previous CO_2 laser patients.
Conclusion: This study indicates that DDMA improves acne scars and photoaging appearance and is highly effective and safe even in pigmentary disorders of dark skin patients and VAT proved to effective over the laxity providing a deep dermis collagen remodeling.

#79

A FRACTIONAL CO_2 LASER WAS EVALUATED FOR EFFECTIVE REJUVENATION OF THE PERIORBITAL AREA AND BROW LIFTING EFFECT: 2 YEARS EXPERIENCE

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Background: The purpose of this study was to assess the efficacy and safety of a fractional CO_2 laser system for improving periorbital rhytides tightening skin and elevating the eyebrow.
Study: 200 subjects were treated with a fractional CO_2 laser for superficial and deep wrinkles, tightening skin and elevating the eyebrow. The procedure consisted of topical anaesthetic on the periorbital area followed by one to four treatments (the average was two treatments) at 4 week intervals with a SmartXide Dot fractional CO_2 laser device, The setting was 12–14 Watts ; Pitch 500–900 μm and Dwell Length 500–900 μm. Pain sensation during treatment was rated by the patients using a 4/5 scale. At 3, 6, 12 and 24 months after treatment, patients were evaluated using a four-point scale for the measurements of the increasing distance from the pupil to the brow. Improvements in eyelid wrinkles, crow\'s feet and skin laxity, were evaluated photographically by two blinded independent observers. Eyebrow elevation was measured by the investigators. Subjects also scored satisfaction.
Results: The rejuvenation of the periorbital area in all subjects was very successful. Periorbital wrinkles were reduced and tightening of the cutaneous surface was achieved in a very significant way: 45% of the subjects maintained 26–50% improvement at 24 months. Also we obtained a brow lifting effect and 35% of the subjects maintained results of 1–2 mm elevation at 2 years. During treatment, pain was minimal. Downtime was 3–4 days.
Conclusion: This technique, obtained by CO_2 laser SmartXide Dot, demonstrated successful rejuvenation of the periorbital zone and brow-lifting effect in all patients. We maintained the results for 2 years.

#80 Late Breaking

PHOTODYNAMIC THERAPY WITH METHYL 5-AMINOLEVULINATE (MAL-PDT) AFTER FRACTIONAL CO_2 RESURFACING—AN ANIMAL MODEL

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Background: Ablative fractional resurfacing (AFR) creates vertical channels that may enable an improved PDT-response to deep skin layers. We tested a hypothesis that pre-treating the skin with AFR could facilitate a deep PDT-response after topical MAL application.
Study: In-vivo Yorkshire swine were treated with a prototype fractional CO_2 laser using stacked single pulses of 3 ms and 91.6 mJ per pulse. MAL was applied and left under occlusion for 3 hours (Metvix®, Photocure, Oslo, Norway). A 635 nm LED array source was delivered for PDT at 37 J/cm^2 and 200 J/cm^2. Fluorescent photographs and fluorescence microscopy were assessed before and immediately after PDT. MAL-induced porphyrin fluorescence and PDT-response were quantified at skin depths from 120 to 1800 μm. Results were compared to conventional MAL-PDT, AFR alone, red light, vehicle, and untreated controls.
Results: Laser-ablated channels approximately 1850 μm deep, enhanced the biodistribution of MAL to superficial and deep skin layers and resulted in higher epidermal fluorescence than MAL alone. MAL-PDT at 37 J/cm^2 reduced the epidermal fluorescence and the porphyrin fluorescence of hair follicles (HF) and dermis at skin depths of 120, 500, 1000, 1500, and 1800 μm (HF: $P < 0.0015$ 120–1000 μm; Dermis: $P < 0.003$ 120–1800 μm). MAL-PDT at 200 J/cm^2 resulted in additional photobleaching of porphyrins at deep skin layers down to 1800 μm.
Conclusion: AFR facilitates delivery of topical MAL into the skin and enables a PDT-response to deep skin layers. AFR appears to be a clinically practical means for improving PDT of thick skin lesions.

#81

A PROSPECTIVE STUDY OF THE IMPROVEMENT IN PERI-ORBITAL WRINKLES AND EYEBROW ELEVATION WITH A NOVEL FRACTIONAL CO_2 LASER

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Background: The purpose of this study was to assess the efficacy and safety of a new fractional CO_2 laser system for improving periorbital rhytids, tightening skin, and elevating the eyebrow.
Study: One hundred subjects with periocular wrinkles, tissue laxity, photoaged skin, and moderate dermatochalasis of the face were prospectively treated 1 to 4 times in the periorbital area with a fractional CO_2 laser device equipped with a scanning handpiece. Improvements in eyelid wrinkles, crow's feet, and skin laxity were evaluated photographically by two blinded, independent observers. Eyebrow elevation was measured by the investigators. Subjects also scored satisfaction and tolerability.
Results: Approximately half of subjects achieved or maintained 26% to 50% improvement at 12 months. Nearly 40% of subjects maintained 1 to 2 mm elevation of the brow at 6 and 12 months after treatment. Subject satisfaction was high and the procedure was well tolerated. Mild to moderate erythema and edema persisted for up to 3 to 4 days.
Conclusion: Treatment with a fractional CO_2 laser device improves periorbital rhytids, tightens skin, and elevates the eyebrow with minimal adverse effects.

#82

FRACTIONAL CO_2 LASER RESURFACING IN CW MODE: CLINICAL RESULTS OF TRADITIONAL CO_2 RESURFACING IN A SINGLE TREATMENT, SAFETY ADVANTAGES OF MICRO-FRACTIONAL SKIN RESURFACING

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Background: A histological study was undertaken using CO_2 lasers with scanners in CW and Ultrapulse modes to establish depth of tissue ablation and width of residual thermal damage (RTD) at equal spot size and fluence. A concurrent retrospective study was also done to determine if using a CO_2 laser in CW vs. Ultrapulse mode at high energy would resulted in a marked increase in patient downtime or adverse side effects.
Study: Twenty-four patients (skin types II–IV) with medium to severe rhytids or acne scars (from 45 to 67 years of age) were reviewed. All subjects received a single facial treatment using a micro-fractional CO_2 laser with a 180 μm spot in CW or Ultrapulse mode. A variety of power settings, percent of tissue coverage (density), scan size, and number of passes, were used to conform to the patient's clinical needs. Subjects were evaluated for improvement in dyschromia, skin tightness, scar and wrinkle reduction at day 7, 3 months and 12 months post-treatment.
Results: Histology revealed a near linear increase in tissue depth of ablation as power was increased for both CW and Ultrapulse laser systems. Interestingly, histology showed only a 5–20% proportional decrease in ablation depth vs. RTD with an increase in pulse width (0.5 ms, 2.5 ms, 5 ms, 8 ms 12 ms, 16 ms). There was no histological evidence of thermal bleed between CW scanned spots even at spot energy greater than 1,500 J/cm^2. Time to complete epithelial recovery was 4–8 days in all cases, including high energy and high coverage cases. One patient (skin type IV) experienced post-inflammatory hyper-pigmentation 6 weeks post treatment which resolved within 3 months.
Conclusion: Maximum temporal separation of sequentially scanned spots is required in high energy fractional CO_2 resurfacing to retain the safety advantages and rapid recovery. Pulse durations of greater than 2 ms exploit the thermal relaxation time of dermal tissue and therefore; can be used to selectively deliver a greater proportion of pulse energy as RTD vs. ablation to precise skin depths. Treatment depth and proportion of ablation vs. RTD can be more precisely manipulated by instruments that give the physician independent control of both pulse width and pulse energy. Instruments that enable the trained clinician to target tissue by independently manipulating these factors, may result in the best and safest outcomes.

#83

TWO-YEARS TREATMENT TO BRAZILIAN PATIENTS WITH DARK SKIN BY DEEP FRACTIONAL CARBON DIOXIDE LASER (TOTAL FX) USING TRIDIMENSIONAL DOCUMENTATION

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Background: Dark skin type III to V Fitzpatrick, due to its melanocitic intolerance to heat and ablation, tends to present post-inflammatory hyperpigmentation (PIH) with any kind of

ablative procedure including standart fractional CO_2. The incidence of PIH in previous studies are bettwen 37% to none. The objective of this work is to present two years of follow up of 45 brazilian dark skinned patients with acne scars and/or photoaging skin treated once with TOTAL FX (UltraPulse) with a specific factory protocol.
Study: 45 patients with phototype III–V, with clinical indication of acne scar and/or photoaging skin were treated with TOTAL FX. Each one had been treated under the factory protocol with one pass of DEEP FX device exactly over the scars and rhytides, with energy level ranged from 5–25 mJ, pattern 1–4, size 2, and density 2–3, followed by full-face single pass with the ACTIVE FX with energy level used ranged from 70–125 mJ, 150 Hz, pattern 3, size 2–5, and density 2–3 in a vectorial fashion way over the lax skin. Patients were followed-up up to 2-years. Responses and side effects were recorded with VECTRA 3D, patient's and physicians' assessment.
Results: Significant improvement on the appearance is noticed. 100% of them had mild and transient PIH; one with intense and transient PIH; one with intense and long term PIH; one with late hypocromia; and one with mild hypertrophic scars on the neck. Post-inflammatory hyperpigmentation, delay onset hypopigmentation were observed and had resolved by 4 months post-treatment.
Conclusion: This study indicates that in dark-skinned subjects, TOTAL FX is highly effective in the improvement of acne scars and photoaging appearance and is safe even tropical sunny country as Brazil. Using the regular factory protocol, the main temporary adverse effect is mild PIH. We suggest further studies, with lower energies and densities.

#84

FOCUSED CO_2 LASER RADIATION TO CREATE A GATEWAY FOR TRANSDERMAL LIGHT DELIVERY

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Background: Optical scattering and/or absorption of the skin can cause an optical barrier impairing the delivery of either highly focused or strongly absorbed laser radiation into deeper layers of the skin. We investigated a novel approach to overcome this barrier by creating CO_2 laser-assisted micro channels as optical gateways for laser radiation. As experience from ablative fractional procedures has shown that small diameter channels are well tolerated, such approach may become feasible.
Study: Full thickness human skin samples, procured as discarded tissue from abdominal surgery, were used for the experiments. The subcutaneous fatty tissue was removed prior to exposures. After application of a skin stabilization technique, a focused CO_2 laser beam of approximately 1 J was employed to create the gateway. A second CO_2 laser pulse of substantially lower energy was delivered a few seconds later. The effectiveness of the gateway was assessed by measuring the ratio of energy that was delivered by this subsequent laser pulse through the gateway.
Results: The dermal thickness was approximately 2.5 mm and the CO_2 laser created gateways exhibited an entry diameter of up to approximately 400 mm. More than 60% of the entry energy was delivered through the gateway by the second pulse. Skin stabilization was key in maintaining an effective optical gateway for several seconds.
Conclusion: Laser-created micro channels can be used as a novel gateway to deliver laser radiation to deep layers of the skin without the usual limitations related to optical scattering or absorption.

#85

FRACTIONAL CO_2 LASER-ASSISTED DRUG DELIVERY

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Background: Ablative fractional resurfacing (AFR) creates vertical channels that might assist the delivery of topically applied drugs into skin. The purpose of this study was to evaluate drug delivery by CO_2 laser AFR using methyl 5-aminolevulinate (MAL), a porphyrin precursor, as a test drug.
Study: In-vivo Yorkshire swine were treated with single-hole CO_2 laser AFR and subsequent topical application of MAL (Metvix®, Photocure, Oslo, Norway), placebo cream and no drug. MAL-induced porphyrin fluorescence was measured by fluorescence microscopy at skin depths down to 1800 μm. AFR was performed with a 10.6 μm wavelength prototype CO_2 laser, using stacked single pulses of 3 ms and 91.6 mJ per pulse.
Results: AFR created cone-shaped channels of approximately 300 μm diameter and 1850 μm depth that were surrounded by a 70 μm thin layer of thermally coagulated dermis. There was no porphyrin fluorescence in placebo cream or untreated skin sites. AFR followed by MAL application enhanced drug delivery with significantly higher porphyrin fluorescence of hair follicles ($P < 0.0011$) and dermis ($P < 0.0433$) versus MAL alone at skin depths of 120, 500, 1000, 1500, and 1800 μm. Radial diffusion of MAL from the laser-created channels into surrounding dermis was evidenced by uniform porphyrin fluorescence up to 1500 μm from the holes.
Conclusion: Ablative fractional laser treatment facilitates delivery of topical MAL deeply into the skin. AFR appears to be a clinically practical means for enhancing uptake of MAL, a photodynamic therapy drug, and presumably many other topical skin medications.

#86

TREATMENT OF LOWER EYELID RHYTIDS AND LAXITY WITH ABLATIVE FRACTIONATED CO_2 LASER RESURFACING

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Background: Tightening of eyelid skin and improvement of rhytids and overall skin texture is a common reason for cosmetic consultation to a dermatologic surgeon. An increasing array of recent novel technologic advancements in laser and cosmetic dermatology have led to a number of minimally invasive treatment modalities for periorbital rhytids. Non ablative fractionated photothermolysis (NAFP) has been demonstrated to be safe and effective for the treatment of periorbital rhytids and laxity. Our purpose was to prospectively evaluate eyelid tightening with an ablative fractionated CO_2 laser (AFP).
Study: A prospective, single blinded study for lower eyelid laxity in 25 subjects with a series of 2–3 treatment sessions. Treatment

sessions were administered at 6–8 week intervals with physician photographic analysis by 2 non-treating physicians at 6 months post-treatment. Blinded physician photographic evaluation was performed of four clinical indicators: skin texture, skin laxity, rhytids and overall cosmetic outcome.
Results: The number of treatment sessions required for significant improvement of eyelid laxity ranged from 2 to 3, with an average of 2.44 sessions. For skin texture, the mean score decreased from 3.6 pre-treatment to a mean of 1.2 at 6 months post-treatment ($p < .05$) for a 62.6% mean improvement. For skin laxity, the mean score decreased from 3.3 pre-treatment to 1.3 at 6 months post treatment ($p < .05$), 65.3% mean improvement. For rhytids, the mean score decreased from 3.5 pre-treatment to 1.3 at 6 months post treatment ($p < .05$), 62.1% mean improvement. For overall cosmetic outcome, mean score decreased from 3.6 pre-treatment to 1.2 at 6 months post treatment ($p < .05$), 65.7% mean improvement.
Conclusion: This prospective study demonstrates that eyelids of patients can achieve significant improvement in skin texture and tightening with AFP. The efficacy for lower eyelid rhytids with AFP was significantly greater that that seen with the previous generation of non-ablative fractionated (NAFP) devices, with a similar rapid recovery and benign side effect profile. The results obtained using an AFP device rivaled surgical correction and traditional ablative resurfacing in patients with moderate periorbital rhytids and skin laxity.

#87

HIGH-COVERAGE FRACTIONAL TREATMENT STRATEGIES ACHIEVE FULL RESURFACING-LIKE RESULTS WITH BETTER RECOVERY

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Background: High-coverage fractional treatment using both non-ablative and sequential non-ablative and ablative methods in a single treatment were investigated to deliver wrinkle reduction benefits comparable to full skin resurfacing, but with improved safety and recovery profiles.
Study: Facial skin on 6 subjects was treated using the Lux1440, and/or Lux2940 (Palomar, MA) micro-fractional handpieces to achieve total coverage of 65–75% in a single procedure. The 1440 nm handpiece delivered 40–70 mJ/microbeam with a 350–400 μm micro-spot diameter. The 2940 nm handpiece delivered 5.5 mJ for every 0.1 mm of linewidth in "grooves" of 200 μm width and 5 mm length. Biopsies were performed in all patients and clinical efficacy was assessed after 3 months.
Results: Non-ablative fractional treatment with 65% coverage and depths either comparable to, or deeper than, traditional multi-pass CO_2 laser resurfacing, resulted in erythema durations similar to fractional ablative procedures. Re-epithelialization occurred in 4–6 days, but with an improved recovery profile. Biopsies showed cylindrical wounds for the 1440 nm sites with 300–400 μm depths and 350 μm widths. The groove optic showed a depth of 200 μm and width at the surface of 250 μm. Clinical improvement was ~50% for wrinkles and 65% for dyschromia. Sequential non-ablative fractional treatment followed by ablative treatment (in the same session) also had an improved recovery compared to ablative-only treatments. Both approaches showed consistent improvement for facial wrinkles, with skin tightening of lax cheek skin as well as substantial improvements in skin texture and dyspigmentation. Overall outcomes approached those observed following traditional multi-pass skin resurfacing. All subjects reported they were satisfied or highly satisfied with their treatments.
Conclusion: Non-ablative and sequential high-coverage fractional treatment demonstrated significant benefits over prior fractional treatment strategies and had improved recovery profiles. Non-ablative methods achieved results approximating those of ablative fractional methods, yet offered an improved recovery profile which can be attributed to the initial preservation of the epidermis.

#88

ABLATIVE FRACTIONAL RESURFACING FOR REMOVAL OF DEEP DERMAL TISSUE: COMPARISON TO SURGICAL FACELIFT

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Background: Ablative Fractional Resurfacing (AFR) applies thermal injury to dermal skin in an array of microscopic treatment zones (MTZ) surrounded by untreated skin.[1] Ablation of deep dermal tissue and creation of an associated peripheral zone of coagulation induce both tissue contraction and tightening. The objective of this study was to investigate mass of tissue removed during AFR as a function of pulse energy and treatment density.
Study: A 30 W 10.6 nm CO_2 laser prototype device was used to treat post-abdominoplasty skin. Tissue weight measurements were taken before/after treatment, with energy varying from 10–100 mJ, and final density of 800 MTZ/cm^2. A smoke evacuator was used to minimize ablated tissue from settling onto the specimen. Control tissues were processed similarly for evaporative loss. The depth of ablation and peripheral coagulation were determined from H&E tissue sections. Data was obtained from five independent measurements per pulse energy for each of six tissue donors. Post-ablative loss of tissue mass was reported in □g/MTZ as a function of energy.
Results: The lesion depths observed were directly proportional to pulse energy and increased up to 2 mm deep at 100 mJ. Histological evaluation confirmed that 83–97 percent of the ablated tissue was dermal, depending on pulse energy. Ablated tissue mass measurements correlated linearly with treatment energy, with 7.8 □g/MTZ removed at 10 mJ and 50.5 □g/MTZ removed at 100 mJ.
Conclusion: Measurements indicated that for an average-sized face (325 cm^2), a 40 mJ, 1200 MTZ/cm^2 treatment would remove 8.8 g of tissue (12.6% of total dermis, assuming a 2 mm dermis), and a 70 mJ, 800 MTZ/cm^2 treatment would remove 9.6 g (13.7%) of tissue. This study provides evidence that AFR is a unique method of eliminating lax dermal tissue resulting in significant tissue tightening while offering considerable safety advantages to comparable surgical procedures.

#89 Late Breaking

NEW FACES OF INFECTION FOLLOWING ABLATIVE FRACTIONAL RESURFACING: UNUSUAL MORPHOLOGY AND BIOLOGY

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Background: The new paradigm of fractional resurfacing is evolving to include superficial and deep ablative modalities aimed at achieving improved efficacy over non-ablative methods and improved safety compared to traditional ablative resurfacing. Recent early experience with ablative fractional resurfacing has demonstrated risks of scarring associated with excessive thermal injury and prolonged healing, particularly in areas of thin skin and relative lower vascularity.

Study: We present four unusual presentations of infection with unusual morphologies and organisms associated with ablative fractional resurfacing.

Results: Despite the shorter duration of de-epithelialization associated with ablative fractional injury, depth of injury combined with surface ablation may create unique microenvironments in which infections may take on new appearances and etiologies.

Conclusion: We share these experiences to increase awareness that is necessary for early detection and empiric treatment of infections associated with fractional ablation of skin.

#90 Late Breaking

INTRODUCTION OF i-PDT: A NEW PHENOMENON ABLE TO REDUCE SIDE-EFFECTS OF PHOTODYNAMIC THERAPY (PDT) WITH ALA AND ALA DERIVATIVES

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Background: PDT uses light to activate photosensitizers. Topical aminolevulinic acid (ALA) induces accumulation of photosensitizing porphyrins. ALA-PDT with high-fluence red light is very effective for acne, by inhibiting sebaceous glands. However pain, swelling and pigmentation occur due to unwanted epidermal damage. We discovered that low level light exposure during the period of ALA metabolism prevents accumulation of porphyrins, and can be used to selectively inhibit epidermal porphyrins. Because light prevents accumulation of the photosensitizer, we called this phenomenon "photoinhibition" of PDT or "i-PDT".

Study: i-PDT was studied in cultured human keratinocytes, and *in vivo* in Yorkshire swine, by measuring porphyrin accumulation, cell lethality, and inflammatory responses when inhibitory red (635 nm) or blue (420 nm) light was delivered during metabolism after topical ALA application. Subsequent exposure to high-fluence red light was then used to activate a PDT reaction. i-PDT was compared split-face with conventional PDT in a patient with recalcitrant acne.

Results: Photoinhibition is very efficient. In an irradiance-dependent manner, very low threshold levels of blue light (60–100 $\mu W/cm^2$) suppressed porphyrin accumulation *in vitro* and *in vivo*, with corresponding decrease in inflammation after PDT. i-PDT produced much less inflammation, yet a similar profound benefit compared with conventional PDT. The patient's acne has remained clear for 1.5 years.

Conclusion: i-PDT is a new photobiological phenomenon that can potentially be used to prevent major side-effects from ALA-PDT. Epidermal porphyrin is inhibited, while allowing accumulation in unexposed tissue, such as sebaceous glands. A larger clinical prospective study is ongoing.

#91 Late Breaking

TREATMENT OF VENOUS MALFORMATIONS WITH AN 800 nm DIODE LASER

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Background: Venous malformations (VM) are vascular anomalies characterized by their blue or bluish-purple color. They are cosmetically disturbing to patients and can be associated with significant pain and swelling. VMs can progressively worsen with age leading to disfigurement of affected areas and functional impairment. Surgery is a mainstay of treatment. Pulsed dye lasers are typically ineffective. We report the use of an 800-nm diode laser—most frequently used as a laser hair removal device—as a novel, effective, non-invasive treatment of venous malformations.

Study: Six patients with cephalic VMs were treated with an 800-nm diode laser. Three to 14 treatment sessions, separated by at least 4-week treatment intervals, were administered with fluences of 30–60 J/cm^2 and a fixed pulse duration of 30 milliseconds. The spot size was 9 mm with a chill tip for cooling.

Results: All the patients achieved significant improvement of their VMs after multiple treatment sessions. At least two VMs completely cleared. There were no reported adverse side effects other than the pain associated with laser treatment and purpura. Topical anesthetics, as well as injected lidocaine 1% with epinephrine in some cases, are helpful to achieve adequate pain control. It is hypothesized that the 800-nm wavelength achieves some selectivity for deoxygenated as well as oxygenated hemoglobin in VMs. Further, the depth of penetration of the 800-nm wavelength helps to target deeper dermal vasculature than traditional pulsed dye lasers.

Conclusion: 800 nm diode laser provides a promising non-invasive modality for treatment of venous malformations. Long-term follow-up is required to validate these results.

#92 Late Breaking

REPIGMENTATION OF HYPOPIGMENTED SCARS

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Background: Facial hypopigmentation following deep peels has been problematic as there has been no effective remedy. Hypopigmented scars present a similar cosmetic dilemma. Biopsy of both conditions reveals the presence of non-functioning melanocytes, which can be stimulated by high intensity UVB, resulting in only temporary improvement. Treatment with fractional resurfacing has resulted in some degree of long-term improvement. Bimatoprost ophthalmic solution, a prostaglandin analog used for treatment of glaucoma has been reported to have a side-effect of hyperpigmentation when frequent skin contact occurs. A trial has been performed using Fraxel Re:store to treat hypopigmented skin and scars followed by BID application of Bimatoprost and qhs application of Retin-A 0.025% cream.

Study: Five patients having long-standing (2–15 years) partial facial or scar hypopigmentation were treated with 1 to 4 sessions of Fraxel Re:store (1550 nm) followed by BID application of Bimatoprost ophthalmic solution 0.03% (Latisse) and qhs application of Retin-A cream 0.025% and evaluated at 1 to 6 month intervals in comparison to their pre-treatment photos.

Results: All five patients show clinically significant repigmentation of the treated areas in a uniform manner. Follow-up ranges from 2 years to 3 months. There has not been an associated hyperpigmentation of the skin surrounding the area of hypopigmentation.
Conclusion: Bimatoprost ophthalmic solution 0.03% in conjunction with fractional resurfacing and topical Retin-A appears to be effective in repigmenting scars.

#93 Late Breaking

A RANDOMIZED CONTROLLED TRIAL TO ASSESS THE EFFECTS OF AN INTENSE ULTRASOUND TREATMENT ON SKIN LAXITY OF THE LOWER FACE USING A NOVEL 3-D SELF-POSITIONING LASER SCANNER

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Background: The ability to objectively measure the improvement following the use of intense ultrasound (IUS) energy to produce focused thermal collagen denaturation in the superficial musculoaponeurotic system to induce shrinkage and tissue tightening may have significant implications for aesthetic facial rejuvenation. The primary objective of this study was to assess the efficacy of IUS on skin laxity of the lower face via quantitative measurements of surface topography with a novel three dimensional (3D) self-positioning laser scanner.
Study: Twenty-four healthy adults (42–65 year old) with skin laxity of the lower face participated in this single blinded randomized controlled clinical study. Subjects received one IUS treatment (ULTHERA) or served as control (2:1). Skin topographical changes were determined using a new and precise 3D mapping technology. Target areas included the nasolabial folds, jowls, the angle of the jaw bilaterally and the submental area. In addition, clinical and subject assessments were conducted to evaluate gross cutaneous response, pain and discomfort, adverse reactions, as well as global impression of improvement and patient satisfaction.
Results: Differences in percent change from Baseline at endpoint in skin topographical data between the control and experimental groups were observed. Subject and clinical assessments also revealed positive therapeutic outcomes. IUS therapy was generally well tolerated with no unusual treatment-related adverse effects observed.
Conclusion: IUS exposure appears to be a promising method to treat skin laxity of the lower face. The novel 3D self-positioning handheld laser scanner is a propitious method for quantitative measurements of the lower face following IUS tissue tightening treatment. Future studies to advance therapeutic applications of this innovative approach are warranted.

#501 Late Breaking

ACCUMULATIVE ABDOMEN FAT LAYER REDUCTION FROM MULTIPLES ZELTIQ CRYOLIPOLYSIS PROCEDURES

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Background: Previous clinical studies have provided evidence that the controlled cooling of subcutaneous tissue by the Zeltiq Procedure produces selective fat damage with gradual fat layer reduction after a single procedure without damaging the overlying skin or surrounding structures. Procedures on the abdomen, love handle (flank) and back fat have resulted in fat layer reductions confirmed by photographs, ultrasound and a blinded photography review by independent physicians. Previous studies have also confirmed the primary mechanism of fat cell death is cold-induced apoptosis, and not necrosis. To determine if additional cryolipolysis procedures on previously treated areas produce additive fat layer reductions.
Study: Subjects received multiple cryolipolysis procedures in the same area of their abdomen, each procedure separated by 2–6 months. A total of 42 subjects were treated initially, 32 of the subjects received and complete the followup after a second procedure. Baseline and follow-up photographs were obtained for each subject. Baseline and follow-up ultrasound images were used to measure the adipose layer thickness in the treatment area and also in a neighboring control area at each subject visit.
Results: Each of the procedures resulted in a measureable fat layer reduction. The fat layer reduction at the peak of the bulge after one procedure as measured by ultrasound and normalized for weight change during the follow-up averaged $19.7\% \pm 8.1\%$ ($n = 16$). A second procedure performed in the same area provided an additional fat layer reduction averaging $21.6\% \pm 3.5\%$ ($n = 25$).
Conclusion: This interim analysis provides evidence that additional cryolipolysis procedures provide significant additional fat layer reduction. Further analysis should be done to determine the extent to which additional procedures continue to provide significant incremental fat layer reduction with tension headaches related to upper back andneck muscle spasms.

#94

CLINICAL FEASIBILITY OF 3-D FRACTIONAL TREATMENTS WITH FOCUSED ULTRASOUND

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Background: Ultrasound (US) can produce focal heating at essentially any tissue depth, and has been used to cause a single layer of fractional thermal coagulation zones [1]. The objective of this multicenter clinical in use feasibility study is to examine safety and efficacy of 3-dimensional (multilayered) fractional US energy deposition.
Study: Three US energy sources driven by Ulthera™ System delivered energy to a depth of either 4.5 mm or 3 mm at frequencies of 4.5 MHz or 7.5 MHz respectively. Energy per US pulse ranged from 0.25 J to 1.20 J. For a full face treatment, 180 to 220 lines of US focal spots were delivered. Each line contained 17 to 23 thermal coagulation zones spaced 1.1 to 1.5 mm apart. The two depths of treatment were intentionally superimposed in some regions. Subjects were photographed immediately pre- and post-treatment, at 8, 12 weeks, and up to 28 weeks to date. Changes in the upper 1/3 and lower 2/3 of the face were analyzed from digital photographs, including brow position, severity of peri-orbital wrinkles, lower cheek, cervicomandibular, and submental region laxity and position.
Results: Multi-layer fractional US treatment was well tolerated without significant adverse events in over 100 subjects to date. Treatment caused mild to moderate pain, transient redness and

edema. Interim analysis of efficacy at the time of writing this abstract shows initially significant lifting with reduction of skin laxity in over 70% of subjects especially in the lower 2/3 of the face.
Conclusion: A 3-D multilayered fractional treatment pattern using focused ultrasound appears to have the potential to improve clinical outcomes in lifting and tightening of facial soft tissue.
[1] *Selective Creation of Thermal Injury Zones in the Superficial Musculoaponeurotic System Using Intense Ultrasound Therapy* , M.White, I.Makin, P.Barthe, M.Slayton, R.Gliklich. ARCH Facial Plast Surg/Vol 9, Jan/Feb 2007.

#95

MICRO-FOCUSED ULTRASOUND FOR BROW LIFT AND IMPROVEMENT OF FACIAL SKIN LAXITY AND TEXTURE: FINAL RESULTS OF A MULTI-CENTER CLINICAL STUDY

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Background: The objective of this multi-center study, including 4 independent clinical sites, was to evaluate the safety and efficacy of a micro-focused ultrasound treatment for the improvement of facial skin on the upper 1/3 and lower 2/3 of the face.
Study: Ninety-nine subjects ranging in age from 41–70 were enrolled and received a full face treatment utilizing the Ulthera™ ultrasound image/treat device. Photographs taken at three months and six months following treatment were evaluated in both an "un-blinded" and a "blinded" fashion. Five independent, blinded assessors evaluated the photographs on a 3 point scale for nine soft tissue facial features associated with aging.
Results: 84 of 99 subjects completed the follow up through 90 days and 81 of 99 completed follow up through 180 days post-treatment. For the upper 1/3 of the face, the average percentage of subjects responding with an improvement was 84% at 90 days following treatment and 82% at 180 days post treatment. For the lower 2/3 of the face the average efficacy was 69% at 90 days post treatment and 57% at 180 days post treatment. The results were analyzed statistically and a good correlation was demonstrated between the un-masked and masked assessments. Slight to moderate transient erythema and edema was observed immediately post-treatment. A majority of which was resolved by day 7 and all of which was resolved by day 30.
Conclusion: The utilization of micro-focused ultrasound is shown to be a safe and effective treatment for lifting and tightening facial soft tissue. A single treatment resulted in clinically significant improvements in facial soft tissue with minimal transient side effects.

#96

CLINICAL EFFICACY OF TRANSCUTANEOUS FOCUSED ULTRASOUND FOR NON-INVASIVE SKIN TIGHTENING IN ASIANS

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Background: The objective of this study is to determine the clinical efficacy of a focused ultrasound device (Ulthera System®) for the treatment of facial skin laxity in Asians.
Study: The patients received one to three full-face treatments spaced 4 weeks apart with the transcutaneous focused ultrasound device. Two transducers (7.5 MHz, 3.0 mm depth; 4.0 MHz, 4.5 mm depth) were used to deliver a single pass of microthermal areas of coagulation. Standardized photos taken with the Canfield Visia CR system® at baseline, 3 months and 6 months after last treatment were assessed by two independent physicians.
Results: 31 Chinese patients completed a total of 67 treatment sessions. Preliminary objective assessment showed statistically significant improvement for skin laxity along the jawline ($p = 0.001$), cheek ($p = 0.001$), nasolabial fold ($p = 0.007$), mentolabial fold ($p = 0.028$) and infra-orbital fold ($p = 0.014$) at 3 months. Improvement in the jawline ($p = 0.01$), cheek ($p = 0.016$) and mentolabial fold ($p = 0.041$) was maintained at 6 months. Periorbital fine rhytides ($p = 0.033$) also improved at 3 months.
Conclusion: Transcutaneous high intensity focused ultrasound was effective for facial skin laxity in Asians. Improvement in periorbital fine rhytides was observed. Further studies to optimize treatment parameters may enhance clinical outcomes.

#97

PRELIMINARY RESULTS OF A CLINICAL TRIAL USING MICRO-FOCUSED ULTRASOUND FOR BROW LIFT AND IMPROVEMENT OF JAPANESE LOWER FACIAL SKIN CONTOUR AND TEXTURE

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Background: The objective of this clinical trial was to evaluate the safety and effectiveness of micro-focused ultrasound for the non-invasive treatment to obtain brow lift and improvement in lower facial skin contour and texture in a Japanese patient population.
Study: Twenty subjects, ranging in age from 39–60 years received one full-face treatment. Photographs were taken before and after treatment. A qualitative photographic review of the upper 1/3 and lower 2/3 of the face to detect noticeable changes in the skin appearance was performed by two blinded individuals.
Results: Slight to moderate erythema was observed immediately post-treatment, which resolved within seven days. No serious adverse events were noted. Preliminary analysis of 20 subjects at day 90 post-treatment indicated the majority of subjects had noticeable improvement in brow position and eyelid laxity (61%), cheek skin laxity (67%), or lifting and improved facial contour of the lower 2/3 of the face (60%).
Conclusion: Micro-focused ultrasound was demonstrated to be a safe and effective treatment for lifting and tightening soft tissue in a Japanese patient population. One treatment visit was sufficient to result in clinically significant outcomes in both the upper and lower face. The results suggest refinements in treatment protocols to utilize the ability of the Ulthera device to deliver treatment energy at more than one depth to affect specific tissue layers will result in improved clinical outcomes.

#98

TWELVE MONTHS FOLLOW UP OF INTENSE FOCUSED ULTRASOUND THERAPY TO MID-FACIAL DEEP TISSUE IN ASIANS

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Background: Focused ultrasound can produce thermal and/or mechanical effects into deep tissue. The objective of our study is to evaluate the effectiveness and complications of intense, focused ultrasound therapy to mid-facial deep tissue in Asian patients.
Study: Eight Asian patients were enrolled in the study. The mid-face was exposed to a range of focused ultrasound pulses, using an intense focused ultrasound device (Ulthera) emitting up to 45 W at 4.0 and 7.5 MHz with a nominal focal distance of 4.5 and 3 mm respectively. Two patients were treated on one side of the face and six patients were treated on both sides of the face. Patients were seen 1 week, 3 months, 6 months and 12 months after treatment. A facial analysis system (Visia CR) was used to objectively evaluate each patient and a 3D analysis system (Vectra) and computerized tomography (CT) were used to evaluate one patient. The patients were also evaluated for any side effects from the treatment.
Results: Deep tissue tightening was not clinically apparent at the 3 month follow up appointment. This tightening became obvious at the 6 month follow up appointment and continued tightening is seen at the 12 month follow up. Ecchymosis was observed in one patient. Dyspigmentation, blistering, permanent sensory disturbance and scar formation were not observed in any patients.
Conclusion: The effectiveness of intense focused ultrasound is not apparent within 3 months of treatment. However, clinical tightening is apparent at 6 months post treatment it gradually improves up to 12 months after treatment. No delayed adverse events were noted post-treatment.

#99

3-D FRACTIONAL APPROACH FOR TREATMENT OF THE FIRST 3 MM OF SKIN WITH FOCUSED ULTRASOUND; FEASIBILITY STUDY

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Background: Objective is to establish the feasibility of three-dimensional fractional deposition of focused ultrasound energy superficially in first 3 mm of skin, sparing intervening tissue. Conformed thermal lesions were created in ex-vivo porcine muscle and live human skin in a variety of depths and geometries. Gross pathology demonstrating a three-dimensional pattern of non-intersecting lesions in porcine muscle was micro-photographed; follow up to thirty days post treatment was demonstrated in human skin.
Study: Ulthera Device®, utilizing focused ultrasound probes with depth of focus ranging from 1 to 3 mm and frequency 7.5 to 10.5 MHz were used. Energy setting from .12 to .75 J per lesion was applied in a 3-D pattern to freshly excised porcine muscle using multiple probes (layered approach, multiple focal depths). Live human skin was treated with a variety of probes at energy settings of 0.08 to .36 J per lesion. Results were photographed immediately post-treatment and followed up to 30 days.
Results: *Porcine Muscle*—Lesion geometry was measured for energy setting range of .12 to .75 J. Average lesion dimensions approximated by a sphere were from 290 micron (±14%) to 656 micron (±16%) varying with the energy settings. Measured depth and distance between the thermal zones (lesions) were within ±13% of the probes parameters. *Live Human Skin*—During follow up period (up to 30 days) all lesions for all energy settings (0.08 to 0.36 J) were completely resolved. Lower energy settings of .08 J and .14 J lesions were completely resolved by day 2. Mild erythema and localized swelling were the only transient side effects and resolved within 48 hours or less.
Conclusion: Superficial portions of the skin up to 3 mm may be treated in a 3-D fractionated manner with predictable and precise deposition of thermal zones (lesions). Live skin study shows tolerability and reasonably fast resolution of lesions with only transient side effects.

#100

HISTOLOGIC EVALUATION OF DEEP DERMAL HEATING BY FRACTIONAL RADIOFREQUENCY ACCORDING TO ENERGY LEVEL: A 10-WEEK FOLLOW UP STUDY

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Background: Recently deep dermal heating by radiofrequency (RF) equipment which is composed of 5 pairs of insertion needles has been reported. They reported the histologic study which reveals that well organized collagen damage and repair is possible by RF needles. In this study, we investigated the tissue response after fractional RF according to different energy level (EL).
Study: Bipolar fractional RF with treatment tip of 49 needles in 1×1 cm square was used for this study. The needles are insulated except the acral 0.3 mm tip. The depth of skin penetration from 0.5 mm to 2.0 mm by needle insertion is regulated by the motor in the handpiece. Four different EL was used for porcine and human study. Histologic evaluation was done by H&E and HSP47 staining for immediately after, 2 days after, 14 days after, 28 days after and 10 weeks after the procedure. RT-PCR was done for various cytokines including HSP47, HSP72, Procollagen etc.
Results: At low EL, neo-collagenesis was observed without increased cellularity. At high EL neo-collagenesis with increased cellularity was observed. HSP47 also showed increased response at high EL. At high EL, not only the coagulation column but also the intervening area showed increased HSP47 expression. But, at any given EL there wasn't any HSP47 expression below the treated depth.
Conclusion: Fractional deep dermal heating by fractional RF showed well defined foci of degenerative column in deep dermis and those were completely repaired in 10-week's period. More robust response was observed with higher EL.

#101

PROSPECTIVE OPEN-LABEL MULTICENTER CLINICAL TRIAL EVALUATING THE EFFICACY OF FRACTIONAL RADIOFREQUENCY FOR THE TREATMENT OF FACIAL RHYTIDS AND LAXITY

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Institute, Palo Alto, CA; Puget Sound Plastic Surgery, Federal Way, WA; Elixer Institute of Regenerative Medicine, San Jose, CA; Primaeva Medical, Inc., Pleasanton, CA; Premier Plastic Surgery, San Mateo, CA

Background: A minimally-invasive fractional radiofrequency (FRF) device (Miratone^{TM}) was recently developed for skin treatment. The objective of this prospective open-label multicenter clinical trial was to evaluate device efficacy for treatment of facial rhytides and laxity.

Study: One hundred subjects with mild-to-severe facial rhytides and laxity were enrolled at 7 sites. Patients received FRF treatment of the lower face. Energy was delivered through micro-needle electrode pairs deployed into the reticular dermis. Sensors in the electrode tips directly measured lesion temperature and tissue impedance. This real-time feedback was used to actively control energy delivery to attain pre-selected lesion temperatures for specified times. Efficacy was evaluated by blinded grading of standardized photographs at baseline, 3, and 6 months. For selected patient subgroups, efficacy was evaluated by measuring skin elasticity changes; assessed histologically by comparing baseline and follow-up biopsies; and compared to surgical facelift outcomes in double-blind evaluations of intermixed FRF and surgical-facelift photographs. Patient self-assessed improvement and satisfaction data were collected. Side effects and adverse events were monitored.

Results: Ninety-seven patients completed follow-up. Mean improvements of rhytides and laxity following a single treatment were 24% and 22%, respectively. Histological analysis demonstrated neocollagenesis and neoelastogenesis in treated skin. Elastometry demonstrated a statically significant 8.2% improvement in Young's Modulus of skin. Randomized comparative analysis demonstrated a single FRF treatment yielded 33% of the mean surgical facelift improvement. Patient satisfaction was high: 47% very satisfied, 40% satisfied, 11% neutral, 1% dissatisfied, and 1% very dissatisfied. All subjects experienced transient erythema, mild-to-moderate edema, and mild-to-significant purpura that resolved in 5–14 days. Two patients experienced a total of 7 incidences of epidermal injury associated with incomplete electrode insertion ($< 0.01\%$ of insertions) leading to punctate atrophy ($\sim$1 mm diameter, $< \frac{1}{2}$ mm depth).

Conclusion: These results suggest minimally-invasive FRF treatment may be an important non-surgical option for the treatment of facial rhytides and laxity.

#102

MULTI-CENTER CLINICAL TRIALS OF HOME-USE NON-ABLATIVE FRACTIONAL LASER DEVICE FOR WRINKLE REDUCTION

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Background: We evaluated safety and efficacy of a novel non-ablative fractional laser device designed for self-use at home.

Study: A new non-ablative handheld fractional laser device (LOI, Palomar Medical Technologies, Inc.) was used. The trials comprised two studies (Pilot and Pivotal) slightly varying in the protocol. LOI devices were issued to the subjects for self-application at home to treat periorbital wrinkles. Both studies included two phases: active treatment phase (everyday treatments) and maintenance phase (twice weekly treatments). Subjects were followed up to 6 months after completion of the active phase. Evaluations included investigator assessment, digital photography, and subject questionnaires to assess consumer satisfaction. Digital images were graded by blinded evaluators using the Fitzpatrick Wrinkle Score (FWS). The subject was categorized as "improved" if at least two (out of three) evaluators detected positive difference of one or more FWS grade between pre- and post-treatment images.

Results: Total of 124 subjects (out of 136 recruited) completed all treatments and follow ups. All subjects were able to use the LOI devices following written instructions for use. Treatment was well tolerated with good protocol compliance. No unanticipated adverse device events were observed. Blinded evaluations revealed improvement of the FWS score in 90 % of subjects at the end of active phase and in 79% of subjects at the end of maintenance phase, with high degree of grading uniformity between the evaluators. The most significant side effect was transient post-treatment erythema graded as "trace" in the majority of subjects. Consumer satisfaction was high to very high.

Conclusion: Palomar LOI device is a safe and effective modality to treat periorbital wrinkles at home.

#103

MULTI-CENTER CLINICAL STUDY OF COMBINED IN-OFFICE/AT-HOME PROTOCOL OF TOTAL FACIAL REJUVENATION

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Background: Advent of home-use self-treatment laser-based devices (e.g., LOI non-ablative fractional laser device, Palomar Medical Technologies, Inc.) opens up new opportunities for delivering improved benefits to patients seeking skin rejuvenation. In this study, we investigated feasibility of combining professional in-office procedures with home use of the LOI device to maximize the resulting effect of facial rejuvenation.

Study: After obtaining informed consent and baseline evaluation, subjects were treated with one of the following in-office modalities: 1) Photofacial IPL treatment; 2) Injection with an-approved neuromodulator; 3) Injection with an-approved dermal filler. Two weeks after the professional treatment, subjects were issued LOI devices for use at home. Subjects used the LOI devices for 6 weeks on facial areas specified by the investigators. Evaluations included clinical assessment of wrinkles using Fitzpatrick's, Lemperle's scales and pigment Kingsley's scale, digital photography, and subject self-evaluation. The follow ups continued up to 6 months after completing the at-home treatment stage.

Results: On the pilot phase of the study, between 3 and 6 subjects per site were recruited. All subjects completed their respective professional treatments without complications. All subjects were able to use the LOI devices following written instructions for use. Treatment with the LOI device was well tolerated with good

protocol compliance. Initial evaluations revealed noticeable improvement in both wrinkles and pigmented abnormalities. Follow up evaluations are currently in progress.
Conclusion: Preliminary results indicate additive and, possibly, synergistic benefits of the combined in-office/at-home regimen.

#104

TREATMENT OF MILD TO MODERATE ACNE VULGARIS USING A COMBINED LIGHT AND HEAT ENERGY DEVICE: HOME-USE CLINICAL STUDY

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Background: Light and heat devices have become widely used for the treatment of mild to moderate inflammatory acne as an alternative to retinoids and antibiotics. The purpose of this study was to examine whether a handheld device which emits both light and heat energy can safely and effectively be applied at home to shorten time to improvement and time to resolution of acne papules and pustules.
Study: A two-center, randomized, placebo-controlled double blind study was conducted on sixty three (63) subjects with at least four inflamed, facial, acne lesions. Treatments were self administered twice a day for four days. All lesions were photographed on a daily basis. Treatment results were assessed by two blinded evaluators, based on the macro photographs, using a 4-point VAS scale and a lesion reference scale (PLRS), as well as by the subjects. Safety was assessed based on evaluators and subjects\' reported side effects and adverse events.
Results: Twenty nine (29) subjects in the treatment arm and thirty two (32) subjects in the placebo arm, with skin types II–VI, successfully completed the study. Based on blinded VAS scores, 92.24% of the lesions treated with an active device improved within a median time of 1 day vs. 75.78% and a median time of 2 days for the placebo arm. At 24 hours the improvement rate was 76.72% for the active arm vs. 15.63% for the placebo arm. Based on blinded PLRS scores, 87.07% of the lesions treated with an active device improved within a median time of 2 days vs. 64.8% and 3 days for the placebo. 51.7% of the active arm lesions resolved within a median time of 4 days vs. 36% (no median) for the placebo arm lesions. No device related adverse events occurred throughout the study.
Conclusion: This study clearly demonstrates the safety and effectiveness of the handheld, combined light and heat energy device for the at home treatment of individual mild to moderate inflammatory lesions. A statistically significant shorter lesion improvement and lesion resolution rates were found.

#105 Late Breaking

JOWL CONTOURING AND TIGHTENING WITH 1444 NM LASER ASSISTED LIPOSUCTION

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Background: The past few years have seen a growing number of patients demanding aesthetic correction for sagging of the lower third of the face, but unwilling to undergo invasive surgery. Current minimally invasive approaches, including laser, have not consistently satisfied this need. Very recently the wavelength of 1444 nm has attracted much attention in body contouring. We look at the application of this technique in contouring and tightening sagging jowls and redefining the jaw line.
Study: Nine female subjects, aged 48–59 years old, were treated using the AccuSculpt device (Lutronic Inc) delivering 1444 nm interstitially via an optical fibre introduced through specially designed cannulae (treatment parameters: 3.0–3.5 watts used, 20 Hz frequency, 150–175 mJ energy/pulse, 125–200 kJ/zone, 0.5–3.7 cc aspirated per jowl). 2-D and 3-D photography were performed at baseline and at 3, 6 and 12 weeks post procedure. 3-D photography system software was used to calculate objectively the amount of contour change obtained at each follow up assessment compared with baseline. Patient satisfaction was also assessed at various stages of follow up, using a 4 point quartile scale. The five assessment criteria evaluated were lifting of jowls, overall appearance, tightening, increased facial feature definition and wrinkle reduction.
Results: At the time of abstract submission, 3 patients had reached 12 week follow up, 2 patients had reached 6 week follow up and 3 patients had reached 3 week follow up. Validated 3-D photography measurements were taken of facial landmarks at treatment areas on both sides of the face at from each follow up image. These demonstrated an increase in mean lift at each follow up, with a mean lift of 1.6 mm at 3 week follow up, 1.6 mm at 6 week follow and 2 mm at 12 week follow up, suggestive of neo-collagenesis. Patient satisfaction progressively increased at each follow up. At 6 weeks the mean satisfaction score for the five criteria was found to be 3.2/4, at 12 weeks 3.5/4.
Conclusion: The wavelength of 1444 nm offers advantages over shorter wavelengths through its higher absorption in both water and fat, and short pulse width. The unique combination of these characteristics enables thermal confinement, whereby controlled heating is limited to the tissue at, and adjacent to, the very end of the optical fibre, thus restricting the spread of secondary thermal damage. Facial contouring is thereby achieved with sustained tissue shrinkage and collagen remodelling through thermal stimulation of the wound healing process. Side effects and downtime are minimal, and the procedure is well-tolerated. Based on the results, facial contouring with 1444 nm offers a safe, effective and elegant solution for sagging of the lower third of the face.

#106

ARE HOME-USE INTENSE PULSED LIGHT DEVICES SAFE?

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Background: The domestic market for home-use hair removal devices is rapidly expanding and there are a number of intense pulsed light (IPL) devices now available globally to consumers. Technological challenges of such devices are that they should be cost effective in mass-production, easy to use without training and most importantly, clinically effective whilst being eye-safe. However these light based systems, however inexpensively produced, are designed to cause biological damage to follicular structures so precautions to prevent both ocular and epidermal

damage must be considered. At present there are no dedicated international standards for IPL devices.
Study: This study directly compared three leading domestic IPL hair removal devices namely, iPulse Personal (CyDen, UK), Silk'n (HomeSkinovations) and SatinLux (Philips) for fluence, emitted wavelength spectrum, time resolved footprint and spatial distribution of energy. Although each device has a primary mechanical or electrical safety feature to ensure occlusion of the output aperture on the skin to prevent accidental eye exposure, the ocular hazard of each device has been measured to IEC TR 60825-9 standard using an Ocean Optics HR2000+ photo spectrometer for both potential corneal and retinal damage.
Results: This study, using established measurement methods, has shown that the measured output parameters were significantly different for the three systems. Using equipment traceable to national standards, one device was judged to be hazardous for naked eye viewing and this begs the question how safe are home use IPL devices in the hands of consumers? This investigation also reports on the significantly different pulse durations of the devices measured and considers these in the light of the accepted theory of selective photothermolysis.
Conclusion: Although these devices offer low-cost personal convenience of treatment in the privacy of the home, ocular safety may be inadequate in the event of primary safety mechanism failure.

#107

MUSCLE CONTRACTILITY REDUCTION VIA APPLICATION OF LOW TEMPERATURES USING A PORTABLE HANDHELD DEVICE

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Background: A novel minimally invasive percutaneous technology has been developed to reduce muscle contractility with potential clinical application in the reduction of dynamic rhytides. Controlled low temperatures are applied to targeted muscle groups with needle-like probes with the thermal algorithm reducing muscle fiber count and weakening the muscle temporarily without causing long term chronic chnages in the tissue. Thist study was undertaken to establish correlations between treatment temperature and physiologic and histologic outcomes in a murine model.
Study: Preclinical studies of the low temperature device were performed in 35 Swiss Webster white mice which underwent treatment to the gastrocnemius muscle. Muscle function was assessed a minimum of three times a week uisng the digit abduction score (DAS) assay and tissue specimens were explanted for histological evaluation at 3 days and at weekly intervals. To establish comparative data, a series of 51 mice were injected with 29 u/kg botulinum neurotoxin A into the gastrocnemius muscle and analyzed in the same fashion.
Results: −20 degrees C temperatures produced effective muscle weakening in the murine model for 21 days following gradual return to normal muscle function. Mice treated with botulinum toxin A showed an effective duration of muscle weakening for 9 days. Examination of tissue specimens treated to −10, −20, and −30 degrees C showed an increasing zone of effect with decreasing temperature. At 12 weeks post treatment muscle treated at −20 degrees C was histologically equivalent to baseline with no fibrosis or scarring.
Conclusion: A controlled low temperature device is able to temporarily reduce muscle contractility by application of low temperatures with the potential to provide prolonged duration relative to neurotoxin treatment. Recovery of normal muscle function and morphology and the absence of any systemic effects were observed. A clinical study in human subjects is now underway to examine these effects in the glabella and forehead.

#108

A RANDOMIZED CONTROLLED PAIRED COMPARISON OF PHOTODYNAMIC THERAPY WITH TOPICAL TAZAROTENE 0.1% CREAM PRETREATMENT VERSUS PDT ALONE FOR ACTINIC KERATOSES ON AREAS OTHER THAN THE FACE AND SCALP

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Background: Photodynamic therapy for treatment of actinic keratoses (AKs) has been reported to be less effective on the trunk and extremities than on the face. Pretreatment with other pharmaceutical agents may increase the penetrance and hence the efficacy of PDT off the face. This study compares the utility of two different regimens for the treatment of actinic keratoses of the trunk and extremity: (1) photodynamic therapy with 5-aminolevulinic acid and blue light; and (2) topical tazarotene 0.1% cream followed by photodynamic therapy with 5-aminolevulinic acid and blue light.
Study: Rater-blinded randomized control trial. A total of 156 actinic keratoses (clinically diagnosed by a board certified dermatologist) on 10 subjects were marked, numbered and photographed, and then randomized to one of two groups. AKs were either: (1) treated with topical 5-ALA incubated for 1 hour followed by blue light exposure for up to 23 minutes; or (2) treated topically with 0.1% tazarotene cream once a day for 4 weeks, and then treated with topical 5-ALA incubated for 1 hour followed by blue light exposure for up to 23 minutes. At week 6–11 (at least 2 weeks after the PDT treatment was delivered), all of the treated AKs were again marked, numbered, and photographed. Two blinded dermatologist raters evaluated each AK before and after treatment to determine whether it had "improved."
Results: Overall, there was good agreement among the blinded raters. Of the 79 AK lesions receiving PDT alone, 35.4% were noted to have improved. In contract, of the 77 AK lesions receiving tazarotene followed by PDT, 61.0% were noted to have improved. There was slightly more treatment-associated discomfort reported by subjects at sites receiving combination treatment, but mean pain, burning or itching scores never exceeded 3 on a 0–10 visual analog scale.
Conclusion: Combination treatment appears to be more effective than PDT alone for treatment of AKs on the trunk and extremities. Adverse events associated with combination treatment are minimal, and such treatment is well-tolerated.

#109

FINALLY! A WELL-TOLERATED AND EFFECTIVE TREATMENT FOR ACTINIC KERATOSES ON THE FACE

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Background: Actinic keratoses (AK) are precancerous epidermal lesions that occur on photodamaged skin. Cryo/electrosurgery, curettage, topical therapies, photodynamic therapy and chemical/laser resurfacing are all accepted AK treatments. However, lengthy treatment courses, scarring, pigmentary changes, irritation, discomfort, photosensitivity, and prolonged recovery limit their appeal and tolerability to affected patients. A novel 1927 nm non-ablative fractionated Thulium laser delivers microscopic thermal zones within treated skin using a wavelength with moderate to high water absorption. The resulting unique laser-tissue interaction creates precise, superficial zones of thermal damage best suited for removal or resurfacing of epidermal lesions such as AK. We assess the safety and efficacy of non-ablative 1927 nm fractional resurfacing of facial AK.
Study: 30 subjects with facial AK received up to 4 treatments (2–4 week intervals) with a 1927 nm laser (Fraxel Dual, Solta Medical, Inc., Hayward, CA). Topical anesthetic was applied 1 hour before treatment. Laser settings consisted of 5–20 mJ/pulse and coverage densities of 30–70%.
Results: AK counts decreased in all patients during treatment. 1 month after the final treatment, total AK number in patients with extensive AK decreased from a baseline of 51 to 7 (86% clearance). The average patient score for treatment discomfort was 2.2/10 (range 0–5). Post treatment, mild erythema and minimal exfoliation lasted approximately 7 days. No incidents of infection or scarring were observed. All patients uniformly reported very significant improvement in photodamage and AK and in skin texture and pigmentation.
Conclusion: Fractional 1927 nm resurfacing results in dramatic clinical clearing of facial AK. Consistent with the observed clinical improvements in skin texture and pigmentation, histologic evaluation of treated skin revealed reduced epidermal melanin content and increased dermal collagen matrix and collagen I expressing fibroblasts 30 days post treatment. This well-tolerated and safe treatment is an effective new option for facial AK treatment.

#110

MAL-PDT FOR PATIENTS WITH NEVOID BASAL CELL CARCINOMA SYNDROME

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Background: Patients with nevoid basal cell carcinoma syndrome (NBCCS) suffer from multiple basal cell carcinomas (BCCs), requiring numerous surgical procedures that leave them with disfiguring scars. Photodynamic therapy (PDT) with methyl aminolevulinate (MAL) using red light sources (630 nm) has been reported as effective in treatment of superficial and nodular BCCs. In patients with NBCCS, ALA-PDT has been reported to have success rates varying from 30–97%. Herein, we report the first case series of 39 tumors in patients with NBCCS treated with MAL-PDT.
Study: 39 tumors in patients with NBCCS were treated with MAL-PDT. 16.8% MAL in a cream base (Metvixia, Galderma Laboratories) was applied topically under occlusion for 3 hours. Lesions were illuminated with a red light device (630 nm) for 10 minutes (37 J/cm^2). Two consecutive treatments 1 week apart were administered. Treatment response was evaluated utilizing clinical examination, digital photography at 1 week, 1 month, 3 months with final clinical and histologic evaluation at 6 months.
Results: Complete clinical response was observed in (27/27, 100%) of superficial BCCs (sBCCs) and (12/12, 100%) of nodular BCCs (nBCCs). Complete histologic response was observed in (27/27, 100%) of sBCCs and (11/12, 91.7%) of nBCCs. Resolution of lesions was accompanied by excellent cosmetic outcome and there was no hypertrophic scarring observed. Treatments were well tolerated with minimal pain and no incidence of post-treatment discomfort, photosensitivity or allergic reaction.
Conclusion: Our clinical results demonstrate that MAL in conjunction with red wavelengths significantly reduces cutaneous tumor burden in NBCCS patients. In addition, previous treatment options for these patients have been primarily surgical, resulting in prolonged wound healing and disfiguring scars. MAL-PDT represents a significant advance in treatment for NBCCS as it is associated with rapid wound re-epithelialization and improved cosmesis.

#111

RESPONSE AND ONE YEAR FOLLOW UP OF BASAL CELL CARCINOMAS TREATED WITH PULSED DYE LASER

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Background: Basal cell carcinoma (BCC) is the most common human cancer. There is a need for new non-surgical cost-effective approach for BCC treatment that combines efficacy with optimal cosmesis. One such approach is to use pulsed dye laser (PDL) to target the rich vasculature associated with BCC's. We recently published a pilot study that demonstrated the efficacy of PDL with no dynamic cooling device (DCD) on 24 superficial and nodular BCCs with complete histologic clearance obtained in 92% of BCC's < 1.5 cm in size. The purpose of this study is to determine PDL efficacy *with* DCD for BCCs on trunk and extremities and to assess for BCC recurrence at 12 months follow up.
Study: Fourteen patients with 20 suprficial and nodular BCC's, 0.8 cm to 3.5 cm in diameter located on the trunk and extremities, received 3-5 PDL treatments (15 J/cm^2, 7 mm spot size, 3 ms pulse duration, DCD 30/20) at 2–4 weeks interval. The patients were followed up to 12 months after the last treatment. Scouting biopsies or standard excisions were performed at 6 month follow up for histological confirmation of the tumor clearance. The patients were followed up at 1 year to assess for recurrence.
Results: All BCCs less than 2 cm in diameter (19/19) achieved an excellent clinical outcome with no clinical evidence of disease at 6 and 12 months follow up after the last laser treatment. All BCC's less than 2 cm evaluated by scouting biopsies at 6 months follow up (8/8) showed "no evidence of histological disease". Eleven patients refused either excision or biopsy due to an excellent clinical result 6 and 12 months post treatment. One superficial BCC, 3.5 cm in diameter, failed to be completely eradicated after 5 treatments and was completely excised.
Conclusion: PDL is an effective treatment option for SBB and and NBCCs less than 2 cm in diameter on the trunk and extremities with no recurrence observed at 12 months follow up period. It provides an excellent cosmetic outcome, and is well tolerated and preferred by patients.

#112

TREATMENT OF CARBON TATTOOS IN A PORCINE MODEL WITH A NOVEL 758 nm, 500 PICOSECOND LASER

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Background: Optimal selective photothermolysis of a pigment particle requires pulse durations equal to or less than its thermal relaxation time ($t_{1/2}$). Since tattoo particles in skin range in diameter from 40–100 nm, picosecond pulses would approximate $t_{1/2}$ more closely and, therefore, might be more effective at tattoo particle destruction. We evaluated the safety and effectiveness of carbon tattoo removal using a single treatment with a picosecond domain (500 ps) 758 nm wavelength laser (Cynosure) in a porcine model.

Study: India ink tattoos were placed on the back of a Yorkshire pig. Six weeks later, each tattoo was treated with either a 758 nm 500 ps laser, a 755 nm 30–50 ns laser, or not treated at all. After 4 weeks, clinical responses were evaluated by 3 dermatologists based on pre- and post-treatment photographs; histopathologic findings were evaluated by a dermatopathologist; and electron microscopic findings were analyzed for treated and non-treated tattoos.

Results: After a single treatment, picosecond-domain pulses at 758 nm produced a significantly greater degree of carbon tattoo clearance compared to nanosecond-domain pulses at 755 nm. Neither modality resulted in scarring, textural changes, or hypopigmentation, and there was no histopathologic evidence of scarring. Electron micrographs revealed the presence of amorphous material (treated pigment) in picosecond and nanosecond laser treated tattoos, consistent with effective targeting of India Ink pigment.

Conclusion: A 758 nm 500 ps laser is more effective at carbon tattoo clearance after one session in a porcine model than a 30–50 ns laser emitting at a similar wavelength. Both lasers have a comparable safety profile, and neither produced clinical or histopathologic scarring. Further studies of new and previously treated tattoos in humans are necessary to evaluate whether repeated treatments with picosecond versus nanosecond domain modalities might yield superior tattoo pigment clearance with a comparable safety profile.

#113

ABLATIVE FRACTIONAL RESURFACING PLUS Q-SWITCHED LASER THERAPY FOR THE TREATMENT OF UNWANTED TATTOOS

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Background: The gold standard for tattoo removal is Q-switched laser (QSL) treatment. However, even with optimal treatment parameters, multiple treatments are required and complete removal is not guaranteed. QSL induced hypopigmentation also becomes increasingly problematic in darker skin. Ablative fractional resurfacing (AFR) creates columns of tissue ablation and a robust inflammatory wound healing response. By augmenting QSL treated pigment clearance via inflammatory cell pathways, ablating superficial pigment, and creating channels for pigment extrusion, we hypothesized that adding AFR to QSL therapy will accelerate the clearance of treated tattoos. By stimulating melanocytes, preventing blistering, and preserving epidermal integrity following QSL therapy, we hypothesized that adding AFR to QSL therapy will also decrease treatment induced hypopigmentation.

Study: 7 patients (8 tattoos) received treatment at approximately 4–8 week intervals. Subjects received AFR treatment to 1/2 of the tattoo and QSL treatment to the entire tattoo. Standard photographs were taken at baseline and before each treatment. Tattoo clearance, hypopigmentation, and side preference were evaluated by 2 blinded physicians.

Results: Subjects underwent an average of 4 treatments (range 2–6). Blinded raters noted increased clearance of $=1$ quartile higher for the AFR + QSL treated side in over 50% of treated tattoos. Clearance was deemed equivocal by both raters in the remaining tattoos. Blinded raters preferred the AFR + QSL side in 63% of treated tattoos. Rater 1 had no preference in 2/8 tattoos. Treatment induced hypopigmentation was noted in 3 tattoos, and both raters noted decreased hypopigmentation on the AFR + QSL side in all 3 tattoos. Patients noted decreased blistering and quicker healing on the AFR + QSL side.

Conclusion: Our data suggests that the addition of AFR to QSL therapy for tattoo removal results in accelerated tattoo clearance, decreased treatment induced hypopigmentation, decreased blistering, and faster healing. Further research into optimal treatment parameters and intervals is needed.

#114

THE USE OF LONG PULSED ALEXANDRITE LASER IN TATTOO REMOVAL

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Background: Laser assisted tattoo removal is a firmly established technique that has led dermatologists to seek out the right treatment for every kind of tattoo.

Study: We present an open study that compares the long pulsed Alexandrite laser with Ruby laser treatment. We treated eight patients of different skin types and mostly black tattoos with either the long pulsed Alexandrite or the Ruby laser.

Results: Of the eight patients treated, the treatments were significantly less for the Alexandrite compared to the Ruby laser. While the long pulsed Alexandrite laser poses a greater risk of scarring, post-inflammatory pigmentation or textual changes, sometimes a more aggressive therapy is needed for stubborn tattoos, if a patient cannot afford so many treatments and does not mind the above listed side effects which can do occur.

Conclusion: Although our open study showed promising results with the long pulsed Alexandrite laser, nevertheless, a well controlled study is warranted both to validate efficacy and to minimize the significant side effects.

#115

PATIENT COMPLIANCE AS A MAJOR DETERMINANT OF LASER TATTOO REMOVAL SUCCESS RATES: A 10-YEAR RETROSPECTIVE ANALYSIS

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Background: High energy Q switch lasers are the treatment of choice for tattoo removal. The three lasers that are most commonly used are the Q-switched ruby (694 nm), Q-switched alexandrite (755 nm), and Q-switched Nd:YAG (532/1064 nm) lasers. Multiple studies document the tattoo removal efficacy of Q-switched lasers. However, there is scant data that looks at paying patient compliance and its impact on the success rate of tattoo removal. The purpose of this study was to identify reasons for patient noncompliance during long term Q-switched laser tattoo removal and to evaluate how these compliance issues ultimately may contribute to a poor clinical outcome.
Study: All patients in a single cosmetic laser center who were treated with Q-switched lasers for professional tattoo removal over the course of 10 years were initially called. Those that responded to phone call analysis also had their medical records reviewed. Parameters such as clearance rates, number of treatments, type of utilized laser, fluence, spot size and treatment intervals were documented. Adverse effects were also noted.
Results: 238 patients were analyzed. Of these 95 were male and 143 were female. The average ages of the male and female patients were 34.3 and 31.9 respectively. Men received an average of only 3.59 treatments and women received only 3.56 treatments. There was a wide variation in treatment intervals. Reasons for noncompliance included discouragement with treatment results, treatment induced pain and bleeding, as well as expense from laser treatments. Adverse effects from the laser treatment including hypo- and hyperpigmentation, textural changes, infection, and blistering had no impact on patients seeking further treatment.
Conclusion: Q-switched lasers represent the gold standard of treatment for tattoos. Poor patient compliance with today's treatment modalities mandate better future approaches to laser tattoo removal.

#116

TOLERANCE OF THE NEW GENERATION PULSED DYE LASERS ON CHILDREN TREATED FOR PORT WINE STAINS (334 CASES)

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Background: Although the PDL therapy is the gold standard for the treatment of PWS on children, there are not many publications on his tolerance, especially with the last generation PDL (VBeam Perfecta, Candela Corporation). We present the results, in term of tolerance, of 334 children treated for PWS between 2005 and 2009.
Study: All children, younger than 5 years, treated since 2005, were included. Parameters: Vbeam Perfecta Candela, 595 nm, 1.5, 3 or 6 milliseconds pulse-duration: the maximal fluences were respectively 12, 13, and 14 joules/cm^2 with the 7 mm handpiece, or 9 Joules/cm^2 (1.5 or 3 milliseconds) with the 10 mm hand piece. Dynamic cooling device = 30/20 milliseconds. A total of 1640 treatments were performed.
Results: We observed: transient hyperpigmentations in 3% of cases, seen always after the age of 1 year; 14 cases of transient hypopigmentation: (11 cases on the members); purpura in any case, and 2–6 days oedema in 15% (every time on the eyelid); seven cases of eczematiform eruption; crusts: in 14%, mainly with fluences greater than 12 J/cm^2 (with the 7 mm hand piece, or on the members with the 10 mm hand piece at 9 J/cm^2, with 4 cases of remaining discreet atrophy (1.2%), but no cases of visible scar or severe side effects were noticed.
Conclusion: This study demonstrates the very good safety of this laser, even on newborns and young children, and especially on the face, and the possibility to begin very early the treatment of port wine stains.

#117

SCARS AFTER LASER ALEXANDRITE TREATMENT IN PORT WINE STAINS RESISTANTS

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Background: A standard therapy port wine stains are commonly laser pulsed dye. Recently, a long pulse alexandrite laser was used to treat bulky vascular malformations .Based on the theory of selective photothermolysis, vessels in such lesions may be specifically targeted with the laser wavelength of 755 nm. Laser therapy of port wine stains (PWS) resistant to pulsed dye laser is challenging and controversial.
Study: Fourteen patients with port wine stains resistant's (PWS) in face after a mean 12 sessions and Fitzpatrick skin types III–V were recruited in this study. Laser alexandrite used with high energy 50–70 joules/cm^2, 1.5 ms and 8 mm spot diameter with dynamic cooling device (DCD) cooling.
Results: Two cases of scars were observed in 2 patients after one session with Mild to moderate PWS lightening was associated in 6 patients and hyperpigmentation in one case.
Conclusion: The gold standard for the treatment of PWS is the 577–595 nm lasers. The risk significant complications from laser alexandrite are important.

#118

NEXT-GENERATION IPL OPTIMIZED FOR TREATMENT OF VASCULAR LESIONS

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Background: Up to now, for certain classes of vascular lesions the performance of IPL systems fell short of that of the gold standard, PDL. We tried to close this gap by using the latest advances in optical technology.
Study: A novel IPL system has been developed using the StarLux/LuxG (Palomar Medical Technologies, Inc.) design as a starting point. The new device features a high-efficiency, high-pressure Xe flashlamp providing about 13% higher pulse energy than the benchmark design, an optimized optical train with about 12% higher throughput than the benchmark design, dual-band spectral filtration, and an advanced power supply providing extremely high levels of peak power for short pulsewidths. In addition, the power supply enables accurate manipulation of the pulse shape, thus allowing for previously unattainable precision targeting of vascular lesions. A clinical trial of the new IPL system has been commenced. A total of 10 subjects were recruited with indications of telangiectasia and pigment dyschromias. Polarized photography and blinded rater evaluations were used for efficacy evaluation.
Results: Computer simulations predicted significant potential benefits of the pulse shape manipulation when treating vascular targets. The optimized light spectrum provided 8-10% higher

action efficiency for treatment of vascular conditions than the benchmark design. Clinically, shorter pulses resulted in improved clearance of vascular lesions but with a greater risk of focal purpura. Patients overall achieved the same degree of vessel and pigment clearance with less total fluence than in previous handpiece designs. The filtering of the handpiece allowed for a higher vascular to pigment damage ratio than many other IPL handpieces.
Conclusion: Introduction of the advanced design features allows increased clinical efficacy of IPL for a broad class of vascular lesions. Thus, treatments requiring use of PDL in the past can now be successfully performed with IPL.

#119

HYPERTROPHY IN PORT WINE STAINS: A RETROSPECTIVE DATABASE STUDY

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Background: Port-wine stains (PWS) are congenital capillary malformations affecting 0.5% of newborns. During adult life, thickening and darkening may occur in some PWS. To date, little is still known on pathogenesis and development of hypertrophy in PWS due to the lack of large patient group studies. Aim of our study was to assess hypertrophy in PWS and to define predicting factors for the development of hypertrophy in PWS.
Study: PWS patients visiting our outpatient clinic between 2006 and 2009 and patients from the Department of Plastic Surgery of the Amsterdam Medical Center were analyzed. Medical records and clinical photographs were examined to identify hypertrophy, which was subdivided into thickened, nodular or both. These patients received a questionnaire.
Results: 220 patients with a PWS were included. The color was classified red (48%), pink (28%) and purple (24%). Hypertrophy was found in 75 patients (34%; 35 male, 40 female). PWS were thickened (11%), nodular (12%), or both (11%). 83% of hypertrophic PWS but only 49% of flat PWS were located on the face. Flat PWS were mainly pink (38%) and red (45%) while thickened and nodular PWS were mainly purple (56%). 40% of patients with hypertrophic PWS reported color change, 29% reported change in thickening, 32% reported nodules. Mean age of onset of PWS thickening and nodules was 30 and 34 years respectively. 36% of patients with hypertrophic PWS reported interference with daily life by their PWS.
Conclusion: These preliminary results show that 34% of patients with PWS will eventually experience PWS hypertrophy. Gender seemed to be of no influence. Color of the PWS seems to be associated with hypertrophy. PWS on the face seem to be more prone for development of hypertrophy. More research on prevention and treatment of hypertrophy in PWS has to be done.

#121

SECOND STAGE CLINICAL STUDY ON NEW PHOTOSENSITIZER HEMOPORFIN MEDIATED KTP 532 NM PDT FOR 24 CHINESE PORT WINE STAINS VOLUNTEERS

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Background: In order to search the chinese FDA approved new photosensitizer's (PS) safety and efficacy, a random double-blind control study was carried out in multi-centre of China. As one of four centre, we reported our centre's result.
Study: From Nov. 2007, to July, 2008, there are 25 volunteers of pws were enrolled in this study, 24 volunteers had completed study except one suspend. Laboratory examination were tested before and after study, such as BRT, URT, BUN¢CR etc. Each volunteer was treated by KTP 532 nm laser PDT twice at the interval of 8 weeks. Study was random designed group devision as control/treating groups at the ratio of 1:4. Treated group used new PS of hemoporfin 2.5 mg/Bkg concentration injection. Control group used normal saline solusion injection as contrast. Laser illumination method: Near continuous wave 532 nm KTP laser at out put of 4.7 watt, beam diameter of 6.0 cm, was used for PDT. Exposure time is 20 minutes. Each volunteer was irradiated for one test site. Laser exposure started 10 minute after the ps/normal saline solution injection introvenously started, which lasted 20 minutes using by vein pump. Clinical results were classified as four grades: Complete response,CR(lesion fade degree, lfd = 90%), effective response ,ER (lfd = 60%£¬ < 90%), fair response, FR (lfd = 20%£¬ < 60%)and no response, NR (lfd < 20%). The evaluated method was carried out by the third-party experts.
Results: Safety of study: There are no statistical bias or differences before and after hemoporfin PDT, at laboratory examination tests. Efficacy of study: There is 1/20 got CR, 3/20 ER, 10/20 FR, 6/20 NR, at ps treated group, while 0/5 CR, 0/5 ER, 2/5 FR, 3/5NR in control group.
Conclusion: This result reveals that hemorporfin is save and effective ps in treating chinese pws.

#208 Late Breaking

755 nm ALEXANDRITE LASER FOR THE REDUCTION OF TUMOR BURDEN IN BASAL CELL NEVUS SYNDROME

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Background: Basal Cell Nevus Syndrome (BCNS) is an autosomal dominant genodermatosis characterized by numerous basal cell carcinomas (BCCs). Management of BCNS is often frustrating due to the large tumor burden. Photodynamic therapy (PDT) is a promising therapeutic modality for the treatment of large numbers of BCCs in BCNS. Pulsed dye laser (PDL) has been shown, in small studies, to be effective for the treatment of superficial and nodular BCCs by targeting the supporting vascular supply of BCCs. Like PDL, the alexandrite laser can be vessel-selective, but has the added advantage of deeper tissue penetration. We evaluated the alexandrite laser as an alternative means of reducing the tumor burden in a single BCNS patient.
Study: One adult patient (45-year-old male) with BCNS and a history of radiation therapy presented with an extraordinarily high tumor burden (> 250 BCCs). He was unable to tolerate large or multiple fields of PDT treatments during a single session, even with general anesthesia due to unmanageable post-procedure pain. The rate at which he developed new tumors outpaced the patient's ability to tolerate interval PDT treatments. As a compassionate measure to reduce the tumor burden, we treated

several lesions outside the field of PDT treatment during one session with two passes of a flashlamp excited long-pulse 755 nm alexandrite laser using a 6 mm spot size, pulse duration of 3 ms, and a fluence of 100 J/cm^2, without epidermal cooling. Photographs were taken after the solitary treatment session and at two-month clinical follow-up and compared to baseline photographs.
Results: At two-month clinical follow-up, about eighty percent of the alexandrite laser treated lesions showed a complete clinical response and now appear as hypopigmented areas with central fibrosis. Histopathologic analysis is planned at six-month follow-up to assess for recurrence.
Conclusion: The alexandrite laser may be helpful in significantly reducing tumor burden in difficult to manage BCNS patients, and provides an alternative to PDT for the management of BCNS. Larger, prospective studies are needed to confirm these preliminary findings.

#122

TREATMENT OF FOCAL ALILLARY HYPERHIDROSIS USING A LONG PULSED Nd:YAG 1064 nm LASER AT HAIR REDUCTION SETTINGS

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Background: Axillary hyperhidrosis is a common, often socially distressing idiopathic disorder of the eccrine sweat glands for which treatment is difficult and often unsatisfactory. The purpose of this study was to examine the effect of laser hair reduction using the Nd:YAG 1064 nm laser on excessive sweating in patients with focal axillary hyperhidrosis.
Study: This institutional review board approved, case-controlled, prospective, randomized study involved six participants with axillary hyperhidrosis who received up to six (6) monthly laser hair reduction treatments to a randomly assigned axilla using the long pulsed Nd:YAG 1064 nm laser at settings appropriate for skin type and hair color. The other axilla acted as a control. A relatively long laser pulse width of 20 ms was utilized to allow for potential collateral photothermal injury to eccrine structures adjacent to hair follicles. At weekly intervals following each treatment, participants were asked to subjectively classify improvement in sweating using a patient global assessment questionnaire. Qualitative assessment of sweat production for both axillae was performed at baseline, prior to each treatment, and at one month following the final treatment using a modified starch iodine test.
Results: All six study participants reported gradual subjective improvement in axillary sweating following each of the laser hair reduction treatments. All reported good to excellent subjective improvement in sweating of the treated axilla at one month follow-up after the final treatment. Three participants were followed up three months after the final treatment. One reported fair to excellent improvement while two continued to report good to excellent improvement in sweating of the treated axilla. Analysis of digital photographs of the modified starch iodine test demonstrated noticeably reduced sweating of the treated axilla compared to the control axilla in all study participants.
Conclusion: Results indicate that long pulsed laser hair reduction using the Nd:YAG 1064 nm laser at normal hair reduction settings may offer a relatively easy, effective, non-invasive alternative to currently used treatment modalities for axillary hyperhidrosis.

#123

HISTOLOGIC EVALUATION OF 1450 nm DIODE LASER WITH PNEUMATIC SKIN FLATTENING

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Background: Acne vulgaris is a common disorder afflicting millions in the United States alone. We have previously reported the safety and efficacy of the 1450-nm diode laser with a dynamic cooling device (DCD) for the treatment of facial inflammatory acne vulgaris. This device specifically delivers thermal damage to depths in the dermis where the sebaceous glands are located. Pneumatic skin flattening (PSF) was developed to decrease pain associated with laser therapy and to eliminate the need for topical anesthetic creams. This is the first histologic evaluation of these devices (1450-nm diode laser with a DCD and PSF) used in combination.
Study: Ex vivo samples of human skin were treated with a 1450-nm diode laser with a DCD and PSF (1–3 passes). The variables included energy levels (7–14 J/cm^2), PSF levels (1–4 seconds), DCD levels (10–100 msec) and spot size (6 and 12 mm). A vertical section of each sample was stained with hematoxylin and eosin (H&E).
Results: The energy, PSF, DCD levels, and spot size determined the degree of epidermal preservation and sebaceous gland destruction. At higher energy levels, the diode laser with PSF and without a DCD thermally damaged the epidermis. At a range of energy levels, the diode laser with PSF and a DCD protected the epidermis from thermal injury.
Conclusion: At specific settings, a diode laser with DCD can be employed with PSF to preserve the epidermis creating non-ablative treatments.

#124

LOW FLUENCE MULTIPLE PASS vs HIGH FLUENCE SINGLE PASS DIODE LASER HAIR REMOVAL—TWO YEARS POST TREATMENT

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Background: A prospective split leg comparative study of high fluence single pass verses low fluence multiple pass diode laser hair removal—efficacy, tolerability, and two year followup to assess permanent laser hair removal.
Study: 25 females skin type I–V underwent five diode laser hair removal (LHR) sessions at 6–8 week intervals. One leg was treated with the Lightsheer diode 810 nm to tolerated fluence, 20–50 J, 30 msec pulse duration, single pass conventional LHR. The other leg was treated with the Soprano SHR diode 810 nm, 5–10 J, 20 msec pulse duration, multiple passes. Hair counts were done 6 and 18 months following the last treatment. VA Pain Scores were done at each treatment session. There is only one other study in the literature showing 6 and 18 month hair count reductions are similar.
Results: Hair counts 6 months following the fifth treatment demonstrated a 86–91% reduction (NS) on each leg. Pain scores were statistically significantly less with the lower fluence, multiple pass protocol. There was one minor burn in the single pass, high fluence group. We are currently tabulating 18 month hair counts. At this time, the 18 month hair counts are comparable to the 6 month hair counts.

Conclusion: Low energy, multiple pass diode LHR is safe and has comparable efficacy to conventional single pass high energy diode LHR. However, pain is less with the low energy protocol, which represents a paradigm shift in treatment algorithms which historically called for treating the patient at the highest tolerated energy. This mode of treatment is safer for dark skin tones as one is less likely to burn a patient at 5 J than 20 or more J.

#125

SIDE-BY-SIDE COMPARISON OF HIGH-FLUENCE AND LOW-FLUENCE DIODE LASER IN AXILLARY HAIR REMOVAL

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Background: Recent approaches to laser hair removal suggest that lower fluences, provided under certain conditions, may retain efficacy while improving tolerability. We performed a pilot study comparing the efficacy, safety, and tolerability of laser hair removal using traditional settings in one axilla compared to lower fluences, delivered from a larger handpiece and under vacuum, to the contralateral axilla.

Study: Fourteen healthy women were recruited and treated with diode laser (LightSheer Duet, Lumenis). Participants underwent 5 treatments at 1 month intervals, with follow-up 1 and 3 months after the 5th treatment. One axilla was treated with the ET handpiece (9×9 mm) at 25–32 J/cm^2 and 30 ms, using a chilled tip and gel. The contralateral axilla was treated with the HS handpiece (22×35 mm) at fluences up to 12 J/cm^2 and low vacuum, without chilling or gel. Follow-up assessments were performed after each treatment and at each follow-up visit, and included photography and questionnaires.

Results: Eleven participants completed the study and follow-up. All experienced significant hair removal in both axillae. At the 3-month follow-up visit, the difference in hair density between the high-fluence (ET) and low-fluence (HS) axillae was either small or indiscernable in all participants. Participants found the lower fluence treatments to be more tolerable. Nine participants asked to continue treatment beyond the study, at their own cost. Of these, 7 chose the low-fluence HS handpiece for future treatments. No adverse events were reported.

Conclusion: Lower fluence diode laser, delivered under conditions of vacuum and using larger spot sizes, can provide efficacy equivalent to that of higher-fluence approaches in axillary hair removal. The retained efficacy is likely explained by the increased spot size, which increases depth of penetration, and by the vacuum-induced topological skin change. The combination of retained efficacy and improved tolerability and speed render low-fluence laser an attractive approach to hair removal.

#126

FINE CALIBER HAIR REMOVAL WITH AN ELECTRO-OPTIC Q-SWITCHED Nd:YAG LASER

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Background: To evaluate the efficacy and tolerability of a novel electro-Optic Q-swited Nd:YAG laser for dark fine caliber hair removal in the Standard Single Pulse and a novel Double Pulse modes.

Study: 11 patients with pigmented fine caliber hair underwent 4 laser treatments at monthly intervals. Half of a predetermined and pre-measured area (2 by 2 inches or less) received treatment in the Standard Single Pulse (SSP) mode, and their other half was treated with the Double Pulse (DP) option. Blinded investigators conducted hair counts at baseline and again at 3 to 6 months post-treatment. Investigators and subjects also assigned a grade of improvement of mild, moderate or excellent hair loss. Subjects assessed stinging/burning sensations during and post-treatment. Six subjects rated their satisfaction with the procedure at 6 months.

Results: At 6 months, investigators found an average reduction of 50% in terminal fine hair counts in areas treated with the Double Pulse option. Areas treated with the Standard Pulse showed an average reduction of 45.67%. Most subjects (90% in DP mode and 50% in SSP mode) reported none to mild stinging/burning during and immediate post-treatment. Half of the subjects recorded less discomfort on the side treated with the DP option with the rest having similar discomfort. Transient erythema and edema were observed less frequently and with a lower severity rating (minor as opposed to mild) on the side treated with the Double Pulse option. No other side effects were reported in this study. The majority of subjects (83.3%) who completed the study expressed satisfaction with the results of treatment.

Conclusion: Treatment with an EO Q-switched Nd:YAG laser is an effective therapeutic option for unwanted fine dark hair. There is less therapeutic discomfort in the Double Pulse mode.

#127

A PROSPECTIVE PILOT STUDY OF THE PULSED-DYE LASER (595 nm) FOR THE REMOVAL OF RED HAIR

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Background: Red hair, due to its pheomelanin content, is traditionally not considered a candidate for laser hair removal. Pheomelanin's absorption spectrum parallels that of melanin, albeit much lower. Wavelengths with high melanin absorption, thus higher pheomelanin absorption, may allow for enough selective photothermolysis to produce a clinical effect of permanent hair loss. Commercially available cutaneous lasers with wavelengths in the portion of the electromagnetic spectrum with high melanin absorption are often limited by propagation length in the skin and the high absorption of hemoglobin. When using laser wavelengths with high absorption by hemoglobin, compression blanching of superficial vasculature permits the preferential absorption of melanin. Our objective was to determine the effect of the 595 nm pulsed-dye laser for the removal of red hair.

Study: Four patients with red axillary hair completed a 6-visit, two-treatment, single-sided investigation. Treatment and follow-up intervals were 6–8 weeks apart. Treatment parameters were: 5–7 mm spot size, no cooling, 15–30 J/cm^2, compression, and 6 ms pulse duration. Clinical endpoints of hair singeing and perifollicular erythema determined treatment settings. Photographic documentation up to 6 months following the second treatment was conducted.

Results: Two patients demonstrated no improvement, one patient demonstrated areas of hair loss, and one patient demonstrated mild improvement.

Conclusion: The 595 nm pulsed-dye laser can be useful for the removal of red hair. Careful attention to appropriate compression during treatment is essential to provide effective treatment.

#128

THE USE OF NON-ABLATIVE FRACTIONAL RESURFACING IN ASIAN ACNE SCAR PATIENTS

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Background: Non-ablative fractional resurfacing (NA FR) has been shown to be effective for photorejuvenation and acne scarring. Previous studies indicated that density, more than energy, is associated with post-inflammatory hyperpigmentation (PIH) in Asians. The objective of this retrospective study is to assess the efficacy and complications of 'full fraxel' (8 passes) versus 'mini fraxel' (4 passes with same energy and treatment level as 'full fraxel', but double the number of treatment sessions) with the 1,550 nm erbium-doped fiber fractional laser (Fraxel, Reliant Technologies, Inc.) in Asian acne scar patients.
Study: 47 Asian atrophic facial acne scar patients who received full-face 'full fraxel' or 'mini fraxel' treatments between December 2005 and February 2009 were included. All photographic images captured with the Canfield Visia CR system at baseline and follow-ups were assessed for clinical efficacy and complications by an independent, non-treating and blinded physician.
Results: The total densities for 'full fraxel' and 'mini fraxel' were 442.5 MTZ/cm^2 and 210.5 MTZ/cm^2 respectively. For 'full fraxel', the PIH risk was 18.2% with cross-polarized images compared to 6.0% for 'mini fraxel'. This difference was statistically significant ($p < 0.001$). Improvement in skin texture, acne scarring, enlarged pores and overall pigmentation irregularity all reached statistical significance at last follow-up compared to baseline. There was no statistically significant difference in clinical efficacy between 3 'full fraxel' and 6 'mini fraxel' treatments.
Conclusion: NA FR is effective and safe in Asians. By reducing the number of passes and total density, the risk of PIH can be reduced. Meanwhile, clinical efficacy can be maintained by increasing the total number of treatment sessions.

#129

CO_2 FRACTIONAL LASER (LINE-XEL) RESURFACING FOR FACIAL SCARS IN KOREANS

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Background: The objective of all scar revision is to improve the texture, contour, color, shape, length, width, direction, or viscoelasticity of a scar. Lasers are used primary to improve the first four criteria. Atrophic facial scars usually from acne, surgery, or truma with ablative laser resurfacing. Ablative CO_2 laser resurfacing, while effective, is associated with an undesirable side effects profile, lengthy recovery period, and risk of infection as well as potential pigmentary alterations. Fractional resurfacing is a new concept in the laser field. The fractional technique produces a distinctive thermal damage pattern by creating columns of thermal damage, referred to as microthermal treatment zones (MTZ) and thereby, thermally alters a fraction of the skin while leaving intervening areas of normal skin untouched. This study was designed for effectiveness of CO_2 Fractional Laser (Line-Xel) resurfacing on facial scar.
Study: Forty-five patients (skin type III–IV, aged 17–58 years) with facial scars underwent two or six treatments with the CO_2 Fractional Laser (Line-Xel) at 1–2 months intervals. The Laser treatment was done for the whole face, not only for the scar, in the case of the middle aged female patients. The result of the treatment was evaluated by comparative pre- and posttretment photographs and three independent physician evaluations using a quartile grading scale and patient satisfaction which were graded on a 4-point scale (Excellent, Good, Fair, None). Side effects were recorded at each follow-up visit.
Results: Post-treatment side effects were mild and transient, resolving rapidly within the study period. No delayed onset hypopigmentation or permanent scarring was observed. The improvement in facial scars and texture after CO_2 Fractional Laser resurfacing was significant. Thirty-six (80%) patients in the satisfaction survey were from good to excellent. Patients' satisfaction (Excellent: 12, Good: 24, Fair: 9, None: 0), Photo Evaluation (Grade IV: 9, Grade III: 26, Grade II: 10, Grade I: 0).
Conclusion: CO_2 Fractional Laser resurfacing of facial scars resulted in significant improvement, with good satisfaction and unremarkable side effects.

#130

COMPARISON STUDY OF FRACTIONAL CO_2 vs ER:YSGG RESURFACING FOR ACNE SCARS IN ASIANS

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Background: Many types of fractional ablative lasers have been investigated. However, there are few reports comparing different types of fractional ablative lasers in Asians. The objective of this study is to compare the efficacy and complications of a fractional CO_2 laser (Solta Medical, Re:pair TM) vs. a fractional Er:YSGG laser (Cutera Inc, Pearl Fractional TM) for acne scars in Asians.
Study: Fifteen Asian patients were enrolled in the study. Half of the face was treated with the fractional CO_2 laser (40–50 mJ with density level 8) and the other half of the face was treated with the fractional Er:YSGG laser (160–200 mJ with density level 3 and 4) in 3 patients. Seven patients were treated with fractional CO_2 laser only and 6 patients were treated with fractional Er:YSGG laser only. Patients were seen 1 and 3 months after laser treatment. A Canfield Visia CR system was used to objectively evaluate each patient.
Results: There is no significant difference in efficacy, pain score and recovery time. However, the risk of hyperpigmentation in patients treated with the fractional Er:YSGG laser group is significantly higher than that of the fractional CO_2 laser group. Tiny holes in the skin were observed in fractional Er:YSGG laser group, but not in fractional CO_2 laser group.
Conclusion: Both the fractional CO_2 and the fractional Er-YSGG lasers are effective in the treatment of acne scarring in Asians. High density treatment using a stamp pattern with the Fractional Er-YSGG has a risk of hyperpigmentation in Asians. Because of the large spot size and high energy of the fractional Er:YSGG laser, patients are at risk for developing visible tiny holes in the skin which may be long lasting.

#131

SURGICAL SCAR REMODELING AFTER AMINOLEVULINIC PHOTODYNAMIC THERAPY (ALA-PDT): A RETROSPECTIVE, BLINDED STUDY OF PATIENTS WITH FIELD CANCERIZATION

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Background: Aminolevulinic acid photodynamic therapy (ALA-PDT) achieves better cosmetic results than conventional tumor surgery. We evaluated whether patients with field cancerization (multiple non-melanoma skin cancers) who underwent ALA-PDT had improvement of their surgical scars.

Study: Eight adult patients (43–82 years) with multiple surgical scars within the PDT treated area, received topical 20% ALA under occlusion for 3 hours followed by 200 J/cm^2 fluence of 635 nm LED light. Patients underwent 1–4 PDT sessions/area at ~1 month intervals, to a total of 21 scars on the back, thigh, arms and neck. Scar photographs taken before each treatment session were compared to baseline photographs by blinded investigators. Photographs were cropped and randomly mixed to minimize evaluator bias; no other image manipulation was performed. A forced-choice of the best-appearing scar was made from pairs of photographs, and the degree of improvement (none, minor, moderate, major or impossible to evaluate) was recorded.

Results: This study is still in progress, but preliminary results show a statistically significant effect of ALA-PDT on surgical scars. About 40% of the baseline photos were incorrectly chosen as the best outcome. About 60% of these mistakes were made when comparing the first PDT session vs. baseline. When the blinded evaluators correctly identified the follow-up photos, there was a statistically significant improvement in scars with the number of PDT treatments (one, two or three treatments; $p < 0.05$). Improvement was proportional to the number of treatments. Improvement after one treatment was not statistically different from baseline ratings ($p > 0.05$).

Conclusion: ALA-PDT appears to stimulate scar remodeling, and may be useful for this indication. There is improvement of scars with more than one PDT treatment, which increases with the number of treatments. We hypothesize that MMP-1 and MMP-3 stimulation are involved. Larger, prospective studies are needed.

#132

PULSED DYE LASER TREATMENT OF PIGMENTED LESIONS: COMPARISON OF A NEW 607 nm LASER TO THE 595 nm LASER

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Background: The 595 nm laser is FDA cleared for the treatment of benign epidermal pigmented lesions (EPLs). The goal of this study was to compare a new 607 nm laser, which has a wavelength meant to maximize melanin absorption while reducing blood absorption and thus collateral injury to blood vessels, with the 595 nm laser, for the treatment of EPLs.

Study: 10 patients with EPLs were treated with the 607 nm laser or the 595 nm laser (both with no DCD and no compression) on either the left or right side (usually the hand) on a randomized and symmetrical basis. Patients were treated twice at 2–4 week intervals and seen in follow-up at 6–8 weeks after the last treatment. Study endpoints included (a) clearance rate of lesions evaluated by blinded observers, (b) incidence and severity of side effects including pinpoint bleeding, edema, erythema, hyperpigmentation, and blistering immediately after each laser treatment, (c) patient ratings of discomfort and/or pain, and (d) overall side effects of treatment at the final follow-up evaluation. Five board-certified dermatologists were blinded to both treatment modality and pre- or post-treatment status. They evaluated lesion clearance based on pre-and post treatment photographs without knowledge of which photograph was pre- or post-treatment. Also, Monte-Carlo simulations were performed to characterize laser interaction with skin with both wavelengths.

Results: Monte-Carlo simulations have shown that the 607 nm is absorbed more specifically by melanin than the 595 nm wavelength. Both the 607 nm laser and the 595 nm laser were effective in treatment of EPLs. The average degree of improvement with the 607 nm and the 595 nm lasers was 41.2% and 40% respectively. There was a trend towards more discomfort on the side treated with the 595 nm laser, but there was no difference in side effects immediately after each laser treatment.

Conclusion: Both the 607 nm laser and the 595 nm laser were equally effective in treatment of epidermal pigmented lesions.

#133

NON-ABLATIVE FRACTIONAL LASER THERAPY vs TRIPLE TOPICAL THERAPY FOR THE TREATMENT OF MELASMA: A SPLIT FACE STUDY

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Background: Fractional laser therapy (FLT) has been proposed as an alternative in the treatment of melasma. To date, triple topical therapy (TTT) (hydroquinone 5%, tretinoin 0.05%, triamcinolone acetonide 0.1% cream) is regarded to be the gold standard. Aim of this study was to assess the efficacy and safety of non-ablative FLT compared to TTT.

Study: Randomized controlled observer blinded study. In 29 patients, both sides of the face were randomly allocated to either 4–5 non-ablative FLT sessions (Fraxel re:store, Solta Medical Inc., 15 mJ/microbeam at 1,550 nm, coverage 14–20%, three weeks inter-treatment interval), or treatment with TTT, applied once a day for 15 weeks. All patients were treated between April and July 2009. Three, 12 and 26 weeks after the last treatment, clearance of hyperpigmentation was assessed by melanin index (MI), lightness assessed by chromameter (L*), patient's global assessment (PGA), and patient's satisfaction.

Results: Twenty-nine patients (skin type II–V) were included in this study, of which two were lost to follow-up. Nine patients developed postinflammatory hyperpigmentation at the FLT side (33%). MI and L* at three and 12 weeks significantly worsened for the FLT side, whereas for the TTT side no significant difference was found. Average PGA at three and 12 weeks follow-up was 5.7 and 4.8 for FLT, and 5.0 and 5.7 for TTT (Visual Analogue Scale 0–10). Treatment satisfaction at three, and 12 weeks follow-up was 5.7 and 3.5 for FLT, and 5.1 and 5.5 for TTT (ns).

Conclusion: In this study, both TTT and non-ablative FLT did not result in improvement of melasma. Moreover, a high rate of postinflammatory hyperpigmentation was observed after FLT. This might be explained by summertime treatment and relatively high FLT settings. We conclude that FLT at the settings used is not effective for the treatment of melasma in summertime.

#134

LASER TREATMENT OF PIGMENTED LESIONS WITH A 605 nm LASER

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Background: Various laser sources can be being used for the treatment of benign epidermal pigmented lesions due to the broad absorption of melanin. Pulse dye lasers emitting 595 nm light are ideal for treating vascular lesions, but less so for epidermal pigment. Broad spectrum light sources target melanin, but are less specific for hemoglobin absorption. Blood absorption drops off very quickly at wavelengths over 600 nm, while melanin absorption decreases more slowly with increasing wavelength. This study was the first to investigate a 605 nm dye laser as a treatment for pigmented lesion, in the hopes of developing a dual wavelength dye laser.

Study: Under IRB approval 25 females of Fitzpatrick skin type I, II, III were enrolled into an open label study to explore the safety and efficacy of a 605 nm pulsed-dye laser. Two treatments of the chest one month apart were conducted with a fluence range of 3–6 J/cm^2, 10 mm spot size and pulse duration of 1.5 msec. Photographs were before and 7 weeks following the final treatment. Subjects recorded occurrence and severity of side effects and rated degree of improvement and satisfaction on a point scale. Digital photographs were taken by Canfield Scientific and sent to blinded observers for evaluation.

Results: Clearance attained was excellent (76–95%) for 55%, good (51–75%) for 32% and fair (26–50%) for 14% of the subjects. Subject self assessments were 4.5% rated no improvement, 4.5% little, 27.3% moderate, 54.5% significant and 9.1% complete improvement. Side effects were limited to mild erythema and edema which occurred after each treatment for all subjects.

Conclusion: This novel 605 nm dye laser is safe and effective for treating photodamage with an outstanding safety profile, and may expand the benefits of the pulsed-dye laser for improving photodamaged skin.

#135

FACIAL DEPIGMENTATION ASSOCIATED WITH LOW FLUENCE Q-SWITCHED 1,064 nm Nd:YAG LASER FOR SKIN REJUVENATION AND MELASMA

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Background: 'Laser toning' using low fluence, large spot size, multiple passed Q-switched 1,064 nm Nd:YAG laser has gained much popularity in Asian countries for non-ablative skin rejuvenation and the treatment of melasma. One of the complications associated with laser toning is facial depigmentation.

Study: Fourteen patients with laser toning-associated facial depigmentation were assessed with cross-polarized and ultraviolet (UV) photographic images captured with the Canfield Visia CR system. The laser toning regimens received by these patients, as well as the treatment given for depigmentation, were analyzed retrospectively.

Results: All 14 patients were Chinese females, 8 of which received laser toning for non-ablative skin rejuvenation and the others for melasma. The treatment regimens received by these patients were highly variable. The total number of treatments received ranged from 6 to 50 (mean 22.07). UV photographic images demonstrated facial mottled depigmentation in all the patients. Laser toning failed to significantly improve the melasma in five patients. Four patients received targeted NB-UVB for depigmentation with good clinical results.

Conclusion: Laser toning with low fluence Q-switched 1064 nm Nd:YAG laser for skin rejuvenation and melasma can be associated with mottled depigmentation. With laser toning being frequently performed, this complication may become more commonly encountered in clinical practice. The depigmentation can appear after only a few treatment sessions, and can cause much disfigurement, especially in cases with background melasma. Further studies on laser toning are needed with the view to optimizing efficacy and minimizing side effects.

#136

A RETROSPECTIVE COMPARATIVE ANALYSIS OF THE MANAGEMENT OF FRECKLES AND LENTIGINES USING 595 nm LONG PULSED DYE LASER, 755 nm LONG PULSED ALEXANDRITE LASER, 532 nm Q-SWITCHED Nd:YAG LASER AND 532 nm LONG-PULSED Nd:YAG LASER IN ORIENTAL PATIENTS

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Background: Freckles and lentigines are common cosmetic concerns among Asian patients. Epidermal pigmentation can often be a challenge to treat in darker skinned patients as the risk of post-inflammatory hyperpigmentation (PIH) is increased. With increasing number of lasers available for such treatments, we compared the efficacy and complications associated with different types of Q-switched (QS) and long pulsed (LP) lasers in patients with Fitzpatrick type III and IV skin. To determine the effectiveness and safety of using 595 nm long pulsed dye laser (LPDL), 755 nm LP Alexandrite laser, 532 nm QS Nd:YAG laser and 532 nm LP Nd:YAG laser for management of freckles or lentigines in Oriental patients.

Study: 40 Chinese patients with a diagnosis of freckles and lentigines were divided into four groups, with each group undergoing full facial treatments using 595 nm LPDL, 755 nm LP Alexandrite laser, 532 nm QS Nd:YAG, or 532 nm LP Nd:YAG laser. Each patient attended between 1 to 4 treatments, 4 to 6 weeks apart, depending on their clinical response. Improvement was assessed using visual analogue scales by an independent clinician of pre and post treatment photographs.

Results: There was statistically significant improvement of global and focal facial pigmentation in patients treated with 595 nm LPDL, QS Nd:YAG, and LP Nd:YAG lasers. Optimum improvement was achieved by 50% of patients in the 595 nm LPDL group by 3 months, 60% of patients in QS Nd:YAG group after 3–12 months, and 70% of patients in the LP Nd:YAG group after 6–12 months. PIH risk was 38% after 755 nm LP Alexandrite

treatment, 33% after QS Nd:YAG, 6% after 595 nm LPDL and none after LP Nd:YAG treatment.
Conclusion: For treatment of freckles and lentigines in Fitzpatrick type III and IV skin, 595 nm LPDL and 532 nm LP Nd:YAG appear to be more effective with less complications compared to 532 nm QS Nd:YAG and 755 nm LP Alexandrite laser. 595 nm LPDL appear to achieve good results, but was associated with a small risk of PIH. 532 nm LP Nd:YAG achieved excellent results and is associated with no PIH risk in this study.

#138

308 nm EXCIMER LAMP vs 308 nm EXCIMER LASER: A PROSPECTIVE COMPARATIVE STUDY IN THE TREATMENT OF VITILIGO

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Background: The 308 nm excimer lasers and 308 nm excimer lamps have both been shown to be effective in the treatment of vitiligo but a direct comparison has never been performed. The objective of the study was to compare the efficacy of those two devices.
Study: Controlled prospective monocentric intra individual comparative study in patients with symmetrical vitiligo patches. In each patient 2 to 8 symmetrical vitiligo patches were treated. One side was treated with the 308 nm excimer laser (Talos®, Quantel) and one side with the 308 nm excimer lamp (308®, Quantel). Lesions were treated twice a week with the same doses in both sides for a total of 24 sessions. The evaluation was done by two independent physicians blinded to the treatment on direct light and UV light photos.
Results: Twenty patients were included. Three of them stopped the study for professional reasons. 104 lesions were treated (52 with lamp and 52 with laser). The two treatments showed similar results in term of efficacy (equivalence test for a repigmentation of at least 50%: $p = 0.006$). The tolerance was good and comparable with the two devices. The lamp induced more erythema than the laser (mean MED: 278 and 225 mJ/cm^2 for laser and lamp, respectively). The length of the sessions was longer with the lamp as compared to laser.
Conclusion: The 308 nm excimer lamp and laser showed a similar efficacy in treating vitiligo. Although inducing more erythema and being a little bit slower than the laser, the ratio cost/effectiveness appears more favorable for the lamp.

#139

EFFECT OF IRRADIATION WITH UVA, 311 nm UVB, OR 632.8 nm HELIUM NEON LASER ON SPREAD OF PIGMENT AFTER MINIGRAFTING IN VITILIGO

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Background: Autologous minigrafting is a commonly used surgical therapy in stable vitiligo, involving the transfer of 1.5 mm punch grafts from a normally pigmented area to a depigmented area. Narrowband 311 nm UVB (NB-UVB) and ultraviolet A (UVA) are known to stimulate repopulation of melanocytes in vitiliginous skin. Recently 632.8 nm Helium Neon (HeNe) laser was proposed as alternative treatment for segmental vitiligo without long-term side effects like photoageing and photocarcinogenesis. Aim of this study was to evaluate the clinical effects (onset and degree of repigmentation) of NB-UVB, compared to UVA, HeNe laser and control (no post-treatment) after autologous minigrafting in patients with stable non-segmental vitiligo.
Study: In a randomized controlled observer-blinded study, five patients were included with stable non-segmental vitiligo. In each of four 2×2 cm areas located on the torso or upper extremities, four 1.5 mm (1.8 mm^2) punch grafts were placed. These four areas were randomly allocated to NB-UVB, UVA, HeNe laser and no phototherapy. Phototherapy was given twice a week during three months. Directly after the last treatment and at three months, pigment spread was assessed by a blinded physician.
Results: Preliminary results in five patients directly after the last treatment showed pigment spread in NB-UVB (mean repigmented area of 3.9 mm^2) and UVA (4.7 mm^2) compared to HeNe laser (1.0 mm^2) and no treatment (0.7 mm^2) (non-significant).
Conclusion: In this study both NB-UVB and UVA were effective in inducing spread of pigment after autologous minigrafting in stable non-segmental vitiligo. Spread of pigment did not occur without additional treatment or with HeNe laser as adjuvant.

DENTISTRY/ORAL AND MAXILLOFACIAL

#140

LASER USE IN DENTAL PROSTHETIC SURGERY: STATE OF THE ART

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Background: The use of CO_2 laser beam in oral surgery has several advantages: bloodless surgery, no scar formation (after healing), no need for suture, immediate decontamination of the surgical site, good visibility of the field of surgery, fast work, positive psychological impact on patients.
Study: The use of CO_2 laser in prosthetic surgery is helpful. The no need for suturing avoids the anatomical deformation of the surgical site and the decrease of the vestibulum deepening of the crest. The bloodless surgery and the low inflammatory reaction decrease the post surgical discomforts and patient complaints.
Results: Several clinical cases (Prosthetic Fibroma, Floated ridge, vestibulum deepening, crown lengthening, removal of gingival pigmentation (Melanin), removal of gingival Amalgam tattoo, Esthetic correction of lips' design, . . .) will be showed and discussed. The clinical procedure: step by step, the limits and the advantages of the laser use will be exposed.
Conclusion: Surgeries were done using the laser output power ranging from 2 to 10 W in a continuous or super-pulsed and focus

mode. The beam diameter was 0.3 mm, which allowed the dissection of oral tissues with high precision or a soft peeling. The complete and good quality of Healing took place with minimal post-operative, discomfort and pain complaints. The use of CO_2 laser in prosthetic surgery gave better results than those of conventional treatment.

#141

CLINICAL TREATMENT OF TEETH HYPERSENSITIVITY

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Background: Previous study showed the possibility to seal the dentinal tubules by means of Nd-YAG laser. The aim of our study was to verify the efficiency of laboratory study on vital teeth.
Study: Laser irradiation conditions used were: Nd - YAG (Fotona Laser system; Fotona- Slovenia); 0,5–0,75 Watts; VSP pulse (120 μsec,); Beam diameter: 200 μm; 10 Hz; scanning speed: 2 mm/sec. (Pd 0,5 W = 1591,55 W/cm^2; Pd 0,75 W = 2387,325 W/cm^2). Before treatment, the surfaces of dental necks are covered by means of graphite substance. The laser beam is used without contact and with an angle of 45° with the surface. The lasering is used until complete removal of graphite. The evaluation of hypersensitivity reduction was made as following: The intensity of pain was evaluated before treatment and after by means of application of air flow on the surface of each tooth with 1 cm distance from the surface and during 3 seconds. The degree of hypersensitivity was evaluated using a graduated scale ranged from 0 to 10 before treatment and immediately after. The follow up recall of each patient was done one week later, 6 months and 1 year after treatment.
Results: The Mean of hypersensitivity before treatment was $7{,}787 \pm 0.8876$ and 2.912 ± 1.506 immediately after treatment. The means and SD of hypersensitivity were: $1{,}77 \pm 1.467$ at one week, $0{,}9180 \pm 0.34$ at 6 months and $0{,}78 \pm 0.21$ at 1 year after treatment.
Conclusion: Laser irradiation conditions used in our study are therapeutically relevant and efficient against teeth hypersensitivity.

#142

OPTICAL COHERENCE TOMOGRAPHY AND SCANNING ELECTRON MICROSCOPY ANALYSIS OF MICROABRASSION EFFECTS IN DECIDUOUS TEETH ENAMEL

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Background: The objective of this work was to study the effects of microabrassion in deciduous teeth enamel. The microabrassion was done in a vestibular surface of health deciduous teeth (n = 68) with 3 different materials: (A) phosphoric acid with and extra-fine pumice; (B) Opalustre® and (C) Whitness RM®.
Study: Each application was accomplished with rubber cup and contra-angle handpiece by 10 s, under controlled pressure and rotation. The teeth were submitted to Optical Coherence Tomography and Scanning Electron Microscopy analysis at 500 and 1000 μm from the center of the rubber cup after 0, 3, 5, 7 and 10 applications.
Results: It was observed at 500 μm of the center it was smaller than at 1000 μm in the material (A) after 10 applications; the material (A) presented smaller values of waste at 500 μm after 7 and 10 applications and at 1000 μm after 10 applications; at 500 μm after 3 and 5 applications material (A) have less waste than material (B), but it didn't differ from material (C); The materials (B) and (C) presented larger waste values. In conclusion, the microabrassion with Whitness and Opalustre materials have the largest waste values, and could be recommended for deciduous teeth.
Conclusion: The phosphoric acid didn't present values of waste, suggesting new studies with this material. The materials promoted pattern of conditioning type I and II. And the OCT technique was able of mensurar the waste promoted in the substratum, and could become an important clinical tool in the control of waste of dental enamel.

#143

INVESTIGATION OF DENTAL HARD TISSUE AFTER Er:YAG LASER IRRADIATION

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Background: The purpose of this study was to investigate the dental hard tissues morphology after Er:YAG laser-assisted treatment using *en-face* Optical Coherence Tomography (OCT) and Scanning Electron Microscopy (SEM) analysis.
Study: Thirty single- and multi-rooted freshly extracted human teeth free of caries were used in this study. All teeth were randomly divided into two study groups, group I (laser) and group II (control). In group I, the dental hard tissues were prepared using Er:YAG laser. The laser parameters used were VSP mode, 40–320 mJ and 10–20 Hz. In group II, the dental hard tissues were prepared using conventional methods. The dental hard tissues were first investigated using en-face Optical Coherence Tomography prototype, based on transverse scanning and operating at 1300 nm. Then the samples were sectioned transversally and submitted to SEM analysis.
Results: Both investigation methods demonstrated qualitatively the surface morphology after Er:YAG laser-assisted treatment, which was considerably more suitable for filling as compared to the control group, in which the dental hard tissues were prepared conventionally.
Conclusion: The en-face OCT method provided a superior non-invasive, in depth and real time investigation method, while the SEM analysis offered more accurate surface information. Moreover, based on the results of both investigation methods, it may be concluded that Er:YAG laser-assisted treatment provides an improved surface morphology of the dental hard tissues.

#144

FTIR SPECTROSCOPY MONITORING CHEMICAL CHANGES IN ENAMEL, DENTIN AND BONE DUE TO LASER IRRADIATION

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Background: Lasers emitting in the 3 micrometers region are strongly absorbed by hydroxyapatite and water.of biological tissues. When these lasers irradiate dental hard tissue they can change its chemical and crystallographic properties. In some laser irradiation conditions the resulting surface can be chemically more resistant or harder depending mainly on the temperature reached due to laser action. So it is important to know any chemical changes in order to avoid possible undesired ones. Laser irradiation has been considered a promissory alternative for caries prevention, which was firstly suggested with the use of carbon dioxide lasers. Infrared lasers have also the ability to cut bone tissue with less mechanical damage and more defined cut borders than drill. This study used the Fourier Transform Infrared Spectroscopy (FTIR) in order to monitor the chemical changes in enamel, dentine and bone after Er:Cr:YSGG laser irradiation.

Study: 10 samples of human enamel, 10 samples of dentine, and 10 samples of rabbit bone were cut in blocks of 3×3 mm and were polished down to 100 micrometers thick. All samples were analysed by Attenuated Total Reflection- FTIR (ATR-FTIR) before and after Er:Cr:YSGG laser irradiation. During irradiation samples were positioned in a motorized translation stage to assure uniform irradiation and avoid pulse overlapping. The area under phosphate (1030–1150 cm^{-1}), amides (1680–1200 cm^{-1}), water (3600–2400 cm^{-1}) and carbonate ($\sim$875 cm^{-1} and 1560–1410 cm^{-1}) bands were calculated and normalized. All data analysed by ANOVA/Tukey test at 5% significance.

Results: It was observed under specific irradiation conditions, for all tissues that there was a significant decrease in the water content, amides I and III. It was also observed increase in the FWHM of carbonate and phosphate bands, indicating crystalline changes. The dentin showed different composition depending on the direction of tubules.

Conclusion: The results presented indicate that FTIR is an efficient method to determined chemical changes in irradiated samples.

#145

Er:YAG LASER AND ADHESIVE DENTISTRY: STATE OF THE ART

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Background: Er-YAG laser, due to its affinity for hydroxyapatite and water, is -at the moment- the adequate wavelength able to prepare dental cavities.

Study: The aim of this lecture is to analyze and discuss the: ablated volume (dentine, enamel) via SEM and interferometric observations and quantification, results in terms of superficial modifications of healthy enamel and dentine (enamel micro-cracks, dentine microhardness) as well as in case of carious decays; results, once more, in terms of adhesion (mechanical properties, microleakage) of composite resins; possible re-treatment in case of unsatisfactory composite resin restorations.

Results:

Conclusion: Some clinical observations will illustrate the protocols based on those previous results used in a university hospital.

#146

308 nm EXCIMER LASER FOR THE TREATMENT OF ORAL LESIONS: A PILOT STUDY

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Background: We aimed to implement the use of a 308-nm excimer laser to treat oral T-cell mediated conditions, such as cutaneous GVHD, oral autoimmune bullous diseases, and oral lichen planus. We hypothesized that UVB effects on lesional T-cells will improve these lesions and treatment of oral lesions will be well tolerated with little to no adverse effects. Historically, oral lesions associated with these conditions are quite symptomatic and can present with pain and burning, that at times could significantly compromise patient nutrition. Patients are often prescribed a mouthwash or oral gel with anti-inflammatory, antibacterial, antifungal, or anesthetic agents. The effects of these agents are minimal at best. Currently, there is not one therapy that consistently and effectively alleviates symptoms or induces lesion resolution. Since the oral cavity is an area which poses a challenge to conventional phototherapy, the ability to deliver UVB in a targeted and lesion-specific manner becomes even more valuable for oral mucosal lesions.

Study: Subjects received 200 MJ/cm^2 dose with an excimer 308 nm laser fitted with a light delivery system for intraoral lesions to three treatment areas at the first visit. The treatment was repeated at 48 hour intervals for a total of three treatments. The dose was increased by 100 MJ/cm^2 at the two following visits until a maximum dose of 400 MJ/cm^2 was achieved. The lesions were evaluated via a five point scale and photographed at all visits. Patient symptoms, food diary, and response were documented.

Results: Four patients have completed our protocol thus far. All patients showed improvement in erythema, ulceration, edema, and pain in treated areas. Follow-up visits showed continued improvement from baseline in treated areas at 14 days and one month post-treatment.

Conclusion: There have been no adverse events, no subject complaints, and no pain with treatment. We plan to treat a total of 10–15 patients with this protocol. This therapy will provide a much-needed solution to the problem of oral mucosal conditions for which there is no current treatment to induce sustained lesion resolution.

#147

THE PERFORMANCE OF SHORT LINGUAL FRENULUM SURGERY BY TWO DIFFERENT LASER WAVELENGTHS: A CLINICAL COMPARATIVE STUDY

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Background: The tongue is an important oral structure that affects speech, the position of teeth, periodontal tissue, nutrition, swallowing, nursing, and certain social activities. Short lingual frenulum limits the range of motion of the tongue, impairing its ability to carry out its functions. The consequences of not treating improper tongue function can also influence face development and dental therapy. Malocclusion as lateral posterior cross-bite and anterior open bite can be one of this consequences. To evaluate

and compared the clinical efficiency and the performance of two different laser wavelength for short lingual frenulectomy.
Study: 22 lingual frenulectomies were performed using 2 different wavelengths: **CO_2** superpulse mode 4 W, frequency 250 Hz, pulse duration 250 μs, spot size diameter 0.4 mm and power density 3185 W/cm^2 and **Er:YAG** in VLP mode (1000 μs), 150–180 mJ, 8 Hz, spot size diameter 0.8 mm fluence 30–36 J/cm^2. During surgery and immediately after bleeding, pain or other complications were registered. Check-ups were done at 7,14 and 28 days after surgery in order to follow and evaluate the healing process of the surgical site.
Results: Whatever the wavelength used, frenulectomies were performed in good clinical situations without any complication. None of the patients complained of any pain. In all the frenulectomies done with CO_2 laser there was no bleeding at all. Instead, with the Er:YAG laser in all the 11 cases due to bleeding, coagulation was obtained using a tampon with a haemostatic solution applied with pressure. Seven days after surgery no postoperative complications like swelling, bleeding or pain were observed and a thin layer of fibrin covered the treated zone. Complete healing was observed after a maximum four weeks long period.
Conclusion: Using Er:YAG laser and superpulse CO_2 laser, short lingual frenulectomies can be performed successfully without any real postoperative complications and with good and fast healing.

#148

USE OF Er:YAG LASER TO IMPROVE THE TREATMENT OF DENTAL ROOT FRACTURES

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Background: The aim of this in vitro study, is to compare the microleakage of root perforation sealed with MTA and Er:YAG Laser assisted MTA.
Study: 39 recently extracted human monoroots were used. Two cavities were prepared on each root surface. Cavities were prepared with a stop-diamond bur to 1,7 mm diameter and 2 mm depth. On each root, the exposed dentine of one cavity was irradiated by means of Er:YAG Laser following: 200 mJ/pulse, with air-water spray (20 ml/min), 10 Hz and 0,8 mm of beam diameter, prior to the MTA filling. All cavities were then sealed with MTA. All teeth were submitted to thermocycling (1000 cycles over a 24 hours period, and immersed in 2% Methylene Dye solution for 12 hours. The penetration of Methylene Blue in microleakage for each cavity was observed and recorded using a digital optical microscope.
Results: The dye penetration in cavities sealed by Er:YAG Laser assisted MTA was 50% less compared to cavities only sealed with MTA.
Conclusion: The use of Er:YAG Laser bean prior to MTA sealing, increases very significantly the quality of cavity sealing.

#149

ABILITY OF OPTICAL COHERENCE TOMOGRAPHY TO DETECT CARIES BENEATH COMMONLY USED DENTAL SEALANTS

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Background: Current technology does not offer monitoring for carious activity beneath dental sealant, thus limiting the clinical use of a potentially important prevention tool. The objective of this study is to evaluate the ability of OCT monitoring to detect caries beneath four commonly used dental sealants.
Study: Forty extracted teeth were divided into two groups of 20 carious and 20 non-carious teeth respectively, as determined by visual inspection. After radiographs and OCT imaging, 5 teeth from each group were then randomly assigned for sealant placement with one of four commonly used dental sealants: Clinpro™, Fugi Triage™, Embrace Wet Bond™, and Delton™. Following sealant placement, teeth were again radiographed and imaged with OCT. Teeth were sectioned and examined histologically. The gold standard was histopathological diagnosis. OCT, radiographic, and histolological images were scored separately as healthy/not healthy by two separate blinded pre-standardized scorers.
Results: Caries detection was significantly more accurate using OCT than using radiographs or visual examination. Agreement with histology (Cohen's kappa) was best for OCT pre-sealant ($k = 0.886$), followed by clinical exam ($k = 0.700$) and OCT post-sealant ($k = 0.634$). Radiographs agreed very poorly with histology: k(pre-sealant = 0.091; k(post-sealant) = 0.251. Using positive (PPV) and negative predictive values (NPV), caries detection was more accurate using OCT than with visual or radiographic examination. Of the four dental sealants, Delton™ provided excellent PPV and the best post sealant NPV.
Conclusion: OCT provides lower rates of false positives and false negatives than clinical or radiographic examination. This relatively low rate of false positives may be acceptable, especially within the context of high risk and underserved populations. Though OCT was able to detect tooth decay beneath each of the four most commonly purchased dental sealants from dental distributors, Delton™ was most amenable to OCT-based detection of tooth decay beneath dental sealant.

#150

PERIODONTAL TISSUE CHANGES CAN BE IMAGED DURING ORTHODONTIC TOOTH MOVEMENT

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Background: Orthodontic treatment always needs careful biomechanical considerations to prevent potential side effects such as root resorption, decalcification, and/or periodontal problems which can causeirreversible bone destruction. Although the conventional radiography is one of the most popular diagnostic aids in clinical dentistry, it gives us only over-lapped two dimensional images which may sometimes confuse diagnosis. Optical coherence tomography (OCT) is a non-invasive tomographic medical diagnostic imaging modality with a high resolution which can give near-histological images using safe broad bandwidth light source. Because the OCT uses a near-infrared wavelength, the examination is of minimal discomfort for the patient also. Periodontal ligament itself plays important roles in functions of teeth with specified receptors in it and is also the

first place where sequential cycle of teeth movement starts from during orthodontic treatment. Although there has been wide-ranged researches about periodontal ligament, the role of periodontal ligament around teeth is not disclosed completely yet. If we can identify very early responses of periodontal ligaments to outer stress, it will be so helpful for us to achieve precise differential diagnosis of various undesirable intra-oral situations, for example, affected teeth by bruxism, uneven load distributions on abutment teeth, causing teeth of occlusal interferences, and initial teeth responses just after inserting orthodontic devices.

Study: OCT system: Time-domain OCT system was implemented with a fiber based Michelson interferometer to evaluate periodontal ligament. It utilized a broadband light source having an output power of 4 mW. The center wavelength was $l_c = 1310$ nm and the bandwidth was $Dl = 58$ nm. Animal selection & Force applications : Six 10-weeks white rats were selected. Different levels (0, 5, and 10 gm) of light distractional orthodontic forces were applied on mandibular incisors of six white rats. Under general anesthesia, prepared springs were inserted between mandibular incisors. The lateral ends of springs were positioned on 2 mm above cemento-enamel junctions to avoid spring distortion by rapid tooth eruption and/or irritation during mastication. Each rat was cared in individual cage for 5 days. OCT imaging and X-ray radiography: After 5 days, OCT imaging evaluated periodontal ligaments around mandibular incisors of each rat. To compare with the results from intra-oral digital X-ray radiography, two dimensional OCT images were acquired instead of three dimensional ones. The target area for imaging was periodontal ligament and ligament space at 2 mm beneath cemento-enamel junction where is the easiest area to be examined with OCT in real clinical situation and can show most critical responses of periodontal ligaments in cervical area under orthodontic forces. The focusing laser which is used for visible focusing because the light source is invisible is set at 2 mm beneath cemento-enamel junction with right angle. Intra-oral radiography evaluated the same area for comparison before each OCT imaging. The width of periodontal ligament in both radiography and OCT images were compared. Every 20 points were selected in tensile and compressive regions. Periodontal ligaments in only mesial and lateral portion around teeth could be measured in radiography, although the widths were measured from all directions in OCT images.

Results: In intra-oral radiography, enlarged periodontal ligament spaces could be identified with magnified radiographic images. But only mesial and lateral portion of periodontal ligament could be measured because the overlapped portion by teeth. The same teeth were also evaluated with OCT. OCT showed more precise tomographic images of periodontal ligaments and dynamic mechanical changes of ligament according to different forces. After data logging, OCT image can be converted into more visible one for easier diagnosis for clinicians. The same color in logging images showed the tissue which has same optical properties. The precise figures of compressive and tensile periodontal ligament could be traced using these images. Solid images of ligament between alveolar bone and teeth in OCT showed active responses of periodontal ligament under orthodontic forces from multi-directions not only the lateral gaps shown in radiography. In addition, outer soft tissue including epithelium which is difficult to be distinguished in radiography was also defined clearly in OCT images. The measured widths were compared. Although radiography and OCT showed similar tendencies of periodontal ligaments' width according to the force increase, OCT showed larger measurement in both compressive and tensile sites. In the case of OCT, the differences between maximum and minimum measurement also larger than those from radiography. The standard deviations in measured ligaments' width also were larger in OCT than radiography except tensile side at 5 gm force. To reduce errors, one inspector measured all of the width 3 times with one week interval between each measurement. All of the data were analyzed using statistical software (SPSS® for Windows®).

Conclusion: Using time-domain OCT system, early responses of periodontal ligaments under light continuous orthodontic forces were evaluated. More precise and solid images of periodontal ligaments were acquired by this tomographic system, and active diagnosis on the minute changes of periodontal ligament responses under orthodontic forces was possible using multi-directional evaluations which are impossible with conventional intra-oral radiography. The results of this study support the possible applications of optical imaging to predict teeth movement precisely and prevent side effect in its early stage during orthodontic treatment.

#151

ANALYSIS IN VITRO OF PERIINCISIONAL THERMAL EFFECTS IN ORAL SOFT TISSUES INDUCED BY KTP LASER

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Background: There are still many controversies in oral pathology concerning the possibility to perform safe tissue examinations with laser devices, especially in diagnosis and treatment of potential dysplastic or neoplastic lesions. The objective of this study is to evaluate, the periincisional thermal effect induced in vitro by a KTP laser (SmartLite, ?: 532 nm, DEKA, Italy).

Study: The study was performed on pig tongue selected by its likeness with human oral mucosa. In the first step, forty-five mucosal specimens were taken by laser, using five different power settings 2 W- 2,3 W- 2,5 W- 2,7 W- 3 W (with increasing fluences from 141 J/cm^2 to 212 J/cm^2) nine samples by each power setting. All the samples were taken by the same operator. Moreover one scalpel specimen was taken as control. In the second step all specimens were analyzed at optical microscope by two different pathologists to evaluate the extent of thermal effects.

Results: At each power setting KTP laser allowed clear incisions. The thermal effects into the edges of the specimens were always extremely light and limited to few microns, both in the epithelium and chorion. The edges were always clearly readable, similar to the ones obtained in the scalpel control.

Conclusion: KTP cut effectiveness, is strictly related to the physical properties of this laser whose wavelength coincides with the peak of absorption of the reduced haemoglobin, making of this laser one of the most appropriate device in oral soft tissue surgery. This high cutting power leads to a poor thermal dispersion in the targeted tissues with subsequent reduced thermal artefacts. This in vitro study shows that KTP laser gives optimal results in the evaluation of oral soft tissue lesions permitting clear and safe histological analysis even of the extremely peripheral cellular layers.

#152

ASSESSMENT OF PULP VITALITY USING LASER SPECKLE IMAGING

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Background: The ability to monitor pulpal vitality is crucial for accurate diagnosis and optimal treatment planning. Currently, a reliable method does not exist to assess pulpal health and treatment response. The aim of this study was to develop and validate a non-invasive technique for detecting pulpal blood flow.
Study: We used 9 extracted human teeth ranging from upper and lower premolars to incisors. To simulate pulpal vasculature, the apical foramen of each tooth was enlarged to allow insertion of capillary tubing (0.25 mm inner diameter) into the base of the tooth. To simulate blood flow, Intralipid was pumped through the tubing at flow rates ranging between 0 and 0.040 ml/min. Using the method of laser speckle imaging (LSI), the teeth were transilluminated with 633-nm laser light and imaged on the opposite side with a CCD camera equipped with a macro lens. This transillumination approach was used due to the fact that enamel and dentin are materials which scatter light predominantly in the forward direction. Images collected prior to and during active perfusion of the tubing were analyzed with customized LabView software. A speckle flow index (SFI) was quantified from a region of interest selected on the buccal surface of the tooth.
Results: Our LSI method enables detection of the presence or absence of flow within *in vitro* teeth. Specifically, in the absence of flow (0 mL/min), the mean SFI was ~6580. At 0.040 ml/min, the mean SFI was ~8300. A clear separation existed in the SFI data, between 0 mL/min and >0 mL/min flow conditions.
Conclusion: These preliminary data suggest that LSI has the potential to serve as a non-invasive, real-time method for assessing pulpal perfusion and vitality. *In vivo* studies are warranted.

#153

EVALUATION OF PDT CELL KILLING EFFECT IN ORAL MICROBES INCLUDING ANTIFUNGAL RESISTANT CANDIDA

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Background: In the present study we studied the ability of Photofrin mediated photodynamic therapy to treat the bacterial strain S. mutans and different species of candida and Fluconazole and Amphotericin B resistant isolates.
Study: *S. mutans* were treated with PDT (630 nm) at 1.5 J/cm^2, 3 J/cm^2, 4.5 J/cm^2, 9 J/cm^2, and 18.5 J/cm^2 after being incubated with Photofrin (porfimer sodium) for 15 min. An XTT assay was performed on Biofilm grown on PMMA 1.5 cm^2 squares treated with Photofrin for 15 min and PDT (630 nm) at 9 J/cm^2, 27 J/cm^2, 54 J/cm^2, and 63 J/cm^2. ATCC Candida strains Candida albicans, C. glabrata, C. parapsilosis, C. krusei, and C. tropicalis were used. Fluconazole and AP resistant isolates of each of the following isolates were used for drug and susceptibility testing; *C. albicans*, *C. glabrata*, *C. guilliermondi*, *C. tropicalis and C. krusei*. The strains were pulled from a collection of isolates from the oral cavities of patients from a previous study on adults with AIDS. Candida (C. albicans, C. glabrata and C. krusei) grown on SDA plates were inoculated into YNB w/sucrose for planktonic experiments. Candida suspensions for biofilm experiments were introduced to pre-conditioned PMMA strips according to standardized protocols.
Results: Experiments demonstrate that S. mutans have a high level of susceptibility to the effects of porfimer sodium and 630 nm light resulting in a statistically significant reduction in viability ($p < 0.0004$; Mann-Whitney test). Light doses as low as 4.5 J/cm^2 resulted in a reduction of colonies to less than 0.1% of controls. In Candida planktonic and biofilm preparations PDT demonstrated significant killing in both antifungal (fluconazole and Amphotericin B) susceptible and resistant strains. Experimental conditions resulted in significant reductions in all strains ($p = 0.0006$).
Conclusion: The results of this study, thus far, demonstrate the efficacy of PDT for the treatment of infectious oral microbes including antifungal resistant isolate strains of Candida.

#154

MULTIMODAL TISSUE DIAGNOSTIC SYSTEM COMBINING TIME-RESOLVED FLUORESCENCE SPECTROSCOPY, ULTRASOUND AND PHOTOACOUSTIC IMAGING

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Background: A multimodal tissue diagnostic technology was developed, which combines three complementary techniques into one system: time-resolved fluorescence spectroscopy (TRFS) which provides an evaluation of tissue biochemical composition, ultrasonic backscatter microscopy (UBM) which reconstructs the tissue anatomy, and photoacoustic imaging (PAI) which allows for mapping of optical absorption related to tissue morphology and physiology (e.g. hemoglobin/angiogenesis.
Study: Different configurations of hybrid probes were designed integrating fiberoptics (600 μm, NA 0.22) for delivering excitation light and collecting fluorescence, with 45 MHz ultrasonic transducers for detection of ultrasonic and photoacoustic waves. Fluorescence was induced with a nitrogen laser (337 nm, 1 μJ/pulse) and recorded with the time resolution of 300 ps. Ultrasound signals were detected by the transducer with the spatial resolution on the order of 50 μm. Photoacoustic signals were excited by.
Results: The multimodal TRFS-UBM-PAI system and data coregistration were validated with tissue phantoms. In vivo hamster oral carcinoma model ($n = 22$) was used to test the TRFS-UBM system and demonstrate its ability for tumor detection. Fluorescence spectral intensity ratios of 635 nm to 460 nm were significant different ($P < 0.05$), as well as lifetime values at 460 nm, allowing for discrimination of four histological groups (normal, dysplasia, carcinoma in situ, and invasive carcinoma). An algorithm combining these fluorescence parameters provided the diagnostic discrimination for the four tissue groups with accuracy of 87.5%. Features extracted from ultrasound RF spectra (peak value, center frequency, fitting slope, bandwidth) were used to identify distinct tissue types.
Conclusion: Current results demonstrate that distinct biochemical, anatomical, and functional features of tissues can be

simultaneously extracted by the fusion of these three techniques, suggesting great clinical potentials for multimodal detection of tumors.

#502

AN EVALUATION OF INNER-TUBULAR FLUID MOVEMENT AND THE HYDRAULIC PRESSURE PRODUCED WITH ER,CR:YSGG LASER AND HIGH SPEED DRILL

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Background and Objective: Pain sensation in human teeth has been associated with dentinal tubules fluid movement and hydraulic pressure transmitted to nerve endings during drilling with conventional dental drills. Clinical reports on hard tissue lasers show that patients treated with the laser require minimal to no anesthesia while conventional high speed is painful and anesthetic is necessary. The objective of this presentation is to report on measurements of pressure from tubular fluid movement produced during cavity preparation with an 2.78 μm Er,Cr:YSGG laser and the high speed drill.
Materials and Method: The laboratory model comprised of a dentin disc mounted over a liquid filled cavity within an acrylic block connected to a first capillary tubing open to the atmospheric pressure and a second tubing blocked by a fluid filled syringe. Each disc received ten consecutive laser or drill craters, 1 mm deep before every measurement. Transmitted pressure from the cut surface through tubules to the cavity was captured as volume of liquid displaced in the open capillary tube.
Results: The Er,Cr:YSGG laser showed no displacement of fluid and with the drill a volume of 2.8 mm^3 of liquid was displaced. The amount of dentin removed with each device for each measurement was 2.6 mm^3. The drill displaced liquid was approximately the same as the volume of tissue removed. The lack of fluid displacement with the laser maybe attributed to the sequential vaporization mechanisms of cutting where pressure build-up and release is spontaneous, due to the temporal structure of the pulse, and pressure does not become localized to transmit.
Conclusion: According to this study dentinal tubules transmitted pressure with and Er,Cr:YSGG laser is not detectable where with a high speed drill the pressure correlated to fluid displacement of similar volume as the tissue removed. More studies are needed to understand tubular fluid movement during laser cutting of dentin and the reduced pain perceived from an Er,Cr:YSGG laser cavity preparation on vital teeth.

#155

AN EVALUATION OF OPTICAL APPROACHES TO ORAL CANCER SCREENING AND DIAGNOSIS

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Background: Oral cancer accounts for 2–4% of cancers diagnosed annually in the United States. U.S. survival rate from oral cancer has not improved during the past 50 years, mostly due to late stage diagnosis. A wide range of non-invasive optical approaches to oral cancer detection are under investigation. Goal is to analyze the principles behind the technologies under development, and to evaluate their clinical effectiveness.
Study: Recent clinical diagnostic tools for early detection of oral cancer include tolonium chloride, Oral CDx® brush biopsy kits, Vizilite®, salivary diagnostics and imaging devices such as Velscope®, FastEEM4R System, IndentafiR, PS2-oralR, Optical Coherence Tomography and multispectral imaging systems. Optical approaches can be broken down into 4 categories: Photosensitizers, Spectroscopy/Fluorescence, in vivo microscopy and Optical Coherence Tomography. Each approach uses different markers of pre-malignant or malignant change, resulting in characteristic strengths and weaknesses for each modality.
Results: Photosensitizer-based diagnostics allow for 3-D mapping of large surface areas, and subsequent photodestruction. Limitations include systemic photosensitization, penetration depth, the need for specialized equipment, and lack of specificity. Spectroscopy/fluorescence-based devices include the VelscopeR, FastEEM4R, the IndentafiR, and the PS2-oralR. Preliminary results are encouraging. Challenges include low signal-to-noise ratio, difficulty in identifying source of signals, establishing definitive diagnostic milestones, limited tissue penetration. Currently, high cost precludes the clinical feasibility of in vivo microscopy. Early clinical trials using Optical Coherence Tomography have provided encouraging results.
Conclusion: Several new optical diagnostic approaches show potential as tools for in vivo oral diagnosis.

NURSING/ALLIED HEALTH

#156

SURGICAL SMOKE EVACUATION: COMPLIANCE AMONG PERIOPERATIVE NURSES

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Background: Research has documented that surgical smoke creates a serious workplace hazard for over 500,000 healthcare workers. Toxic gases create an offensive odor, small particulate matter causes respiratory complications, and pathogens may be transmitted within the surgical smoke to the surgical team. Research has also shown that evidence-based recommendations to minimize the hazards associated with surgical smoke are not being consistently followed by perioperative nurses. This study determined key indicators associated with compliance with smoke evacuation recommendations by perioperative nurses.
Study: Rogers' Diffusion of Innovation model was used to determine predictors of compliance including individual innovativeness characteristics, perceptions of the difficulty in following smoke evacuation recommendations, and organizational innovativeness characteristics. A descriptive explanatory/exploratory study was conducted involving a random sampling of 4000 AORN member nurses who were invited to respond to a web-based piloted survey during a two-month period. There were 777 completed responses representing a 19.4% response rate. The SPSS statistical computer package was employed to analyze the data using frequency/descriptive statistical techniques and bivariate analysis techniques to examine the relationship between

the key indicators and the level of compliance with smoke evacuation recommendations.
Results: Major findings revealed that individual characteristics are the most significant in influencing compliance while the specific key indicators that influence compliance include increased knowledge and training, positive perceptions on the recommendation attributes and complexity, and larger facilities with increased specialization, interconnectedness, and leadership support.
Conclusion: Promoting a safe surgical environment is a top priority for perioperative nurses. By identifying key predictors that influence compliance with smoke evacuation practices, a better understanding of the many factors that influence perioperative nurse practices will be fostered. Nurse training programs can be developed that directly address these key predictors so that a safe and healthy surgical environment free from surgical smoke can be promoted.

#157

IDENTIFYING OPTIMAL ENERGY SETTINGS FOR 980 nm CONTINUOUS EMISSION DIODE LASER LIPOLYSIS

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Background: Laser lipolysis is an effective method for selective body contouring and skin tightening. One drawback is the time consuming nature of the procedure. The purpose of this study was to identify power settings that would optimize operating room efficiency, patient comfort, and outcome.
Study: A series of 40 patients were treated for localized lipodystrophy under local tumescent anesthesia using a 980 nm continuous emission diode laser system (25 W) and 600μm optical fiber. Power settings ranging from 6–24 W were employed for each of four body areas: chin (n = 10); arms (n = 10); trunk (n = 10); and thighs (n = 10). Superficial skin temperatures were recorded every 2 minutes until 40°C was reached. Time to temperature endpoint, patient tolerance, and adverse skin changes were noted.
Results: Empirically, specific power settings were identified for each body area that resulted in a skin temperature of 40°C after @ 8 minutes of lasing. These settings were: chin 8 W; arms 12 W; trunk 16 W; and thighs 20 W. With these parameters there were no complications or complaints of pain. Power settings less than these resulted in significantly prolonged heating times and operating room times. Power settings greater than these resulted in undue patient discomfort, skin erythema and blistering (n = 3).
Conclusion: Power settings for laser lipolysis that result in optimal soft tissue heating create a more efficient operating room environment and greater patient safety. This benefits both clinicians and patients thereby facilitating this surgical procedure.

#158

A REVIEW OF MRI AND ULTRASOUND IMAGING: TECHNIQUES FOR IDENTIFYING AND MEASURING SUBCUTANEOUS STRUCTURES

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Background: MRI and ultrasound imaging can be used to locate and measure subcutaneous structures. MRI produces high resolution images of prominent subcutaneous structures, while less prominent structures are difficult to see. Depending on the frequency of an ultrasound wavelength, the ability to image prominent and less prominent structures varies. Two ultrasound systems with different wavelength frequencies and MRI images, captured at the same anatomical location, can be used together to identify and measure subcutaneous structures more accurately than when the systems are used alone.
Study: MRI and ultrasound data was collected for two female volunteers at the same anatomical locations. An ultrasound system with a 20 MHz linear transducer was used to measure skin thickness on the medial lateral thighs. Another ultrasound system with a 13-6 MHz linear transducer was used to measure the thickness of subcutaneous fat. The skin thicknesses measurements from the 20 MHz system were used to identify and corroborate the skin thickness measurements from the 13-6 MHz system, and to validate continued measurement analysis of deeper subcutaneous structures. MRI data from the same location was compared with the ultrasound data. A measurement tool was utilized to compare thickness of subcutaneous fat from the MRI to fat imaged with the 13-6 MHz ultrasound system.
Results: Subcutaneous fat in the MRI was measured and used to validate the subcutaneous fat measured on the 13-6 MHz ultrasound images. Two subjects had subcutaneous fat imaged by the 13-6 MHz ultrasound and MRI; the same measurement procedure was utilized. The difference in the subcutaneous fatty tissue thickness imaged by the two methods was .03 mm in one subject and .34 mm in the other.
Conclusion: Combining ultrasound and MRI images results in greater accuracy identifying and measuring subcutaneous structures than when each method is used independently.

#159

OUR APPROACH TO ABLATIVE FRACTIONAL RESURFACING

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Background: Ablative fractional resurfacing (AFR) is a commonly performed outpatient procedure. While AFR is considered a safe treatment, serious side-effects such as infection, scarring and prolonged healing can occur. Diligent patient education and nursing care before, during and after the procedure are essential to avoiding these complications and to ensuring safe and effective outcomes.
Study: We have experience with over 2000 AFR procedures in our clinical practice. Our careful approach to patient education, pre-operative evaluation, pre-medication, anesthesia, eye protection, and post-operative wound care has resulted in an excellent safety record and high patient satisfaction. We present a systematic approach to caring for the AFR patient. We divide the procedure into the pre-operative, operative, and post-operative periods.
Results: For the pre-operative period, we discuss contraindications to AFR, key points for patient education, and a standard protocol for pre-medication. For the operative period we will review the AFR room set-up, our approach to prepping the patient, and our method for obtaining adequate pain control during the resurfacing procedure. We also review appropriate ocular protection when treating near eyelid skin. We will highlight the essential components and considerations for post-operative wound care. Immediately post procedure, careful skin care begins, and topical medication and wound dressings are applied before the patient leaves the office. Patient education

regarding proper post-operative skin care is reviewed, and appropriate follow-up evaluations of healing will be discussed.
Conclusion: This comprehensive approach to managing the AFR patient enhances procedural safety and comfort and improves patient outcomes and satisfaction.

#160

OUR APPROACH TO PEDIATRIC LASER PROCEDURES

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Background: Laser treatment is a safe and effective option for a variety of pediatric dermatologic conditions, including vascular malformations. However, treatment of patients in the pediatric age range requires special attention to pre- and post-operative education and skin care. Additionally, topical anesthetics must also be applied in appropriate quantities to avoid potential side-effects.
Study: Our laser center specializes in laser treatment of pediatric skin conditions. We have extensive experience with well over 10,000 pediatric laser procedures with an excellent safety record. We have no reported incidents of ocular injury from a laser procedure or complications resulting from improper use of topical anesthetic. We review our approach to pediatric treatment by dividing it into the pre-operative, operative, and post-operative considerations.
Results: We will discuss the importance of educating parents regarding the laser procedure and any post-operative care required. We review the safe use of topical anesthetics in the pediatric age range, and we provide recommendations regarding appropriate ocular protection based on treatment location. Post-procedural considerations are also discussed.
Conclusion: Our approach to treating pediatric patients maximizes procedural safety and enhances patient and parent satisfaction following laser treatment.

PHOTOBIOMODULATION

#161

EFFECTS OF LOW LEVEL LASER THERAPY ON STEM CELLS FROM THE HEART AND BONE MARROW-OVERVIEW OF IN-VIVO AND IN-VITRO STUDIES

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Background: Low-level laser therapy (LLLT) has been shown to biostimulate various biological processes. Our research was focused on the beneficial effect of LLLT application to stem cells prior to their implantation to injured skeletal muscle and the ischemic heart. The aim of another study was to evaluate the possible beneficial effects of implantation of mesenchymal stem cells (MSCs) that had been laser irradiated prior to their implantation into the infarcted rat heart.
Study: MSCs have been isolated from rat bone marrow and grown in culture. The cells were laser irradiated with Ga-Al-As laser (810 nm wavelength), labeled with 5-Bromo-2\'deoxyuridine (BrdU), and then implanted (control or laser-treated) into infarcted rat hearts. Hearts were excised three weeks later and cells were stained for BrdU and c-kit immunoreactivity.
Results: A better cell survival was achieved following implantation of cells that were pre-treated with laser. In the regenerative liver application of LLLT caused a significant increase in c-kit positive stem cells in the regenerative liver. Infarcted hearts that were implanted with laser-treated cells showed a significant reduction of 53% in infarct size compared to hearts that were implanted with non laser-treated cells. The hearts implanted with laser-treated cells prior to their implantation demonstrated a 5 and 6.3-fold significant increase in cell density that positively immunoreacted to BrdU and c-kit respectively as compared to hearts implanted with non laser-treated cells.
Conclusion: The findings of the present study provide the first evidence that LLLT can significantly increase survival and/or proliferation of MSCs post implantation into the ischemic/infarcted heart, followed by a marked reduction of scarring, and enhanced angiogenesis.

#162

LIGHT TO THE CAUSE OF THE BIPHASIC BIOLOGICAL RESPONSE IN DIFFERENT CELL TYPES

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Background: Many reports have shown the low level light triggers biphasic biological response in tissues, such as intracellular ATP production and activation of signaling mechanisms. Low level light with continuous wave can stimulate various biological activities; however, those activities will either become saturated or suppressed when the total light energy goes beyond certain fluence. In this study, we try to study the mechanism of this biphasic response occurring in-vitro. The goal of our study is to determine whether this biphasic response is resulted from the saturation of photo receptors or changing cell integrity by the heating process caused by the low level light giving.
Study: A continuous wave 810 nm diode laser is applied to several cell types, including murine embryonic fibroblasts and rat cardiomyocytes with various fluences. The dosimetry relation of intracellular ATP concentration can be drawn to provide the baseline of the further experiments. Then we will alter the laser to pulse from the continuous wave by changing one of the following parameters: repetition rate, duty cycles or pulse duration. Then we will conduct the same assay on the same cell types with the same laser and the same fluences.
Results: The intracellular ATP level was changed when the repetition rate changed from the continuous waves to pulse waves. This change has led us to postulate that the biphasic response is caused by the change of cell integrity by light irradiation, potentially the heating.
Conclusion: By testing the characteristics of laser, we are looking for the evidence that might help us to understand the mechanism of the biphasic response of light. Most important of all,

it might help us to further optimize the efficacy of low level light therapy.

#163

LED PHOTOMODULATION I: EFFECTS OF PULSED AND CONTINUOUS WAVE MODES ON PROCOLLAGEN PRODUCTS OF HUMAN SKIN FIBROBLASTS

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Background: The effect of exposure to various pulsed and continuous wave treatments on human dermal fibroblasts *in vitro* was studied using ELISA assay procollagen I production as the endpoint measurement. The study was designed to evaluate the complex interactions that occur between the light source and the cell.

Study: Human dermal fibroblasts in culture were exposed to a 590/870 nm LED array fixed at 3.8 mW/cm^2. In the pulsed mode, a matrix of exposure parameters was tested including: msec exposure 'on' times of 1 (single pulse), 10, 100, 250, 500, 1000; msec 'off' times of 10, 100, 250, 500, 1000; and total pulse numbers of 1, 10, 100, 250, 500, 1000. In continuous wave mode, a range of fourteen exposure times from 0.5 to 10^6 msec were tested. Four days after exposure, supernatants from the exposed fibroblasts were collected and assayed.

Results: Measuring percent change from control, the parameters tested produced a wide range of responses from 0% change to greater than 90% increase in procollagen I. Pulse duty cycles (msec 'on') of 100 and 250, and msec 'off' of 10 and 100, and number of 100 pulses produced the most procollagen, as did 100 msec and 10,000 msec in continuous wave mode.

Conclusion: These experiments show that procollagen production by human dermal fibroblasts *in vitro* can be modulated using pulsed and continuous wave modes. Responses to pulsed modes reveal a more complex pattern of cellular response to light than continuous wave mode.

#164

LED PHOTOMODULATION II: EFFECT OF ENERGY FLUENCE ON PROCOLLAGEN PRODUCTS OF HUMAN SKIN FIBROBLASTS

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Background: Delivery of pulsed or continuous wave 590/870 nm LED light modulates the production of procollagen I by human dermal fibroblasts *in vitro*. In pulsed mode, the number of pulses and exposure or on time of the LED pulsed mode the duty cycle determines the energy fluence delivered to the target. In continuous wave mode, the cumulative exposure time determines the energy fluence delivered to the target.

Study: Human dermal fibroblasts in culture were exposed to a 590/870 nm LED array with an energy density of 3.8 mW/cm^2. In the pulsed mode, a matrix of exposure parameters were tested including: msec 'on' times of 1 (single pulse), 10, 100, 250, 500, 1000; msec with 'off' times of 10, 100, 250, 500, 1000; and total number of pulses of 1, 10, 100, 250, 500, 1000. In continuous wave mode, a range of fourteen exposure times from 0.5 to 10^6 msec were tested. Four days after exposure, supernatants from the exposed fibroblasts were assayed by ELISA for procollagen I production.

Results: For pulsed parameters, procollagen production was highest for energy fluence of 0.01–0.24 J/cm^2 with a peak around 0.1 J/cm^2 for parameters of 250/100/100 (msec on/msec/off/# pulses). Continuous wave highest peaks were at 100 msec and 10,000 msec (0.0004 and 0.04 J/cm^2 respectively.

Conclusion: 0.1 J/cm^2 using a pulsed 590/870 nm LED parameters of 250 msec 'on' 100 msec 'off' 100 pulses was selected as most effective for procollagen I production.

#165

DIFFERENTIAL RESPONSE OF NEURONS TO LIGHT IRRADIATION IN AN IN VITRO DIABETIC MODEL

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Background: Neuropathy is a common complication of diabetes in which nerves are damaged as a result of high blood sugar levels. Damage to sensory neurons can result in pain, loss or alteration of sensation and damage to the motor neurons is manifested as muscular weakness. The purpose of this study was to compare the effects of different wavelengths of light on neurite extension of neurons in an *in vitro* diabetic model.

Study: Rat cortical and dorsal root ganglion neurons (DRGs) were cultured in media with either normal glucose (25 mM) or high glucose (180 mM) as a hyperglycemic diabetic model. Neurons cultured in high glucose were irradiated immediately after seeding and 24 hours later with either 810 nm or 980 nm wavelength light at a power density of 10 mW/cm^2 and fluences of 0.01, 0.05, 0.2, 1 and 5 J/cm^2. Cells were fixed at 48 hours post-seeding. For each group, a minimum of 20 individual neurons were randomly selected and digitally photographed. Neurite extension was measured by NeuronJ.

Results: High glucose concentrations in the media in both types of neurons significantly suppressed neurite extension. For cortical neurons subjected to high glucose concentration, light irradiation significantly promoted neurite extension with 980 nm light at fluences of 0.01, 0.05 and 0.2 J/cm^2 while 810 nm light did not significantly alter neurite extension. For DRGs grown in medium with 180 mM glucose, irradiation with 810 nm light at 0.01 J/cm^2 significantly increased neurite extension while irradiation with 980 nm light had a trend of inhibition.

Conclusion: These different neurons responded differently to the two wavelengths of light tested. The data indicate a greater sensitivity of the DRGs to both wavelengths of light. This differential response may be caused by differences in either chromophores involved or in the expression of the chromophores.

#166

LOW LEVEL LASER, 820 nm, ACTIVATES CREB BY AN ERK1/2 DEPENDENT MECHANISM

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Background: LLLT has been reported to modulate inflammation; therefore, information as to how LLLT modulates T-cells is important. LLLT has been shown to activate ERK1/2 and alter gene regulation in differing cell types. However, no reports have demonstrated whether LLLT activates the ERK1/2 pathway in human T-cells and little is known about the downstream phosphorylation of DNA binding proteins following LLLT-ERK1/2 activation. Study objectives: 1) determine whether LLLT 820 nm activated ERK1/2 in a human T-cell line and 2) identify ERK1/2 dependent phosphorylation of DNA binding protein(s).
Study: Jurkat cells were rested for 2d in serum free media, stimulated with varying doses of LLLT (0, 3, 9, 18 or 35 J/cm^2), rested for 15, 30, 60 or 90 min and harvested. Time and dose response activation curves were established for the phosphorylation of ERK1/2 (T202/Y204, T185/Y187) and CREB (S133) using ELISA which recognized the phosphorylated forms of the proteins. Cell lysates from treatment conditions activating ERK1/2 were analyzed via a DNA binding protein array which identified CREB (S133) as a possible LLLT sensitive protein. All statements of significance are supported by a $P > 0.05$, ANOVA.
Results: Exposure of cells to LLLT resulted in the phosphorylation of ERK1/2 in a time and dose dependent manner with peak activation occurring 15 min and 30 min post exposure of 9 or 18 J/cm^2. Analysis of the DNA binding protein array showed that LLLT exposure (9 or 18 J/cm^2, T = 30 min) resulted in CREB phosphorylation. A CREB p-133 ELISA demonstrated that exposure of cells to LLLT led to the phosphorylation of CREB at 5, 15 and 30 min with LLLT treatment doses of 3, 9 and 18 J/cm^2. Pretreatment of cells with OU126 inhibited both ERK1/2 and CREB phosphorylation.
Conclusion: Exposure of Jurkat cells to LLLT resulted in the transient phosphorylation of CREB via an ERK1/2 dependent pathway.

#169

PRELIMINARY STUDIES OF THE ANTIMICROBIAL EFFECTS OF LIGHT ACTIVATED COLLAGEN-EMBEDDED RIBOFLAVIN -5 PHOSPHATE IN-VITRO

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Background: Vitamin B2 (Riboflavin,), a naturally occurring compound and an essential human nutrient, acts as a photosensitizer for the inactivation of pathogens when exposed to UV light. This study was undertaken to determine whether visible light activation of collagen-embedded and non-embedded Riboflavin exhibits bactericidal activity in-vitro.
Study: Suspensions containing 0.5 McFarland Density Units of Pseudomonas aeruginosa or Staphylococcus aureus (ATCC) were used to create "lawns" on Mueller-Hinton agar plates (Cardinal Health). Riboflavin-5-phosphate (Sigma) solution was prepared in 0.12%–2% concentrations (NCERB). Paper disks (8.0 mm diameter) saturated with 40 μl of each solution and collagen disks (8.0 mm diameter) embedded with1% Riboflavin (CEE) were placed on the seeded agar plates (CERB). Each disc underwent individual photoradiation (457 nm, 300 mW CW output, 12.0 mm spot diameter) for 5, 10, or 15 min using a diode laser (CEE). An opaque mask was applied to prevent light exposure of the other disks during exposure. Control disks were placed and not photoirradiated. The growth inhibition zone (mm^2) was determined after 24 hrs of incubation (GIZ).
Results: The GIZ was compared to assess the bactericidal activity of the compounds. Representative data is shown in the following table:

Bacteria	Construct	[Riboflavin]	Photoradiation 457 nm, 300 mW, 12 mm diam.	GIZ (mm^2)
S. aureus	NCERB	1%	15 min	211.5
	CERB	1%	15 min	128.6
P. aeruginosa.	NCERB	1%	10 min	81.6
	CERB	1%	10 min	67.9

The GIZ for nonirradiated Control constructs was < 50 mm^2 in all cases.
Conclusion: Visible light photoirradiation of collagen-embedded and non-embedded Riboflavin at 457 nm was bactericidal on both strains of bacteria in this in-vitro study. Further studies for detailing and developing new antibacterial modalities for clinical use are warranted.
*- Supported by NIH NIGM Grant # 1R43GM087753-01.

#170

PHOTODYNAMIC THERAPY WITH NANOMETALOXIDES ON MICROORGANISMS

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Background: In recent years nanometaloxides have been of special interest due to their higher chemical reactivity as compared to that of similar materials in the bulk form. Of particular interest are nano-TiO_2 and ZnO, which have been widely used for their bactericidal and anticancerous properties.
Study: Using electron-spin resonance (ESR) coupled with spin-trap technique we examined the capability of TiO_2 and ZnO nanoparticles water suspensions to produce ROS with and without visible light irradiation. The possibility to excite these nanoparticles with visible light in order to enhance their antimicrobial activity was also tested.
Results: Electron-spin resonance measurements revealed that ZnO and TiO_2 nanoparticles are capable to produce ROS in water suspension. A remarkable enhancement of the ROS was found following illumination with blue light. Illumination was also found to enhance the biological activity of the nanoparticles.
Conclusion: The results suggest that nanoparticles alone or combined with visible light can be used for sterilization purposes.

#171

PROPHYLAXIS EFFECTS OF INTRANASAL LOW INTENSITY LASER IRRADIATION ON INFLUENZA A

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Background: Rapid antigenic evolution in the influenza A virus hemagglutininprecludes effective vaccination with existing

vaccines. Both zanamivir and oseltamivir reduce the time to symptom alleviation in both healthy adult and at-risk populations, but the clinical value of reducing symptom duration by between half a day and 1 day is debatable, particularly in otherwise healthy adults. Moreover, either vaccination or antiviral treatments might be iatrogenic, but there is zero risk for intranasal low intensity laser therapy (ILILT). The possible prophylaxis of ILILT treatment on influenza A will be studied from sirtuin viewpoint in this paper.
Study: Human nasal mucosa, olfactory nerve and intranasal microvascular blood (MOB) in homeostasis can resist influenza A virus infection (IAI), but MOB far from homeostasis is very susceptible to IAI. Sirtuin activities may maintain homeostasis. The effects of latitude, polyphenols, laser acupuncture and ILILT treatment on influenza A were compared with one another in terms of their shared sirtuin enhancement mechanism.
Results: ILILT treatment might promote the homeostasis establishment of MOB so that ILILT might be used for prophylaxis on IAI. This was supported by a gradient of increasing IAI prevalence with increasing latitude, polyphenol inhibition on IAI, and laser acupuncture on IAI since those treatments might share sirtuin enhancement mechanism.
Conclusion: There might be possible prophylaxis of ILILT treatment on influenza A.
*It was supported by National Natural Science Foundation of China and National 973 basic project.

#172

LED PHOTOMODULATION III: EFFECT OF WAVELENGTHS AND RATIO OF WAVELENGTHS ON GENE EXPRESSIONS IN HUMAN SKIN FIBROBLASTS

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Background: A variety of parameters with LED photomodulation can alter cellular response *in vitro*. The effects of one visible and one infrared wavelength were evaluated to determine the optimal ratio to produce a net increase in dermal collagen by altering the ratio of total energy output of each wavelength. The ratio between the two wavelengths (595 nm and 870 nm) was shifted in 25% increments.
Study: Human dermal fibroblasts in culture were exposed to a 595/870 nm LED array with total combined energy density fixed at 4.0 mW/cm^2. The ratio of 595/870 nm parameters were: 100%/0%; 75%/25%; 50%/50%; 25%/75%; and 0%/100%. These ratios were tested using pulsed duty cycle of exposure (250 msec 'on' time/100 msec 'off' time/100 pulses) and examined using commercially available extra cellular matrix and adhesion molecule RT PCR Arrays (SI Biosciences) for gene expression 24 hours post exposure.
Results: There were different expression profiles noticed for each of the ratios studied. Overall, there was an average (in an 80 gene array) of 6% directional expression difference. The greatest increase in Collagen I and decrease in Collagenase (MMP-1) was observed with 75%/25% ratio of 595/870 nm. The addition of increasing ratios of IR wavelengths causes an alteration in the gene expression profile. Even when the genes followed the same directional change, the ratios of the wavelengths caused variation in magnitude of expression.
Conclusion: Varying the ratios of specific wavelength intensity in multiwavelength light therapy can alter the resulting gene expression patterns.

#173

PHOTOBIOMODULATION ON TNF-ALPHA INDUCED EXPRESSION SUPPRESSION OF CIRCADIAN CLOCK GENES IN CULTURED NIH3T3 FIBROBLASTS

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Background: Campbell *et al.* (1998) found that 3 h of bright light exposure to the area behind the knee caused phase shifts of the human circadian rhythms, but Wright *et al.* (2002) did not find the circadian phase resetting. It was studied by using cellular model in this paper.
Study: The expression of the circadian clock genes in NIH3T3 fibroblasts was synchronized by 50% horse serum shock. Its suppression was induced with tumor necrosis factor (TNF)-alpha at 10 ng/mL. Its photobiomodulation was then done with low intensity 810 nm laser irradiation (LIDL) at dose[intensity (mW/cm^2)@irradiation time (min)], dose 1, 5@5; dose 2, 5@10; dose 3, 10@5; dose 4, 10@10; dose 5, 10@20. The mRNA expression level of the circadian clock genes *mPer1, mPer2, mPer3* and clock control genes *mDbp* was assessed by semi-quantification reverse transcriptase polymerase chain reaction (RT-PCR).
Results: LIDL at dose 1 and dose 5 promoted and inhibited the TNF-alpha induced expression suppression (TAES) of *mPer1, mPer2, mPer3* and *mDbp*, respectively ($P < 0.01$). LIDL at dose 2 inhibited *mPer1* TAES($P < 0.01$). LIDL at dose 3 inhibited the TAES of *mPer1* and *mDbp*
Conclusion: TNF-alpha induced inhibition effect of the circadian clock gene expression may be modulated with LIDL. It was supported by National Natural Science Foundation of China and National 973 basic project of China.

#174

RED LIGHT PROMOTION ON THE RECOVERY OF HYDROGEN PEROXIDE PRETREATED DIFFERENTIATED PC12*

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Background: Cellular rehabilitation is often used to study the cytotoxicity of drugs or radiation. Its photobiomodulation with red light (640?lt;/SPAN > 15 nm) from light emitting diode array (RLED) will be studied in this paper.
Study: The differentiated PC12 cells (dPC12) were subjected to hydrogen peroxide (H_2O_2) at 150 μmol/L for 0.5, 1, 3, 6 and 12 h, and then cultured in fresh media without H_2O_2 for 0, 1, 3, 6, 9, and 12 h, and then irradiated with RLED at dose[intensity (mW/cm^2) @ irradiation time (min)], dose[0.06@10, 20, 40 and 60], or dose[0.03@40] , dose[0.06@20] , dose[0.12@10] and dose[0.145@5], respectively. The cell viability and apoptotic rate were assessed by ATP Assay Kit and FAScan flow cytometer, respectively. The mRNA expression of brain-derived neurotrophic factor (BDNF) and caspase-3 were assessed by reverse transcriptase polymerase chain reaction (RT-PCR).

Results: dPC12 recovered from H_2O_2 induced injury. The cell viability and apoptotic rate of irradiated dPC12 vs non-irradiated dPC12 were 87.92% vs 59.39% ($P < 0.01$), and 7.11% vs 15.39% ($P < 0.01$), respectively, 6 h after removal of H_2O_2, and the cell viability was 73.12% vs 41.61% ($P < 0.01$) 36 h after removal of H_2O_2. Among the different dosages of fixed dose (72 mJ/cm^2) or fixed intensity (0.06 mW/cm^2), the irradiation at dose[0.06@20] was the most effective to attenuate H_2O_2-induced ATP change ($P < 0.01$) or apoptosis change ($P < 0.01$). In dPC12 irradiated at dose[0.06@20], BDNF mRNA level increased to 4 fold ($P < 0.05$), the caspase-3 mRNA level decreased to 0.7 fold ($P < 0.05$) respectively, compared to non-irradiation group.
Conclusion: RLED640 may promote the recovery of dPC12 from hydrogen peroxide pretreatment, which may be mediated by enhancing secretion of neurotrophic factors and down-regulating the apoptotic genes.
*It was supported by National Natural Science Foundation of China.

#175

TRANSCRANIAL LOW LEVEL LIGHT THERAPY FOR TRAUMATIC BRAIN INJURY: IN VITRO AND IN VIVO STUDIES

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Background: Transcranial low level light therapy (LLLT) using red or near-IR lasers or LEDs is in clinical trials for stroke, and is under investigation for other brain disorders such as Alzheimer's and Parkinson's diseases. The light is thought to be primarily absorbed by cytochrome c oxidase, which is unit four in the mitochondrial respiratory chain. Since cortical neurons have high mitochondrial activity they respond well to light. We tested whether LLLT may have applications in treating traumatic brain injury (TBI) by a combination of in vitro and in vivo studies.
Study: We isolated and cultured cortical neurons from embryonic day 16 mouse brains. We used a mouse model of TBI produced by a controlled weight drop method and neurological testing was accomplished by performance testing (beam walking and balancing etc). Histology was done on mouse brains removed at necroscopy Mice with severe TBI were treated with a single exposure to laser light (670-nm. 810-nm or 980-nm) at an irradiance of 150 mW/cm^2 for 4 minutes to deliver an energy density of 36 J/cm^2.
Results: Mouse primary cortical neurons cultured in vitro and subjected to LLLT had elevated ATP levels, increased production of mitochondrial ROS (superoxide) and increases in mitochondrial calcium. Both 670-nm and 810-nm were effective and there was no major difference between laser and LED of the same wavelength. LLLT also protected neurons from excitotoxicity cell death caused by added glutamate. A single transcranial exposure to 670-nm or 810-nm laser 4 hours post-TBI produced better neurological scores compared to untreated control that lasted for the entire 28 day follow up period. Histological analysis of brain sections at the end of the follow up showed a smaller lesion area in the laser treated mice.
Conclusion: Transcranial LLLT is a promising novel approach to treating TBI that has had a history of failed clinical trials involving a multitude of pharmacological interventions. Further studies are underway.

#176

NEAR-INFRARED LIGHT TREATMENT IN AN IN VITRO MODEL OF TRAUMATIC BRAIN INJURY

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Background: In TBI, Mitochondrial dysfunction can lead to energy depletion, free radical release, and further cell death pathway activation. In the 70s and 80s, electron microscopy studies confirmed that mitochondrial swelling was part of the subcellular changes following brain injury, and regional brain metabolite level alterations supported mitochondrial dysfunction in TBI. Another mechanism emerging as important in TBI is apoptosis. Early in vitro and in vivo experiments in ischemia demonstrated that neuronal cells under specific conditions of substrate deprivation could follow a preprogrammed pathway of controlled cell death. Apoptosis demonstrated in TBI was quickly correlated with mitochondrial integrity and function.
Study: Photobiomodulation by far-red to near-infrared (630–1000 nm) light [NIR-PBM] has been shown to improve recovery from ischemic injury in the heart, attenuate degeneration in the injured optic nerve, and protect against mitochondrial dysfunction in the retina. Mechanistic studies have shown that NIR light interacts with the mitochondrial enzyme cytochrome oxidase, triggering signaling mechanisms that result in improved energy production, antioxidant protection and cell survival.
Results: These studies were performed to test the hypothesis that NIR-PBM will improve cellular viability and attenuate cytoxicity using in vitro models of TBI. After 6 days in culture, neurons from 16-day gestation mouse fetuses were insulted with compression (900 g weight) and/or metabolic compromise using chemical hypoxia. Cells were treated with 670 nm LED-PBM (2x/day, 5 minutes, 8 J/cm^2 energy density) for 3 days following the insult. On the 9th day, the effects of NIR-PBM were analyzed using measurements of cell viability and mitochondrial function. The experiments demonstrated that NIR-PBM treatment enhanced mitochondrial function and cell viability, and support the potential for NIR-PBM in the treatment of in vivo TBI injuries.
Conclusion: Current therapies for TBI are limited, and dependent on surgical and/or pharmacological intervention. NIR-PBM may represent an innovative therapy for injury processes in which mitochondrial dysfunction plays a role.

#177

DEVELOPMENT AND PRECLINICAL TRIAL OF PHOTOACTIVATED ANTIMICROBIAL COLLAGEN FOR WOUND CARE IN A MURINE MODEL

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Background: Millions of surgical, traumatic and iatrogenic wounds occur annually, requiring appropriate management to facilitate healing and reduce potential infectious complications. The objective this study was to examine the feasibility of using photoactivated collagen-embedded riboflavin-5-phosphate in a murine infected wound model.
Study: Female retired breeder Balb/C mice (n = 60, Jackson Labs) were anaesthetized with 50% CO_2: 50% O_2. Axially oriented 1 cm

incisions were made on the dorsal midline after shaving and cleaning with 70% ethanol. An 8.00 mm tip of a cotton swab was inserted in each wound after soaking in 1 McFarland unit density ($\sim$3–5 $\times$ 10^6 CFU) bacterial suspensions of Pseudomonas aeruginosa or Staphylococcus aureus. The incisions were closed with 2 skin staples, and animals recovered for 24 hrs. The animals were anaesthetized with IP Xylazine and Pentobarbital. The staples were removed, wounds were reopened and 1 cm $\times$ 1 cm Riboflavin-5-phosphate/collagen wafers (CEE) were inserted. The area was irradiated at 457 nm (300 mW output, 1 cm spot diameter) for 15 min using a diode laser (CEE) immediately after insertion. The incisions were reclosed with staples and the animals were individually caged. Control group animals were handled similarly but did not receive the implant or photoradiation. Animals were euthanized at 24 hr intervals (24–144 hr) post therapy and quantitative wound bacterial counts (CFU/g tissue) were determined to measure bactericidal efficiency.

Results: Treated wounds demonstrated reduced colony counts at all time intervals. Inhibition of bacterial growth at 144 hrs was 64.7% for the Pseudomonas and 44.1% for the Staphylococcus groups respectively.

Conclusion: This preliminary study demonstrated that photoradiation at 457 nm after placement of collagen-embedded riboflavin-5-phosphate inhibits bacterial growth in a murine infected wound model. Further studies to develop new clinically relevant wound care modalities are warranted.

*-Supported by NIH NIGM Grant # 1R43GM087753-01

#178

LIGHT THERAPY IMPROVES FUNCTIONAL OUTCOME IN AN AUTOGRAFT REPAIRED PERIPHERAL NERVE

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Background: Loss of large segments of peripheral nerves results in chronic loss of sensation and paralysis. For this type of severe injury, the defect can be bridged by nerve grafts, but even with state-of-the-art microsurgical techniques, there is minimal recovery of sensation and motor function. Light therapy (LT) has been shown to improve functional outcome after surgical intervention to repair injured nerves using different techniques. We hypothesize that light applied non-invasively will improve nerve regeneration and function after severe peripheral nerve injury and autograft repair.

Study: A 6–7 mm segment of the rat median nerve was excised. Sural nerve segments from the same animal were used to bridge the gap. There were four experimental groups: Sham, Injured (I), sural nerve autograft (S), sural nerve autograft + LT (SL). SL group received LT at the surgery site for 14 consecutive days using an 810 nm laser (beam area 7 cm^2, dose 25 J/cm^2, intensity 21.4 mW/cm^2). Functional recovery was assessed weekly by the grasping test. Compound muscle action potential (CMAP) measurements were taken pre-injury as baseline and at 16 weeks post surgery. Flexor muscles innervated by the median nerve were removed bilaterally and weighed.

Results: SL group had better functional outcome when compared to S group with a statistically significant difference at weeks 5, 8, 9 and 11. SL and S had significantly higher flexor muscle weights than I group but there was no significant difference between the two. There was a significant reduction in the CMAP latency of SL group compared to the S group. CMAP amplitude showed a statistically significant increase only in the SL group compared to the I group.

Conclusion: In this study, LT improved function after autograft repair of the severely injured median nerve. This laser based non-invasive treatment has the potential to revolutionize post-operative repair of severe peripheral nerve injury.

#179

COMPARABLE EFFECTS OF PULSED AND CONTINUOUS WAVE LIGHT ON AXONAL REGENERATION IN A RAT MODEL OF SPINAL CORD INJURY

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Background: Transcutaneous delivery of near infrared laser irradiation promotes axonal regeneration and functional recovery in hemisection and contusion rat models of spinal cord injury (SCI). Low transmission of continuous wave (CW) light to the spinal cord presents a challenge for translation of this therapy from the animal model to the human. This limitation can be overcome by using pulsed light with high power output to deliver adequate amounts of energy to the spinal cord level. The aim of this study was to compare the effects of pulsed and CW light on axonal regeneration in a rat dorsal hemisection SCI model.

Study: Rats with thoracic level SCI were randomized into three groups: Control, pulsed light treatment (LT-Pulse), CW light treatment (LT-CW). Irradiation was applied transcutaneously in LT groups immediately after injury and daily for 14 consecutive days. The light parameters were: 808 nm wavelength, fluence 1500 J/cm^2, area 0.07 cm^2, 50 minutes, irradiance 0.5 W/cm^2. The output power was 35 mW for LT-CW and 175 mW for LT-pulse with a 100 Hz frequency and 20% duty cycle. Labeled axons were counted and measured from the lesion site distally. Footprint analysis was performed pre-injury and weekly post-injury for functional assessment. Survival period was 3 weeks.

Results: Both CW and Pulse groups had a statistically significant increase in total number and distance of regenerated axons compared to the Control group. At three weeks post-injury, there was a significant reduction in the angle of rotation of the foot in the LT groups. There was no significant difference between CW and Pulse groups.

Conclusion: These results validate that pulsed light supports axonal regeneration and functional recovery comparable to CW light. The next step for clinical translation of this therapy is to optimize the pulse dosimetry in animal and then determine the pulsed light parameters that will deliver adequate light to the depth of human spinal cord.

#180

LED PHOTOMODULATION: EFFECTS OF DIFFERENT WAVELENGTHS AND DELIVERY MODES ON SELECTED HUMAN CELL TYPES IN VITRO

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Background: LED photomodulation effects on human dermal fibroblasts have been well documented. The effects of various wavelengths of light, on other cell types were evaluated using human dermal papillae, adipose, and retinal pigment epithelial cells.
Study: Human dermal papillae (DP), adipocytes, and retinal pigment epithelial (RPE) cells were grown to near confluence *in vitro* and exposed to selected LED wavelengths in the visible and near IR light range. For DP cells the endpoint measurements were MTT assay, VEGF ELISA and hair growth-related gene expression using RT-PCR. Adipocyte endpoint measurements were leptin ELISA, total glycerol assay, and cytotoxicity measured by adenylate kinase. RPE cells were exposed to 425 nm or UVA1 light to cause cellular damage, post-treated with LED arrays, and stained with fluorescent Annexin V for apoptosis/necrosis levels; VEGF and IL6 gene expression RT-PCR.
Results: A variety of responses were seen in all studies. DP cells demonstrated increased clinically relevant responses in the 623–660 nm range, particularly at 660 nm using selected pulsed or continuous wave modes. Adipocytes demonstrated altered glycerol and leptin levels at 625 nm and 880 nm using pulsed mode. RPE cells showed a 30% decrease in staining and a downregulation of VEGF expression using 590/870 nm pulsed mode. Apotosis and necrosis of RPE cells was decreased from 92% untreated to 62–5% with various wavelengths.
Conclusion: LED photomodulation demonstrated the ability to alter the expression of genes of known significance. Further investigation and optimization of parameters is warranted.

#181

DESIGN, DEVELOPMENT AND EVALUATION OF FIBER OPTIC PROBE BASED HE-NE LOW LEVEL LASER THERAPY SYSTEM FOR TISSUE REGENERATION

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Background: The use of phototherapy in the field of wound healing has gained popularity over the years. In phototherapy, a suitable irradiation is applied on the wounds, accelerates healing process. In the current study our aim was to design and develop a fiber optic probe based low level laser therapy (LLLT) system using Helium- Neon (He-Ne) laser and to optimize the laser dose and treatment schedule for tissue regeneration on Swiss albino mice. For selecting optimum laser dose, the animal wounds were exposed with different doses (1, 2, 3, 4, 6, 8 and 10 J/cm^2) separately except controls. The standardization of treatment schedule was carried out by irradiating wounds to 2 J/cm^2 at different post wounding time (0, 24 and 48 h).
Study: Auxiliary components were designed and fabricated for the development of the low level laser therapy system. Tissue regeneration potential of the system was evaluated by following the progression of wound contraction/area and mean wound healing time.
Results: Animals exposed to 2 J/cm^2 showed significant ($p < 0.01$) enhancement of wound contraction at day 5, day 9, day 12, day 14, day 16 and day 19 post irradiation compared to the controls. Treatment with laser at 2 J/cm^2 resulted a significant ($p < 0.01$) decrease in the healing time (19.83 ± 0.38 days, post irradiation) compared to controls (25.92 ± 0.8 days). The animals exposed to 2 J/cm^2 immediately (0 hr) after wounding showed enhanced wound contraction when compared to control and other treatment schedules.
Conclusion: The LLLT system designed and developed in this study has demonstrated optimum tissue regeneration for 2 J/cm^2 He-Ne laser irradiation, applied immediately after the wounding compared to other post wounding treatment schedules by promoting wound contraction and thereby reducing mean healing time.

#182

COMPARING LASER EVOKED ELECTROMYOGRAPHIC POTENTIAL USING CO_2 AND 1450 nm DIODE LASER

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Background: Infrared (IR) lasers have been used for the evoked potentials in animals. However there is no theoretical analysis about the temperature increases associate with the evoked potentials. In this presentation, we shall measure and compare with theory for the surface temperature, and the threshold laser power of evoked potentials of rats using two IR lasers at wavelength of 10640 nm and 1450 nm. We shall also analyze the role of laser pulse widths for a fixed laser power. The diode laser at 1450-nm used in this study has an absorption coefficient lower than CO_2 laser but higher than previously used diode laser at 980-nm.
Study: Wistar rates (weighting 250–350 g) were anesthetized by sodium pentobarbital (50 mg/kg, i.p.) in this in vivo study. For electromyography (EMG) recording, two stainless still needles were inserted into the hamstring muscle of the hind leg. The EMG signals were filtered and amplified properly and integrated with onset trigger of laser pulse. The infrared lasers applied on the hind paws of the rats have the following parameters: (a) CO_2 laser at 10.6 um, power range of (0.5 to 10 W), pulse width (20–100 ms), collimated spot size 3.0 mm; (b) diode laser at 1450 nm, power of (0.1–5.0 W), pulse width of (0.1–1.0 second), spot size 4.0 mm. Due to the huge different values of the tissue/water absorption coefficients (A) of the 2 lasers ($A = 800$ cm^{-1} in CO_2laser and 3.0 cm^{-1} in 1450-nm diode laser), the pulse widths were controlled in the ranges of 30–60 ms (for CO_2 laser) and 0.3–0.6 seconds (in 1450-nm laser) in order to reach the evoked potential threshold (EPT) indicated by the EMG signals. Thermal probe (attached to the surface area of laser heated rat's paw is used to measure the real time surface profiles and recorded by Labview software.
Results: Both lasers show the same trend that the laser pulse widths (or irradiation time) needed (t) to reach the EPT (measured to be about 43^0 C) is a decreasing function of the laser powers: $t = (50,40, 35)$ ms, for CO_2 laser power of (4,6,8)W; and $t = (0.55, 0.45, 0.35)$ seconds for 1450-nm laser power of (2.0, 2.5, 3.5)W. The surface temperature increase of the treated areas are also an increasing function of the laser energy defined by $E = F$ *Tp, F being the laseerfluency (power/area), Tp is the pulse width. Our measured data are in consistent with the computer modeling. To increase the response time of 1450-nm laser, we need a higher fluency by a tightly focused beam which ,however, is more difficult to meaure the temperature profiles and a non-contact type IR sensor with response time faster than few ms is needed.
Conclusion: Pulsed IR lasers may be an excellent heating sources for the pain studies via laser evoked electromyographic potentials. Diode lasers may be a better light source than CO_2 laser offering the advantage of less surface tissue damage and compactness in system.

#183 Late Breaking

A HIGHLY EFFECTIVE NEW MICROSPOT-BASED IR-LASER FOR HOME USE SKIN REJUVENATION—A RANDOMIZED, DOUBLE-BLINDED, PROSPECTIVE ULTRASONOGRAPHIC STUDY

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Background: The objective of the present study was to evaluate a home-use laser device for skin rejuvenation using objective ultrasonographic measurements.

Study: 12 volunteers were treated 3 times with intervals of 1 week with a new 1425 nm, 900 mW diode-based, scanned home-use device (Intenzity Innovation, Canada). Five passes were delivered (5 mJ/microspot on one side of the face and 7 mJ/microspot on the contralateral side in a randomized fashion). The effect on the dermal collagen matrix was evaluated by high frequency ultrasonography (DermaScan, Cortex Technology, Denmark) before treatment and 1 month after the last treatment. Skin thickness and dermal ultrasonographic tissue density were calculated.

Results: There was a highly statistically significant increase in ultrasonographic skin density of 42.8% (SD: 29.1%) for the 5 mJ/microspot treatment ($p = 4.2 \times 10^{-5}$) and 41.2% (SD: 26.2%) for the 7 mJ/microspot treatment ($p = 5.5 \times 10^{-6}$)—with no difference between the two treatments energies. No change in total skin thickness was observed. Slight edema and moderate erythema was experienced during the first post-treatment day and the erythema lasted up to 3 days. No other adverse effects were registered. The subjective sensation was reported as being a feeling of small needle pricks followed by a slight warmth sensation.

Conclusion: Objective skin measurements with high frequency ultrasound showed that a series of three near-IR laser treatments, one week apart, delivered by a new home-treatment device resulted in significant improvement of dermal connective tissue density of more than 40%. This kind of home treatment may potentially replace expensive fractional laser treatments offered by cosmetic dermatology and plastic surgery clinics.

#185

THE APPLICATION OF LOW-LEVEL LASER THERAPY FOR THE SYMPTOMATIC CARE OF LATE STAGE PARKINSON'S DISEASE: A NON-CONTROLLED, NON-RANDOMIZED STUDY

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Background: Parkinson's Disease (PD) is the degeneration of dopaminergic neurons of the substantial nigra resulting in a reduction of strital dopamine content. The exact mechanism is not well understood; however, several pathophysiologic mechanisms such as oxidative stress, mitochondrial dysfunction, and and degradation of major intracellular proteins have been postulated to explain the progressive neuron loss. Numerous studies have revealed that LLLT can modulate cell bioenergetics influencing the intracellular redox state of a cell. With histological evidence suggesting that laser therapy can repair oxidatively damaged cells and increase neuronal axonal transport, the objective of this non-controlled, non-randomized study was to evaluate the improvement of symptoms associated with late stage PD.

Study: Eight volunteers between 18 to 80 years with late stage PD participated in a non-controlled, non-randomized study. Participants received LLLT treatments (PL5000, manufactured by Erchonia Medical Inc.) daily for two weeks. Each participant received treatment of the brain stem, bilateral occipital, parietal, temporal and frontal lobes, and treatment along the sagittal suture. Patients were asked, using the Visual Analog Scale (VAS), to record the severity of their symptoms of balance, gait, freezing, cognitive function, rolling in bed, and difficulties with speech pre-procedure and at study endpoint with 10 being most severe and 0 as no symptom.

Results: Compared with baseline, all participants demonstrated a numerical improvement in the VAS from baseline to study endpoint. A statistically significant reduction in VAS rating for gait and cognitive function was observed with average mean change of -1.87 ($p < 0.05$) for gait and a mean reduction of -2.22 ($p < 0.05$) for cognitive function. Further, freezing and difficulty with speech ratings were significantly lower at study endpoint with a mean reduction of -1.28 ($p < 0.05$) for freezing and -2.22 ($p < 0.05$) for difficult with speech.

Conclusion: These data suggest that laser therapy may serve as a non-invasive instrument for symptom reduction of PD.

#186

DOSE EFFECT EVALUATION OF LOW LEVEL LASER THERAPY AS AN ADJUNCTIVE TREATMENT IN PATIENTS WITH MYOFASCIAL PAIN

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Background: This study evaluates the dose effect of Low Level Laser Therapy (LLLT) as an adjunctive intervention in the treatment of myofascial pain of the masseter muscles. This study also investigates optimal dose/time parameters to achieve reduction of symptoms in this set of patients.

Study: The study recruits volunteers from the Temporomandibular Disorders and Orofacial Pain (TMD) clinic, University at Buffalo School of Dental Medicine. Eligible subjects had a confirmed diagnosis of myofascial pain following the specifications of the Research Diagnostic Criteria for TMD and have a Characteristic Pain Intensity of at least 5/10. LLLT was implemented using light obtained from an 810 nm laser diode cluster total output at 810 nm 1 W and 660 nm LED cluster with a total output of 100 mW. Patients received light using a total dose of (energy density) 2, 4 or 6 J/cm^2 delivered at an irradiance of 110 mW/cm^2 twice weekly for 4 weeks. A control group receiving a placebo treatment was used for comparison. At baseline and follow-up all subjects completed the patient questionnaire from the RDC, and clinical examination following the RDC/TMD guidelines. For the evaluation of pain the Visual Analog Scale (VAS) was used every session before and after intervention.

Results: Thus far, there are general trends to discuss as the study is continuing to accrue patients for statistical significance. The data demonstrates that there is a decreasing level of pain and increasing level of pain free opening as a function of increasing light dose compared to the placebo group.

Conclusion: The significance of this study lies in how different doses, delivered with controlled dosimetric parameters, can reduce the baseline self-reported pain and increase the range of motion. The accurate documentation of delivered dosimetry can be used to establish more consistent standards for treatment across the range of devices available.

#187

PULSED INFRARED LASER TREATMENT FOR ONYCHOMYCOSIS: CONTROLLED, RANDOMIZED, MULTI-CENTERED TRIAL (N = 155)

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Background: Onychomycosis (toenail fungus) affects 10's of millions of Americans. The standard treatment, oral terbinafine, has a complete cure rate of only 38% and potential toxicity. In a controlled, randomized pilot study 14 out of 16 (86%) great toes improved with an average of 3.7 mm of new clear nail at 3-months following a single PinPointe FootLaser treatment ($p < 0.001$). A retrospective study of 71 patients receiving a single FootLaser treatment demonstrated 60–80% efficacy at 6-months ($p < 0.001$). To date, no serious adverse effects have been reported. A prospective multi-center trial is in process at four clinical sites in the U.S. and Canada.

Study: Subjects with a clinical diagnosis of onychomycosis of both great toes have left/right great toenails randomized to FootLaser treatment or no treatment. At each visit mycology is sampled and analyzed with KOH, PCR and culture tests. Margins between involved and clear nail are marked by investigators who are blinded to the treatment condition and close up digital, calibrated photographs are taken. Subjects receive three consecutive treatments at 2 month intervals (0, 8, 16 weeks). Comprehensive follow-up visits are at 24 and 48 weeks. Computer-based planimetry is used to measure the area of clear nail from the photographs. The primary outcome variable is change in area of clear nail.

Results: Interim analyses of the multi-center data will be conducted, per protocol, in March, 2010 post 6-month (24 weeks) follow-ups. Detailed results of all three studies will be presented.

Conclusion: This laser treatment for toenail fungus appears to be safe and effective. Results from the large multi-site trial will confirm or negate the very positive preliminary results obtained from a smaller sample.

#188

EFFECTS OF LOW-LEVEL LASER THERAPY IN SUBCUTANEOUS FAT REDUCTION AND IMPROVEMENT IN BODY CONTOUR

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Background: Low-level laser therapy (LLLT) has evolved as efficient tool to provide therapeutic outcomes for a variety of medical indications. Currently, this is a USFDA-approved technology for pain alleviation. However, recent studies on LLLT indicate "liquefaction" of stored fat in adipocytes by opening of the cell membrane after a short treatment. Nonetheless, clinical data is limited. The aim of the study is to assess clinical effects of LLLT on subcutaneous fat reduction and improvement in body contouring.

Study: Retrospective data review of patients ($n = 311$) treated with Lapex2000; 658 nm, 150 mW array/40 mW +/−20% diode laser radiation (Meridian Medical Inc.) from 26 months. All patients were screened and advocated on proper diet and exercise before treatment initiation. LLLT was applied topically to skin of the abdomen and torso areas where undesired fat was present.

Results: 272 females, 39 males (age range: 18–81 yrs) underwent from 1 to 24 laser treatments to the abdominal and torso areas. 54.6% ($n = 170$) patients had 6 or more treatment sessions. Measured loss at single first session in 81% of the sample ($n = 253$) averaged 2.79 cm (range: 0–9 cm) or 1.4 cm in girth reduction covering all application times. Overall, 130 patients who completed all 6 and 12 sessions achieved an average sustained loss of 6.55 cm and 11.04 cm corresponding to an average girth reduction of 0.48–0.55 cm/session. With weight loss of a minimum of 0.68 kg/week, results averaged 9.0 cm - 6 session group; 16.1 cm - 12 session group corresponding to an average girth reduction 0.67–0.75 cm per session. 75.2% sustained $= 4$ cm loss in 6 or more sessions. Patient satisfaction photographic assessment demonstrated significant higher score in all patients. Only 6 patients ($< 3\%$) of 253 patients measured for their first session experienced no loss from the treatment. No significant complications were encountered.

Conclusion: LLLT is safe and efficacious for reducing subcutaneous fat in the abdomen and torso areas.

#189

THE REDUCTION IN SERUM LOW-DENSITY LIPOPROTEIN LEVELS FOLLOWING LOW-LEVEL LASER THERAPY: A NON-CONTROLLED, NON-RANDOMIZED PILOT STUDY

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Background: The application of low-level laser therapy has been recognized as a viable means to treat a wide-assortment of medical conditions and disorders. Numerous studies have revealed the modulatory capabilities of laser therapy at the cellular level, impacting transcription factor activation and gene expression. Low-density lipoproteins (LDL's), when elevated, have been identified as a direct contributor to the onset of cardiovascular disease. With a significant percentage of LDL produced in the body via specific transcription activated biochemical pathways, LLLT may have the potential to impact cholesterologenesis. The objective of this non-randomized, non-controlled study was to evaluate the efficacy of laser therapy in the reduction of LDL's.

Study: Forty-one patients between 18 to 65 years participated in a non-controlled, non-randomized study. Participants received low-level laser treatments (Zerona, manufactured by Erchonia Medical Inc.) 3 times per week for two weeks. Standard fasting lipid panels were performed pre-procedure and at the two week post-procedure endpoint. Patients were asked to maintain normal eating and exercise habits throughout the entire investigation; further patients were not using any cholesterol lowering medications or supplements.

Results: Compared with baseline, participants demonstrated a statistically significant mean reduction in low-density lipoprotein levels of 12.05 points, a 13% reduction at study endpoint ($p < 0.005$). The mean baseline measurement of 103.88 mg/dL was reduced to 91.83 mg/dL.

Conclusion: Based on the FDA Guidance Document: *Guidelines for the Clinical Evaluation of Lipid-Altering Agents in Adults and Children, September 1990, Division of Metabolic and Endocrine Drug Products, Food and Drug Administration*, a change in LDL from baseline to study end point evaluation is considered both

statistically significant and clinically meaningful if it is a 15% or greater decrease. These data suggest that laser therapy may serve as a subtle, non-invasive instrument for the reduction of LDL levels in just two weeks.

#191

THE APPLICATION OF LOW-LEVEL LASER THERAPY FOR THE REDUCTION OF ADIPOCYTE-DERIVED HORMONE LEPTIN: A NON-CONTROLLED, NON RANDOMIZED STUDY

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Background: Body weight is regulated by the endocrine and neural components controlling energy intake and expenditure. The complex nature of this regulatory process is responsible for preventing even the smallest of imbalances between energy intake and expenditure. Regulation is a complex interplay of hormonal and neural signals. A major regulator within the body is the adipocyte-derived hormone leptin which acts primarily in the hypothalamus to influence appetite, energy expenditure, and neuroendocrine function. The gene responsible for coding the hormone is *Ob(Lep)* gene. Numerous studies have identified that laser therapy can modulate gene expression; therefore, the objective of this non-controlled, non-randomized study was to evaluate the efficacy of laser therapy in the reduction of serum Leptin levels.
Study: Twenty-two volunteers between 18 to 65 years participated in a non-controlled, non-randomized study. Participants received low-level laser treatments (Zerona, manufactured by Erchonia Medical Inc.) 3 times per week for two weeks. Standard fasting leptin panels were performed pre-procedure and at the two week post-procedure endpoint. Patients were asked to maintain normal eating and exercise habits throughout the entire investigation.
Results: Compared with baseline, all participants ($n = 22$) demonstrated a numerical reduction in leptin levels at study endpoint. The mean reduction was 14.89 points, a 50% reduction. The mean baseline leptin measurement of 29.49 was reduced to 14.60, a statistically significant change of $p < 0.0001$. Long-term evaluation was not performed.
Conclusion: These data suggest that laser therapy may serve as a non-invasive modality for the reduction of Leptin levels in two weeks, potentially positioning LLLT as a safe means to temporarily suppress appetite. Further study is highly warranted.

SURGICAL APPLICATIONS

#192

SEMIAUTOMATED INTRAOCULAR LASER SURGERY USING HANDHELD INSTRUMENTS

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Background: In laser retinal photocoagulation, hundreds of dot-like burns are applied to the retina. We introduce a robot-assisted technique using an active semiautomated handheld instrument to enhance the accuracy and reduce the tedium of the procedure.
Study: Laser burn locations are selected on pre-operative images of the retina using common patterns such as grids and arcs. A stereo camera/monitor setup registers and displays the planned burn locations overlaid on a real-time video of the workspace. Using a handheld micromanipulator, a 7×7 grid of burns spaced 650 μm apart is applied to both paper slides and porcine retina on felt using 30 ms laser pulses at 532 nm. Two scenarios were tested: unaided, in which the micromanipulator is inert and the laser fires at a fixed frequency; and aided, in which the micromanipulator actively targets burn locations and the laser fires automatically upon target acquisition. Error is measured by comparing the center of the observed burn mark to the pre-operatively selected target.
Results: An experienced retinal surgeon performed four unaided trials and four aided trials each on the paper slides and porcine retina. In the paper test cards, with a 1.0 Hz laser repeat rate, the aided case showed a 22% decrease in mean error of burn placement and a 44% decrease in mean trial duration over the unaided case. In porcine retinal tissue in vitro, a laser repeat rate of 2.0 Hz was used, the aided case reduced mean error of burn placement by 37%.
Conclusion: Retinal photocoagulation with robot assistance can increase the accuracy of laser burn placements while positively affecting the duration of the operation.

#193

REGRESSION OF RECALCITRANT PERIPAPILLARY CHOROIDAL NEOVASCULARIZATION AFTER ICG ASSISTED OSCILLATING TRANSPUPILLARY THERMOTHERAPY AND ANTI-VEGFS

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Background: Transpupillary thermotherapy (TTT) has been used to treat choroidal neovascularization (CNV). Its drawback has been generation of an unpredictable thermal coagulation in the choroid and retina depending on the degree of ocular pigmentation. Indocynin green (ICG) a dye used for angiography, and a known weak photosensitizer was used with an infra-red laser (810 nm) in an oscillatory thermotherapy (OTT) mode. This permitted us to effectively combine beneficialof effect thermotherapy with that of photodynamic therapy while avoiding termal coagulation. This report describes the effects of combination treatment of I-OTT with Intravitreal bevacizumab/dexamethasone in refractory peripapillary CNV.
Study: This is a prospective interventional case series of eyes with peripapillary CNV treated with I-OTT. Patients were selected because eyes were resistant to standard therapy. Clinical exam, fundus photography and OCT were performed at baseline and postoperatively along with patients consent. Fluorescein angiogram was performed at baseline and repeated based on clinical findings. An infrared laser (810 nm) with a spot size half the lesion size was used. Parameteres were determined by using an extramacular test spot in a non-oscillating mode with the maximum power tolerable for ten seconds without causing pain. These parameters were used to apply the laser in an oscillatory and rotatory mode over the lesion. The duration of treatment was

90–120 seconds in thermal mode (pre-ICG infusion) and 90–360 seconds post-infusion as PDT. Intravitreal injection of bevacizumab (1.25 mg) and dexamethasone (1000 μg) were subsequently given during the same visit. I-OTT could be repeated, as needed, if persistence of CNV activity was noted by OCT or IVFA.
Results: Four eyes of four patients met our selection criteria. Mean follow up was 8.25 months (range from 3–12 months). The mean energy level was 325 mW (range from 200–500 mW) in oscillatory mode (2–3 Herz/sec.). The spot size was 1.2 mm in three patients and 2 mm in one patient. Initially an ICG dose of (0.33 mg/kg) was found not to be effective. This concentration was increased to 1 mg/kg for all patients treated. Mean visual acuity improved in one patient from 20/60 to 20/30 and remained the same in 3 patients (20/20, 20/40 and 20/400). At the final exam there was no evidence of clinical or angiographic activity of the CNV in any eye. We did not observe any side effects related to the treatment. None of the eyes needed retreatment thus far.
Conclusion: I-OTT is a new modality in the treatment of recalcitrant peripapillary CNV and has potential for treatment of CNV in wet ARMD and other accessible areas of the body. This technique may reduce thermal side effects of TTT and may eliminate or reduce the need for frequent treatment as is needed presently. The effect of I-OTT is postulated to be a synergistic effect of thermal energy combined with a weak photosensitizer (ICG) applied in an individualized manner that minimizes thermal damage to the retina and choroidal tissue. Additional Anti-VEGF pharmocotherapy enhances the effect of I-OTT on abnormal new vessels.

#194

LASER-ASSISTED LIPOABDOMINOPLASTY USING A DUAL WAVELENGTH MULTIPLEXED Nd:YAG LASER

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Background: The surgical techniques for contouring the abdomen are liposuction and abdominoplasty. Both techniques have been performed for years, but with a higher complication profile than desired. Recently, there has been a trend towards more minimally invasive surgical procedures.
Lipoabdominoplasty is a technique which limits abdominal flap elevation compared to traditional abdominoplasty. This reduction in flap elevation yields less neurovascular and lymphatic disruption to the abdominal flap and less surgical trauma. We describe an important and novel advance in lipoabdominoplasty using a multiplexed 1064/1320 nm Nd:YAG laser for internal laser lipolysis and improved skin tightening.
Study: Laser lipoabdominoplasty was performed on 20 female patients under an IRB protocol. Anesthesia was IV sedation, epidural or general; tumescent infiltration was used in all patients. A dual wavelength, multiplexed 1064/1320 nm Nd:YAG laser, with energy conducted via a 600 μ optical fiber, was used for internal laser lipolysis and its salutary effects on small blood vessels and dermal and adipose collagen in the abdomen. Following laser application, low negative pressure aspiration of the oily remnants was performed. These steps also serve to elevate the abdominal flap. The infra-umbilical flap is removed and the upper abdominal flap is advanced inferiorly and inset. A neo-umbilicoplasty is performed. All procedures were performed on an out-patient basis. Follow-up was from 9–12 months.
Results: All patients tolerated surgery well; there were no major complications (dehiscence, flap necrosis, hematoma, thromboembolic phenomena, death). There was one seroma which was aspirated post-operatively and resolved.
Conclusion: By using this multiplexed laser to perform lipoabdominoplasty, we further reduce the operative trauma associated with the procedure; coagulate small vessels in the fat; preserve the larger, more important perforators to the flap; increase dermal and adipose collagen contraction; contribute to an increase in the minimally invasive nature of the procedure and enhance the post-operative recovery experience of the patients undergoing surgery.

#195

LASER-ASSISTED HIGH DEFINITION LIPOSCULPTURE

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Background: The introduction of Smartlipo MPX and Triplex technology (LASER-Assisted Lipoplasty, LAL) has enabled the application of lipoplasty techniques and skin tightening techniques to the superficial fat layers and subdermis, respectively. Differential lipoplasty has been used to detail abdominal musculature in select male patients, historically, by a method called “abdominal etching.”
Study: The study reports on the use of LASER-assisted high-definition liposculpture (LAL Hi Def) to not only improve body contour, but also to highlight the 3-dimensional muscular anatomy in a wide variety of body areas including abdominal musculature, arm musculature, and leg musculature. After deep and superficial infiltration, laser lipolysis was performed using the LAL technology in a multilayer approach including the immediate subdermal plane. Debulking was performed using ventilated cannulas, beginning in the deep layers and continuing to the mid-lamellar and supra-lamellar (Immediate subdermal) layers and between muscle groups. Superficial and subdermal laser lipolysis was performed to define relevant anatomy for the muscle groups in each treatment area. Transitioning was then performed to define superficial anatomy landmarks by debulking some of the remaining fat over the muscles and smoothing the surfaces over the mid-lamellar area. Follow-up intervals were at 3 months, 6 months, and 1 year.
Results: A total of 15 patients were treated. No skin necrosis occurred. Minor complications included 5 seromas, which were easily treated and left no deformity. All outcomes were considered good or excellent, with adequate improvement in muscle definition.
Conclusion: LAL high-definition liposculpture (LAL Hi Def) is an aggressive approach to body contouring that enables the surgeon to perform body sculpting of the superficial tissues to define 3-dimensional surface musculature in a wide range of body parts. It is and advanced procedure that requires knowledge of how underlying muscular anatomy affects superficial appearance, as well as training in immediate subdermal lipoplasty and lipoplasty in the superficial fatty layers. Areas that have been traditionally thought to be difficult to treat and therefore previously avoided by many liposuction surgeons.

#196

ADVANTAGES OF REAL-TIME MAGNETIC TRACKING OF THE CANNULA FOR CONTROLLED LASER ASSISTED LIPOLYSIS (CLAL)

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Background: Laser Assisted Lipolysis (LAL) is relatively a new method for removing localized accumulations of fat under local anesthesia. Despite being a minimally invasive method, some complications can occur. Controlled Laser Assisted Lipolysis (CLAL) is proposed to allow the control in real-time of the position of the cannula inside the fat layer and the delivery of energy. The study aims to evaluate the performance of a new system using magnetic tracking of the cannula.

Study: The study purpose was to design a system tracking the real-time position measurement of the cannula tip. Based on medical experience, the following constraints were defined: The position measurement rate had to be fast enough to track the canula position, to regulate the laser power and to display the actual energy map being delivered into the tissue.

Results: A system was designed to allow the real-time position of the canula tip. A 6D magnetic tracking system was used to determine the position of a moveable sensor relative to a fixed transmitter within the defined operating area. Sensor is plugged on the handpiece. The low frequency pulsed DC fields are unaffected by body tissues and non-ferrous metals. Position of the cannula is given every 10 ms, allowing the display to show the position in real time. Speed of motion is computed every 50 ms, and laser power is calculated accordingly. Since both positions and power levels are known, mapping of energy is possible and displayed on the screen, in real-time. This feature allows a precise measurement of doses already delivered, and allows precise quantification of treatment, avoiding under or over dosage. A prospective clinical study" "Comparison of Laser Assisted Lipolysis (LAL) to Controlled Laser Assisted Lipolysis (CLAL)" is also presented during this meeting and confirms the advantages of using CLAL.

Conclusion: Over the years, the experience in laser procedures has showed the necessity to control dosimetry (for example, scanning devices have considerably improved the laser treatments in dermatology). This study shows that CLAL could be a real advantage for improving LAL, by offering the possibility to control and optimize delivered doses of energy and reducing side effects. Without control, increased power is useless.

#197

EVALUATION OF LASER-ASSISTED LIPOLYSIS COMPARING A 1320, 1370 AND 1440 nm LASER

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Background: The aim of this study was twofold: (1) to evaluate acute and delayed laser effects in lipolysis and collagen deposition, and (2) to compare the histological effects in subcutis using three separate wavelengths of lasers (1320 nm, 1370 nm and 1440 nm).

Study: Six subjects scheduled for abdominoplasty received laser lipolysis on abdominal tissue prior to excision. Treatment was done using a bi-layer technique consisting of application of laser radiation in deep fatty tissue first and then sub-dermally. Areas to be treated were divided into $3 \times 3\text{-cm}^2$ and treated with a laser using radiation at 1320 nm, 1370 nm or 1440 nm. Tissue temperature was recorded real-time using a thermistor glued on the distal end of the cannula. Temperature on surface and at various depths were measured immediately post treatment. Two subjects underwent abdominoplasty at 1-day, two at 1-week and two at 1-month post exposure. The excised tissues were stained with H&E and performed qualitative and semi-quantitative histopathological evaluations.

Results: Temperatures of tissue treated at various wavelengths and powers were compared to histological evaluations. Skin histology at 1-day showed dermal vascular inflammation and reticular dermal coagulation in some specimens. Damage to epidermis and dermal vessels were found in skin heated over 49°C on surface. In subcutis, histology at 1-day showed vascular inflammation, thrombosis, collagen fiber coagulation, and disruption of adipocytes. Adipocytes surrounded by histocytes, a marker of lipolysis, were present at 1-week and 1-month. Collagen deposition in subcutis and in some specimens in reticular dermis was noted at 1-week, and increased at 1-month. Tissue treated with 1440 nm demonstrated more adipocyte damage at 1-day and more collagen deposition in reticular dermis at 1-month as compared to tissue treated with 1320 nm or 1370 nm wavelength.

Conclusion: Sub-dermal laser irradiation can efficiently disrupt adipocytes as well as stimulate collagen deposition in subdermal tissue and reticular dermis. The degree of lipolysis and subdermal collagen deposition depended on wavelength and laser energy.

#198

LASER-ASSISTED LIPOLYSIS: HISTOLOGY EVALUATION OF LASER TUNNELS FORMED BY A HOT TIP AND BY AN OPTICAL TIP EMITTING LIPID—AND WATER-SELECTIVE WAVELENGTHS

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Background: LAL devices produce unique laser tunnels with zones of liquefied fat, coagulated proteins and heat-stressed cells. The zones' dimensions depend on tip design, wavelength and power profile. Objective of the study was to evaluate water- versus fat-selective laser wavelengths by comparing the laser tunnel dimensions and the safety margin against end-hits causing skin burns. Optical tips are similarly compared with hot tips.

Study: Lipid-selective 924 nm (20 W) and water-selective 975 nm (20 W) laser light is delivered through 1.5 mm diameter optical tips (SlimLipo™, Palomar Medical Technologies, Inc.) during controlled-speed stroking (2–25 mm/s) through porcine skin and subcutaneous fat. Hot tips fabricated to provide 20 W pure heating were similarly evaluated. Tissue was excised, sectioned, NBTC stained and evaluated for degree of charring and thermal damage. End-hit safety margin scales inversely with the size of the dermal coagulation profile. Coagulation dimensions in fat and dermis versus wavelength and tip were used to evaluate selectivity and safety.

Results: Under identical conditions, the coagulation dimensions in the dermis caused by water-selective 975 nm light are three times larger than those caused by lipid-selective 924 nm light. The coagulation profiles in fat are more than 70% larger for 924 nm

than for 975 nm light. The laser tunnels created by hot tips at the same power have larger coagulation zones with significantly more char compared to optical tips.
Conclusion: A fat selective wavelength such as 924 nm provides a 3-fold increase in safety margin and more than twice the efficiency for fat melting compared to a water-selective wavelength such as 975 nm. Hot tips generate higher temperatures than optical tips in the fat with significant char. An LAL device with appropriate design minimizes temperature gradients to reduce char formation without diminishing its ability to coagulate.

#199

TITAN LABIALPLASTY: INITIAL RESULTS AND FOLLOW-UP

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Background: We previously reported on one patient who had significant improvement in Labia Majora laxity after a Titan treatment, but the longevity as well as the reproducibility of the results remained a question.
Study: Ten women volunteered for the study and each had laxity of the labia Majora. They each underwent a series of 3 Titan treatments at one month intervals. The labia where treated in a circular, sliding motion which was repeated until the skin temperature reached 41 degrees Celsius. Pre and post photographs where taken which were later judged as a side by side comparison by 3 blinded observers.. Follow up photos were taken at 1 month, 2 months, and 6 month intervals.
Results: Ten subjects started the study and 8 completed it. The two that did not complete the study had personal issues and non completion was not a reflection on the treatment.. Subjects were between the ages of 25–59. 2 subjects were postmenopausal. 6 were premenopausal. 6 of the subjects had given birth vaginally. 7 were Caucasian and one was of Hispanic descent. All eight subjects are at least eight months out from third treatment with no complications. Seven of the eight still have visible improvement. The oldest patient had reoccurring laxity, which was improved with a fourth treatment. One patient noted increased sexual stimulation which was confirmed by their partner which they felt was due to a decrease/tightening of the vaginal introitus.
Conclusion: This limited study suggests that the labial tightening provided by this technique is significant and sustainable. Given the reoccurring laxity in the oldest post menopausal patient estrogen replacement therapy where indicated may be of value in achieving long term results. Additionally this treatment may provide improvement in sexual stimulation due to vaginal laxity; further studies need to be done to address these issues.

#200

LAPAROSCOPIC PARTIAL NEPHRECTOMY WITH A 980 nm DIODE LASER: FEASABILITY IN A PORCINE MODEL

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Background: With increase of small renal cancer diagnosis, laparoscopic partial nephrectomy appears to be an attractive mini-invasive treatment modality for nephron sparing. Achieving hemostasis during excision is a major challenge. Laser excision appears to be a promising technique for LPN. This study aims to examine the feasability of LPN without hilar clamping using a high energy 980 nm diode laser.
Study: Transperitonal LPN was performed in five 25 to 35-kg female farm pigs. In first time, left lower-pole ablation was performed using incisional laser technique. Two weeks later, all animals underwent a right upper-pole ablation with same modality. 1000 μm and 600 μm end-fire laser fibers were used with 980-nm diode laser (power: 40 to 65 W). The renal function was monitored by serum creatinine dosage. Renal parenchymal resection and hemostasis were achieved only with laser without any adjunctive hemostatic sutures or glues. Ex-vivo retrograde pyelography and histologic analysis of each kidney were performed after animal sacrifice.
Results: A complete 980-nm diode laser resection was successful in 9 cases. In a case of near hilum resection, vascular clampage was necessary during 10 minutes to complete hemostasis. No other peri operative complication was noticed. The mean resection time was 26 minutes (range 23–31). The mean blood loss was 95 mL (range 25–150 mL). Speed of resection was limited by smoke emission. This one was reduced in pulse mode and using saline serum instillation on section slice. There was no evidence of urinary extravasation on ex-vivo retrograde pyelograms at 2 weeks. Histopathologic analysis of section slices shows a 4 mm (range 3–5 mm) thickness of coagulation necrosis into renal parenchyma.
Conclusion: This study confirms the feasability of 980-nm diode laser LPN without hilar clamping in porcine model. Clinical trials are necessary to determine its role for resection of small exophytic renal tumors.

#201

FOCALIZED LASER INTERSTITIAL THERMOTHERAPY AT 980 nm FOR PROSTATE CANCER: TREATMENT FEASABILITY IN DUNNING R3327 AT-2 RAT PROSTATE TUMOR

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Background: With the increasing incidence of low risk prostate cancers, focal therapy appears to be an attractive middle ground between active surveillance and actual radical treatments. Laser interstitial thermotherapy (LITT) could be one modality of this focal therapy. This study aims to examine the feasibility and reproducibility of LITT as a minimally invasive method for treatment of prostate cancer.
Study: Heterotopic tumors (Dunning R3327 AT-2) were induced in 20 male Copenhagen rats. After preoperative MRI, 10 mm cylindrical diffusing fiber developped by our research department was inserted under sonographic control into the tumor. LITT was perfomed with a 980 diode laser (power 5 W) during 60 seconds (fluence rate of 980 J/cm^2, 10 rats) and 75 seconds (fluence rate of 1145 J/cm^2, 10 rats). Real time intra tumoral temperature was monitored with thermocouples. Nonenhanced T2-weighted and dynamic gadolinium-enhanced T1-weighted MR imaging examinations were performed at baseline and one hour after the procedure.

Results: MRI visible necrosis volumes correspond to intratumoral temperatures above 65°C treated. With fluence rate of 980 J/cm^2 and 1145 J/cm^2, the ellipsoid necrosis volumes were 0,559 cm^3 (+/−0,083) and 0,748 cm^3 (+/−0,075) respectively. Volumes are correlated to the energy level. and significantly different between the two groups ($p < 0,001$).
Conclusion: In a prostatic adenocarcinoma model, LITT induces reproducible necrosis volumes. Further characterization of the response to LITT in an animal model and in human tissues will be important in establishing the efficacy of the procedure for cancer prostate focal therapy.

#202

NOVEL TREATMENT STRATEGY FOR REFRACTORY HEMORRHAGIC CYSTITIS FOLLOWING RADIATION TREATMENT OF GENITOURINARY CANCER: USE OF 980 nm DIODE LASER

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Background: Hemorrhagic cystitis is a potentially life-threatening complication following pelvic radiation for genitourinary malignancy. This devastating condition occurs when the bladder vasculature undergoes tissue remodeling resulting in obliterative endarteritis and vascular telangiectasia. We report our institution experience using a 980-nm diode laser which could be adapted to definitively manage refractory hemorrhagic cystitis. We hypothesize that this laser has the advantage over the Nd: YAG and KTP approach because its wavelength is highly- absorbed by both hemoglobin and water for simultaneous high ablation potential and concurrent hemostasis. To our knowledge, this is the first original report of use of the 980 nm diode laser for hemorrhagic cystitis.
Study: Four patients with severe hemorrhagic cystitis secondary to radiation therapy for genitourinary cancer, refractory to conservative therapy and standard cystoscopic electrocautery fulguration, were, after obtaining informed consent, taken to the operating room and underwent laser vaporization of the bleeding vessels with the 980 nm diode laser using the Evolve Laser system (Biolitec Inc., Longmeadow, MA). The laser was transmitted to the tissue via a 600 micrometer side-firing flexible fiber. A standard laser resectoscope (Storz, Germany) was used for all four patients. Initial cystoscopy was performed to define the extent of bleeding bladder vasculature and areas of neovascularization. The resectoscope was advanced into the bladder, and bleeding vessels were selectively vaporized by painting the bleeding areas in a non-contact mode technique with a right- angle laser fiber. Inspection after fulguration revealed complete hemostasis.
Results: Four patients with history of refractory hemorrhagic cystitis following radiation therapy for genitourinary malignancy underwent laser vaporization of bleeding neovascularization and were followed for a median time of 6 months. None of the patients had experienced hematuria requiring treatment.
Conclusion: Our results demonstrate very effective control of bleeding hemorrhagic cystitis employing the 980 nm diode laser. This therapy may potentially prevent radical treatment options such as cystectomy and urinary diversion. It may be attempted in patients with hemorrhagic cystitis who have been refractory to other treatments, have co-morbidities, and for possible bladder preservation. We conclude that for refractory hemorrhagic cystitis, this treatment modality should precede more radical surgical intervention, such as urinary diversion or cystectomy.

#203

CIRCUMFERENTIAL VAPORIZATION OF POSTERIOR AND ANTERIOR URETHRAL STRICTURES: LONG TERM RESULTS

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Background: A recent national survey of board certified urologists (J.Urol.2007 Feb;177(2):685–90) indicates that 93% of the urethral strictures are treated with repeated dilatation, 85.6% with optical internal urethrotomy and 23.4% with endourethral stents. **The results have been poor with 50–64% recurrence within the first 6–12 months**. This presentation is a long-term follow up of the patients managed using contact Nd: YAG or Holmium laser (HO:YAG) vaporization to ablate urethral strictures.
Study: Sixty two male patients and one female 26–72 years old (51 spinal cord injured and 12 others including 4 post radical prostatectomy patients) had their strictures (1 to 4 cm long) ablated circumferentially using contact Nd: YAG or HO:YAG laser. Strictured area was defined and a metal guide wire was left after dilating with filliform boogies. An initial urethrotomy was made at the 12 o\'clock position; Retrograde vaporization of the scarred tissue was done through the length of the stricture so that a cystoscope could be passed to determine the extent of stricture and also to define the external urethral sphincter.
Results: The mean operation time was 32 minutes (range 15 to 57 minutes).). No significant bleeding was encountered. Two earlier patients developed extravasations in the scrotum who were extensively vaporized posteriorly. Subsequently 6 o'clock vaporization was restricted to minimal. Patients have been followed from 2 to 9 years. (Mean 7.1 years). Only 17% needed revaporization (10% were in the first year).
Conclusion: For strictures of the urethra the success rate following the circumferential laser vaporization is greater than the other reported techniques. It may be considered a minimally invasive procedure instead of repeated dilatation with resultant repeated bactraemia, or stent which are difficult to remove, or open urethroplasty.

#204

HOW PROSTATE CONFIGURATION AFFECTS THE EFFICACY AND SAFETY OF GREENLIGHT HPSTM LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY

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Background: We evaluate the efficacy and safety of GreenLight HPS^{TM} laser PVP for the treatment of lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH) with bilobe and trilobe prostates.
Study: We prospectively evaluated our GreenLight HPS^{TM} laser PVP experience. Based on the results of cystoscopy and transrectal ultrasonography, patients were stratified into two groups: bilobe (group I) and trilobe (group II) BPH. Transurethral PVP was performed using a 120 W GreenLight HPS^{TM} side-firing laser system. American Urological Association Symptom Score

(AUASS), Quality of Life (QoL) score, maximum flow rate (Qmax) and post void residual (PVR) were measured preoperatively and at 1 and 4 weeks and 3, 6, 12, 18 and 24 months postoperatively.
Results: 171 consecutive patients were identified (l: 94, ll: 77). There were significant differences in prostate volume (I: 47.7 ± 19.3, II: 97.3 ± 44.0 mL, $p = 0.001$), Qmax (I: 10.1 ± 4.2, II: 8.5 ± 3.4 mL/sec, $p = 0.021$) and PVR (I: 87.9 ± 148.5, II: 138.8 ± 154.3 mL, $p = 0.045$), while AUASS (I: 22.8 ± 6.0, II: 22.9 ± 6.4, $p = 0.858$) and QoL (l: 4.7 ± 1.0, ll: 4.6 ± 1.1, $p = 0.096$) were similar. Significant differences in laser utilization (I: 9.2 ± 6.4 II: 19.6 ± 11.8 minutes, $p = 0.001$) and energy usage (I: 61.1 ± 42.5, II: 132.3 ± 80.0 kJ, $p = 0.001$) were noted. Clinical outcomes (AUASS, QoL, Qmax and PVR) were significantly improved within each group. AUASS, QoL and Qmax showed immediate and stable improvement during the follow-up period. There were no significant differences in the postoperative clinical outcome parameters between the two groups ($p > 0.05$). The incidence of adverse events was low in both groups.
Conclusion: Our experience suggests that BPH configuration has little effect on the efficacy and safety of GreenLight HPS™ laser PVP.

#205

INCIDENCE, MANAGEMENT AND PREVENTION OF PERI-OPERATIVE AND DELAYED ADVERSE EVENTS OF GREENLIGHT HPS LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY

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Background: We report the incidence, prevention and management of peri-operative (< 30 days) and delayed (> 30 days) adverse events in patients treated with GreenLight HPS laser PVP.
Study: Transurethral PVP was performed using a GreenLight HPS side-firing laser system. Patients had American Urological Association Symptom Score (AUASS), Quality of Life (QoL) score, Sexual Health Inventory for Men (SHIM) score, serum prostate specific antigen (PSA), maximum flow rate (Qmax) and post void residual (PVR) determinations and volumetric prostate measurements with transrectal ultrasonography (TRUS). Laser and operative times and energy usage were recorded. AUASS, QoL, SHIM, Qmax and PVR were evaluated 1 and 4 weeks, and 3, 6, 12, 18 and 24 months post-surgery. Adverse events were recorded peri-operatively and at each follow-up interval.
Results: 178 consecutive patients with a mean age of 68 ± 10 years, mean prostate volume of 70.1 ± 41.1 mL and mean PSA of 2.6 ± 2.5 ng/mL underwent GreenLight HPS laser PVP from July 2006 through June 2009. Mean laser and operative times and energy usage were 13.4 ± 10.0 minutes, 31.0 ± 23.0 minutes and 90.0 ± 67.8 kJ, respectively. All were outpatient procedures. Perioperative complications included intraoperative bleeding (3.4%), postoperative clinically non-significant hematuria < 7 days duration (64.0%), hematuria requiring clot evacuation (1.2%), urinary retention requiring recatheterization (5.6%), urinary tract infection (5.1%) and prostatitis (0.6%). Delayed complications included hematuria (1.2%), new onset retrograde ejaculation (15.2%) and bladder neck contracture (0.6%). Prostate cancer was subsequently diagnosed in 2 (1.2%) patients. No urethral strictures, urinary incontinence or erectile dysfunction were noted.
Conclusion: GreenLight HPS laser PVP appears to have a low incidence of perioperative and delayed adverse events.

#206

IS GREENLIGHT HPSTM LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY SAFE AND EFFECTIVE AFTER FAILED PRIOR SURGICAL TREATMENT OF BENIGN PROSTATIC HYPERPLASIA?

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Background: Repeat procedure rates of surgical therapy for BPH range between 1 and 14%. The GreenLight HPS™ laser PVP is evaluated as treatment for symptomatic BPH previously treated with surgical management.
Study: Transurethral PVP using a GreenLight HPS™ side-firing laser system was performed in patients failing prior surgical therapy (transurethral resection of the prostate (TURP), transurethral microwave therapy (TUMT), holmium laser ablation of prostate (HoLAP) and potassium-titanyl-phosphate (KTP) laser PVP) for symptomatic BPH were prospectively evaluated.
Results: Thirty-nine of 178 consecutive patients were identified, having a mean prostate volume of 80.8 ± 50.0 mL. Prior surgical management included TURP (18), TUMT (9), KTP laser PVP (8), HoLAP (2), TUMT and TURP (1), and TUMT and KTP laser PVP (1). Mean laser and operative times and energy usage were 12.5 ± 10.5, 30.0 ± 24.0 minutes and 83.2 ± 64.4 kJ, respectively. Five patients developed a urinary tract infection. 36 patients had nonsignificant hematuria for less than one week. Three patients had persistent urinary retention requiring clean intermittent catheterization. No urethral strictures or urinary incontinence were noted. All patients were able to discontinue their prostate medications following surgery. Mean American Urological Symptom Association Score (AUASS) decreased significantly from 22.8 to 8.2, 6.5, 6.5, 5.5, 4.6, 3.6 and 4.6 ($p < 0.05$) at 1 and 4 weeks and 3, 6, 12, 18 and 24 months, respectively. Mean maximum flow rate (Qmax) and post void residual (PVR) measurements also showed significant improvement from baseline. The incidence of adverse events were low.
Conclusion: Our initial results demonstrate that GreenLight HPS™ laser PVP is safe and effective for the treatment of symptomatic BPH recurring following prior surgical management.

#207

SYMPTOMATIC BENIGN PROSTATIC HYPERPLASIA: INTERMEDIATE OUTCOMES OF GREENLIGHT HPSTM LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY

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Background: GreenLight HPS™ laser PVP is a treatment option for lower urinary tract symptoms (LUTS) secondary to BPH. We review our experience using the GreenLight HPS™ laser system.

Study: We prospectively evaluated our experience with GreenLight HPS™ laser PVP. All patients who failed medical therapy and/or surgery underwent GreenLight HPS™ laser PVP (CW). All had American Urological Association Symptom Score (AUASS), Sexual Health Inventory for Men (SHIM) score, American Society of Anesthesiologists (ASA) risk score, serum prostate specific antigen (PSA), maximum flow rate (Qmax) and post void residual (PVR) determinations and volumetric measurements with transrectal ultrasonography. Transurethral PVP was performed using a GreenLight HPS™ side-firing laser system.
Results: 178 consecutive patients were identified, having a mean age of 68 ± 9.5 years. The mean prostate volume was 70 ± 41 mL and the mean ASA score was 2.3 ± 0.7. Mean laser time, operating time and energy usage were 13 ± 10 minutes, 32 ± 24 minutes and 90 ± 68 kJ, respectively. All were outpatient procedures with 96 (54.0%) patients catheter-free at discharge. 61 (34.3%) patients required catheter drainage for < 23 hours. 9 (5.1%) patients developed a urinary tract infection. 14 (7.8%) patients had nonsignificant hematuria > 1 week. 1 (0.6%) bladder neck contracture and no urethral strictures were noted. Mean AUASS decreased from 23 to 8, 7, 5, 5, 4, 3 and 3 ($p < 0.05$) at 1 and 4 weeks and 3, 6, 12, 18 and 24 months, respectively. Qmax and PVR values also showed statistical significant improvement ($p < 0.05$) during the follow-up period. The SHIM score did not change postoperatively.
Conclusion: Our intermediate results suggest that GreenLight HPS™ laser PVP is safe and effective for the treatment of LUTS secondary to BPH.

#208

TOWARDS CLINICAL ULTRAFAST LASER MICROSURGERY FOR THE TREATMENT OF VOCAL FOLD SCARRING

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Background: Vocal fold scarring is one of the leading causes of voice disorders and has no agreed upon means of treatment. One possible approach involves localizing a pliable injectable biomaterial underneath the vocal fold epithelium; however, injection here is difficult in fibrotic tissue. To aid accurate placement of injectables, we are investigating precise ablation of sub-surface voids using focused ultrafast laser pulses. Femtosecond laser pulses can create confined damage within bulk tissue without the thermal collateral damage observed with longer laser pulses. We have previously demonstrated femtosecond laser ablation through a fiber-coupled miniature device, allowing for development of new clinical applications.
Study: We use a single compact femtosecond fiber laser delivering 570 fs pulses at 500 kHz repetition rate for image-guided subepithelial ablation of porcine vocal fold lamina propria *ex vivo*. Ablation is visualized by multiphoton autofluorescence and second harmonic generation images of the vocal fold tissue before and after ablation. Studies are conducted using a table-top microscope on freshly excised porcine vocal fold.
Results: We successfully created targeted tissue ablation using sub-μJ pulses at ablation rates up to ~ 0.5 mm^2/s. The use of relatively high repetition rates, with a small number of spatially overlapping pulses, was found to be critical to achieving ablation in clinically relevant timescales, while still avoiding significant heat deposition. We used the visual feedback of tissue structure, such as collagen fiber integrity, to confirm successful ablation.
Conclusion: Image-guided microsurgery for the treatment of scarred vocal folds appears promising. For future clinical application of this technique, we plan to develop a miniaturized fiber-coupled device. We have already demonstrated microsurgery using amplified ultrafast laser pulses transmitted through one meter of air-core photonic crystal fiber to a miniaturized microsurgery and imaging probe, illustrating the feasibility of adapting this technique for use through a standard laryngoscope.

#209

NASAL SEPTOPLASTY BY LASER ASSISTED SEPTAL CARTILAGE RESHAPING: A PRELIMINARY CLINICAL STUDY IN 12 PATIENTS

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Background: Nasal obstruction is a common symptom in otolaryngology practice. The etiology is usually deviation of the nasal septum, although nasal obstruction can be caused by other conditions, such as turbinate or adenoid hypertrophy and nasal septoplasty. Our team has already demonstrated that Laser Assisted Cartilage Reshaping can be used for the correction of ear protrusion (1,2). This study aims to evaluate laser assisted septal cartilage reshaping (LASCR) to treat septal deviation.
Study: Between March 2009 and September 2009, 12 patients (8 males, 4 females—mean age: 23 years) underwent LASCR for treatment of septal deviation. These patients did not present any other abnormality (no enlarged concha, no external or internal valve stenosis, no tip ptosis, no nasal polyps). Preoperative examination consisted of anterior rhinoscopy, nasal endoscopy & rhinometry. Before laser irradiation, anesthesia was performed with cottons soaked with adrenaline 1:100.000 & articaine 4%, rested in the nose for 5 minutes. Both sides of the septum were irradiated using a 1540 nm laser connected to a 4 mm spot handpiece with integrated cooling (fluence: 50 J/cm^2). Immediately after the procedure, an internal splint was inserted into the nostril and kept for 7 days. An anti-inflammatory treatment was prescribed for 3 days. Postoperative examination was carried out at 24 hours, 1 week, 1 month, 2 months.
Results: The entire procedure was performed in less than 20 minutes. Among the 12 patients, no complication, no mucosal necrosis, no septal perforation, no inflammation were observed. At 2 month follow up, a totally straight septum was achieved in 7 patients. For 3 adults, the deviated septum was not improved. Two of them had a thick septum. The thickness of the septal cartilage usually ranges from 2.2 mm to 0.8 mm (3). The third patient had a long septum and the distal extremity could not be reached by the handpiece. For another 2 adults, laser irradiation was too painful and the procedure was interrupted. This was certainly due to an insufficient local anesthesia.
Conclusion: LASCR is a safe and less morbid approach to surgical septoplasty. Since significant variability in the cartilaginous elements of the nose is the rule rather than the exception, some improvements of the technique are still required.

#210

LOCAL CISPLATIN AND LASER THERMAL THERAPY FOR PALLIATIVE TREATMENT OF RECURRENT CANCER

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Background: In recent years laser-induced thermal therapy(LITT) has been increasingly accepted as a minimally invasive method for palliation of advanced or recurrent head and neck of gastrointestinal cancer. Previous studies have shown that adjuvant chemotherapy can potentiate leading to improved palliation in advanced cancer patients.
Study: Nine patients with recurrent head and neck tumors volunteered to enroll as part of pilot study testing local chemotherapy injections (2 mg/cm^3 of tumor) followed 48 hours by LITT treatment. LITT was performed using a Nd:YAG laser powered at 50 Watts (2,200 J/cm^2). The CDDP/gel therapeutic implant was expected to retain a higher concentration of cisplatin in the tumor margins for improved LITT treatment of the patient presented. Toxicity was investigated to access feasibility.
Results: Laser treatments were repeated in patients with residual disease or recurrence for a total of 17 treatments. The treatments were not toxic. All 9 patients were treated on objective was to measure toxicity.As a pilot study.
Conclusion: In this is report 9 patients with an accessible solid tumor who were treated with intratumor injection of CDDP/gel followed by LITT, which proved to be feasible and non-toxic. Based on these results we are encouraged to continue our refinement of LITT combined with chemotherapy for cancer treatment.

#211

LASER SERIES

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Background: Over the last seven years we have been treating T1 and T2 laryngeal cancers with laser excision and frozen section. We are one of only a few centres to offer this treatment in the UK.
Objective: Review long term outcome and follow up of patients receiving laser resection for primary laryngeal carcinomas.
Study: A study of all those patients with T1 and T2 laryngeal cancer who were treated with laser excision and frozen section from Dec 2002–Sept 2009.
Results: 69 patients: 48 male; 21 female. Follow-up: 1–5 years. Mean length: 3.8 years. 50% patients chose to have laser treatment over radiotherapy. 8% were day case. 64% allowed home the next day. 38% required a single procedure to achieve cure. Complications were as follows: 22% patients had recurrence. 8% developed a laryngeal web. 4% had poor voice.
Conclusion: Laser excision with frozen section is a valid technique for the treatment of T1 and T2 laryngeal cancer and offers advantages over radiotherapy. Radiotherapy and laser excision are equally popular treatment modalities when offered to patients. Cure can be achieved in a single day case procedure with laser excision.

#213

1.9 μm DIODE LASER ASSISTED ANASTOMOSIS IN RECONSTRUCTIVE MICROSURGERY: A RETROSPECTIVE FOLLOW-UP STUDY IN 27 PATIENTS

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Background: The most important factor for successful free flap transfer and replantations is a well executed vacular microanastomosis. Currently, many alternatives are being evaluated to help the microsurgeon and to reduce the complications. In this context, after many studies in animals, we introduce our experience with 1.9 μm diode laser in clinical microsurgery with special attention to outcomes and performance of the technique.
Study: Between January 2005 and December 2007, 27 patients underwent microsurgery with 1.9 μm diode laser at our institute. The patients had a mean age of 31 years (range 2 to 59 years), fourteen were women and thirteen were men. This technique was utilized for digital replantations (n = 2) and for free flap transfer (n = 27). Two patients had two procedures. Etiologies of the defect were trauma (n = 14), tumor (n = 9), congenital (n = 2), burn (n = 1) infection (n = 1), arthritis (n = 1), and dog bite (n = 1). Laser assisted microvascular anastomoses (LAMA) were performed with a 1.9 μm diode laser after placement of equidistant stitches. The following parameters were used: spot size 400 μm, power 125 mW, time depending on vessel size (0.8 mm to 1.8 mm) : fluence varying from 70 to 200 J/cm^2.
Results: Three surgical revisions following hematoma and one rupture of the arterial anastomosis leading to a free DIEP-flap necrosis resulting from high-dose radiotherapy prior to surgery occurred after LAMA, accounting for a overall success rate of 96.6%.
Conclusion: This study underlines the numerous benefits of the technique: easier performance of vascular anastomosis with difficult access, decrease of reperfusion bleeding and complications and, finally, a shorter learning curve.

#214

FEMTOSECOND LASER ABLATION AS A SUBSURFACE LIGHT SCALPEL TO ALTER SEIZURE PROPAGATION DYNAMICS

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Background: Surgical techniques that allow for targeted disruption of biological structures in bulk tissue, without affecting overlying structures or causing collateral damage, would open the door to new procedures. Scalpels produce fine precision cuts, but incisions must start at the tissue surface. Radio-frequency and ultrasound ablation enable subsurface disruption, but have spatial precisions of centimeters to millimeters, respectively. We describe an optical technique to make subsurface cuts in *in vivo* rat brain and characterize cut widths and depths for different laser energies.
Study: To produce cuts, high intensity, femtosecond laser pulses were tightly focused and translated within the cortex of craniotomized, urethane-anesthetized rats. Animals were perfused and brains were extracted for histological studies. Slices were stained with H&E and diaminobenzidine and imaged with bright field illumination to characterize cut width.
Results: Cut widths decreased exponentially as a function of depth beneath the cortical surface but showed about 50% variation. For example, at laser energy of 13 μJ, widths decreased from 131 μm ± 47 (AVG ± SD) to 34 μm ± 17 for depths from approximately 200 to 900 μm, respectively. Maximal cut depth increases logarithmically as a function of laser energy. At energies of 0.3, 5 and 13 μJ, maximum cutting depths are 207 ± 88, 654 ± 233 and 746 ± 161 μm, respectively.
Conclusion: Such confined ablation allows for selective dissection of subsurface tissues structures, such as neural

networks. In a rodent epilepsy model, neural connections were disrupted using femtosecond laser ablation to alter seizure propagations. Recordings of local field potential at and far away from the seizure focus indicate, on average, seizure propagations were delayed by 15 seconds, compared to when no cut was present. Femtosecond laser ablation can be used as a light scalpel to produce subsurface, confined tissue damage and permit targeting of structures on the cellular scale.

#215

AUGMENTED MICROSCOPY—SIMULTANEOUS ACQUISITION OF BRIGHT FIELD AND LUMINESCENCE LIFETIME IMAGES

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Background: Photoluminescence imaging with appropriate contrast agents offers an unprecedented potential in diagnostic evaluations. However, its clinical applications have been hampered by numerous technical challenges, including acquisition in a dark environment, slow processing, and disjoined visual and electronic image presentation. We have developed an augmented microscope, which allows for simultaneous acquisition and presentation of bright field optical images and near-infrared luminescence images.

Study: This augmented microscope employs luminescent lanthanide probes, selected due to their extraordinarily long luminescence lifetimes, lack of photobleaching, and the ability to form upconverting materials. A cooled, time-gated CCD camera collects near-infrared luminescence images, which are then converted to a luminescence lifetime map via image processing algorithms. Once a lifetime map is created, the information is delivered to an organic light emitting diode (OLED) connected to the microscope. The virtual (electronic) image from the OLED is optically combined with the real (bright-field) image to create a composite image at the eyepiece.

Results: We successfully synthesized upconverting nanoparticles made up of YbF_3 doped with Y and Tm with peak excitation at 980 nm and peak emission at 800 nm. Emission resulting from laser excitation of these nanoparticles was recorded, processed, and displayed at the microscope eyepiece in the same image plane as the bright-field image. Lifetimes ranging from microseconds to milliseconds were resolved visually and could be refreshed every 2 seconds.

Conclusion: The augmented microscope has potential uses in image-guided clinical intervention, such as microsurgical treatment of cancer. While many advances have been made in the diagnosis and characterization of cancer, early-stage treatment of the disease often employs surgical excision of the tumor. Use of the augmented microscope with a properly selected probe will reduce the surgical margin needed to ensure complete excision, reduce operation time by allowing the surgeon to visualize cancerous regions while operating, and potentially improve the outcome of surgery with tension headaches related to upper back andneck muscle spasms.

#216 Late Breaking

NEW TREATMENT OF BREAST FIBROADENOMA: WORK IN PROGRESS

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Background: Approximately 1 in 8 women in the United States develop fibroadenomas (FA) during their life time; same as breast cancer. The current treatment options of surgical removal or observation are suboptimal. Minimally invasive, image- guided techniques for diagnosis have been reported. The preliminary experience with an FDA approved percutaneous laser ablation of FA is described.

Study:

Patients: 18 women, aged 19–55, with needle core biopsy proven (fibroadenoma: 17, atypia: 1) were treated from January–December 2009 in an office setting.

Method: Initially, stereotatic guidance was employed but ultrasound was selected because of its superior visualization and real-time imaging. Under local anesthesia, in a supine position, a 14 gauge laser needle was inserted into the center of the breast tumor. A second multi-sensor thermal needle was inserted parallel and adjacent to the tumor. A continuous wave, 810 nm laser energy at 3–6 watts was delivered through a 600 micron fiber. The tumor became hyper-echogenic while its peripheral temperature rose to 60°C. The average treatment duration was 15 minutes and the average energy given was 2650 Joules. After one hour of observation patients were discharged in stable condition with an ice pack on the breast and oral analgesics if needed.

Results: The mean tumor size was 12 mm (range: 4–21). 57% of initially palpable tumors became non-palpable within 3 months. Average pain level was 3.5/10 (range: 0–6) during treatment. 50% of patients experienced no pain post-therapy. The remaining half reported transient bruise, pain, heaviness and in one case minimal scalding lasting up to a week. Cosmesis as judged by patients themselves was: excellent 61%, good: 28% and fair: 11%.

Conclusion: In this preliminary report, laser therapy of benign breast tumors (mostly fibroadenoma) appears to be a reasonable third option with no major side effect.

ePOSTER

#601

TEMPORARY IMPROVEMENT OF MILD TO MODERATE INFLAMMATORY ACNE

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Background: The objective of this study (Arizona State University IRB) is to determine efficacy and safety of ultrasound treatments for mild to moderate acne vulgaris. A low power, focused ultrasound device (up to 1 watt) was utilized to investigate its efficacy and safety in treatment of non-cystic inflammatory lesions for the purpose of achieving at least temporary improvement in clearing rate.

Study: The study included 25 subjects ages 18–40 and was designed as 'split-face' treatments with randomized 'control' (not treated side) vs 'active' (treated side). Active side lesions were treated with a hand-held focused ultrasound device at 3 levels of power (0.75 watts, 0.7 watts, and 0.6 watts) for 15.4 seconds per application to a lesion. The default power level was 0.70 W, 3

applications per lesion were used (up to ~46 seconds total treatment time per lesion). The treatment protocol included 5 sequential treatment days and 2 follow up visits on days 8 and 12. At each treatment and visit day a blinded independent clinical reviewer assessed the lesions on both sides using the criteria for clearing as either present or 'completely resolved'. Self-assessment scores and a 4 point satisfaction survey from each subject were also filled out for each date.
Results: A total of 256 assessed lesions were included in blinded lesions review. Incremental daily lesion clearance showed statistically significant temporary improvement in days 4–8 maximizing at day 4 (30% vs. 16%, $p < .009$, chi-square test). Self-reported maxima of rating and satisfaction scores fall on day 5 of treatment cycle with high rate of satisfaction for study participants of 84% (21 of 25—satisfied or very satisfied, $p < 0.0001$).
Conclusion: An ultrasound low power hand-held device appears to be effective and safe for temporary improvement of inflammatory non-cystic lesions in acne vulgaris.

#602

THE EFFICACY OF FULL-SPECTRUM LIGHT GENERATED BY ELECTRICAL DISCHARGE BETWEEN TWO CARBON ARC RODS FOR THE TREATMENT OF ACNE COMPARED TO 1% TOPICAL CLINDAMYCIN

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Background: Full-spectrum light generated by high-energy electrical discharge between carbon arc rods has recently been proved to be effective for refractory atopic dermatitis. Some studies have shown that the biologic markers for inflammation have been signficantly reduced in atopic dermatitis after this light therapy. The present study was designed to investigate its efficacy compared to 1% clindamycin in the treatmehnt of moderate to severe inflammatory acne vulgaris.
Study: Nine patients with inflammatory acne were treated with full spectrum light on the one half of their face, the other half being treated with 1% topical clindamycin twice a day. Treatment and control sides were allocated at random. The light therapy was dellivered twice a week for four weeks, with the treatment during being 10 minutes for each session. The lesion counts were evaluated at every week during the treatment period, and at 2, 4, 8 weeks after the completion of treatment. Melanin levels were measured before and after the treatment on the light therapy side.
Results: The percentage reduction of inflammatory acne lesion counts was 76.8% with the full spectrum light therapy and 25.5% with 1% topical clindamycin. The melanin level measurements did not reveal any significant change after the light therapy compared to before treatment. The subjects rates the treatment as 'good' to 'excellent'. There was no side effect observed.
Conclusion: Full-spectrum light generated by high-energy electrical discharge between two carbon arc rods significantly reduced the number of inflammatory acne lesions without adverse effects. The melanin levels did not show any significant change after this light treatment.

#618

FOCUSED OPTICAL COHERENCE TOMOGRAPHY AND LASER-INDUCED FLUORESCENCE ENDOSCOPE

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Background: Optical coherence tomography (OCT) is a non-invasive, interferometric imaging technique capable of imaging up to 2 mm deep in highly scattering tissue. Laser-induced fluorescence (LIF) has shown promise as a viable option for diagnostic tests in the gastrointestinal tract. Our *in vivo* work on the mouse colon with similar LIF techniques has shown high sensitivity and specificity in spectrophotometric analysis of distinguishing normal tissue from adenoma. Combining OCT and LIF in one endoscope shows a heightened sensitivity to early changes in tumor progression when compared to either modality alone.
Study: Previously, we have built ultrahigh resolution (2–5 microns) OCT endoscopes with unfocused LIF and have demonstrated imaging of mouse colon serially over time. Our new design is a high-resolution endoscope 2 mm in diameter that can focus light from 325–1300 nm. A reflective design ball lens is employed that eliminates the difficulty of operating achromatically over a large range, while taking advantage of TIR at two faces and coating a third mirror face internally to focus the beams downwards. It is a 1:1 imaging system that obtains a theoretical diffraction-limited resolution for both the OCT (800–1300 nm) and LIF (greater than 325 nm) channels.
Results: We have built the focused OCT-LIF endoscope and integrated it into an existing arrangement. Experimental resolution and spot sizes correspond to modeled values, as the endoscope is currently being used in mouse trials.
Conclusion: *In vivo* and *ex vivo* images acquired using this focused OCT-LIF system suggest higher lateral resolution in both imaging modalities than those images collected with previous systems, allowing for heightened specificity and sensitivity in the detection of early changes in tumor progression.

#619

COMPARISON OF THE TISSUE INJURY PROFILE POST-TREATMENT WITH A NONINVASIVE UNIPOLAR vs MINIMALLY INVASIVE BIPOLAR RADIOFREQUENCY SYSTEM

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Background: Noninvasive unipolar and minimally-invasive bipolar radiofrequency (RF) systems used for skin treatments have recently been developed. We performed a side-by-side comparison of the tissue injury profiles obtained following ex vivo treatment of skin with each of these 2 systems.
Study: Swine skin was subjected to a variety of unipolar or bipolar RF treatment parameters. For unipolar treatments, energy was applied to the same location 1, 3, or 6 consecutive times at mid-range power. Target temperature was set to 70°C for 4, 8, or 16 sec for bipolar treatments. Tissue samples were excised and processed for histological assessment.
Results: Samples treated 1 or 3 times with unipolar RF showed no evidence of coagulation in the epidermis, dermis, or subcutis. Vasculature showed no evidence of coagulated blood. Samples treated 6 consecutive times showed fat atrophy secondary to vaporization with some residual feathering of the adipose ultrastructure and mild stromal coagulation. In addition, there was no evidence of coagulation in the epidermal and dermal layers. Similarly, we did not observe any histological evidence of coagulation in the epidermis or subcutis in samples treated with

bipolar RF. However, focal zones of collagen coagulation separated by zones of normal dermis were observed at 4 sec. At 8 and 16 sec, the thermal coagulation was contiguous and lacked interspersed zones of normal tissue. There was no sign of tissue necrosis in any layer. The vasculature showed no evidence of coagulated blood and fat ultrastructure was normal.
Conclusion: Noninvasive unipolar RF localizes thermal injury to the subcutis, while minimally-invasive bipolar RF confines thermal injury to the dermis without spreading to collateral skin layers.

#620 Late Breaking

OBSERVATION BY VIVASCOPE® IN VIVO CONFOCAL MICROSCOPY OF PHOTOTHERAPY EFFECT ON SKIN TAN AND REJUVENATION

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Background: Light-Emitting Diode (LED) is a non thermal, noninvasive treatment that interacts with mitochondria and several cellular mechanisms such as the increase of ATP production and cell synthesis. In this study we investigated the whitening and rejuvenating effect of LED using LED TRIWINGS® which emits two specific wavelengths (590 nm and 630 nm) on pigmented skin lesion. The effects were mainly observed by *in vivo* confocal microscopy.
Study: 5 healthy volunteers aged from 53 to 70 years old were enrolled in this study. They were exposed twice a week to the LED for one month, on the right forearm. The left forearm remained untreated. Evaluation included skin pigmentation by Mexameter®, pictures, *in vivo* confocal microscopy (VivaScope®) assessment, and clinical examination; at the following times: D0, D28 (24 hours after the last exposition), D59 and D89 (respectively 1 and 2 months after the last exposition).
Results: Mexameter® measures revealed a significant decrease in melanin, at D59 ($p = 0.04985$) and at D89 ($p = 0.03085$) on the LED-exposed side compared to the control. ivaScope® study revealed that the thickness of the epidermis tends to be thinner 1 and 2 months after the exposition compared to the untreated skin, suggesting a healthier skin. Observation of the basal layer showed significant improvement of the number and morphology of dermal papillae on the exposed side, on 4 volunteers, at D59 and D89 allowing a better oxygenation of the epidermis and a better supply in nutrients. On 3 volunteers, a decrease in melanin content was observed by VivaScope®. The clinical examination confirmed the previous improvements. The skin appeared for most volunteers healthier, more tonic, with a homogenous color and pink tan.
Conclusion: By its effect on activating cell mitochondria LED light has a whitening and rejuvenating effect on the skin.

#623

THE INVESTIGATION OF A FLUORESCENCE/ ELASTIC SCATTERING SPECTROSCOPY (F-ESS) DEVICE FOR ORAL TISSUE CHARACTERIZATION

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Background: The relative 5-year survival rate for oral cancer drops from 68% for Stage I cancer (tumor < 2 cm and has not spread to lymph nodes or distant sites) to 27% for Stage IV, where adjacent structures have been invaded.[1] These statistics show the importance of early detection and the need for more effective treatment modalities. Long-term objective is to develop and validate the use of elastic-scattering spectroscopy (ESS) and autofluorescence as an in vivo tool for the clinical detection, diagnosis and monitoring of oral dysplasia and malignancy. Prerequisite for this work is the development of a database on the ESS and fluorescence signatures of the healthy oral mucosa, given the many different tissue types that are present in the oral cavity, as well identifying the potential need to control for extraneous variables that may be important, such as temperature, exercise, age, race etc.
Study: In the first portion of this study, goal was to identify what extraneous parameters needed to be standardized during optical data acquisition. 10 subjects with similar age and race and healthy oral mucosa as defined by clinical examination and a gingival index 1 were enrolled. Baseline imaging using a fiberoptic oral probe was performed at 11 standardized locations in subjects at following standardized parameters: at rest, after imbibing standardized hot drinks, cold drinks, and after moderate to strenuous exercise. Then 75 subjects with healthy oral mucosa were imaged at the same 11 standardized locations under the standard conditions identified in the first part of this study. Goal of this portion of the study was to characterize ESS and autofluorescence optical properties in the different types of oral soft tissues.
Results: Each imaging event lasted several seconds and was well tolerated by the subjects. Exercise and hot drinks immediately prior to imaging (> 3 mins) affected study data. Cold drinks had no visible effects. Characteristic and distinct optical data were obtained for the following locations: dorsal surface of tongue; ventral surface of tongue; buccal mucosa, hard palate and gingiva; lips; floor of mouth.
Conclusion: ESS and fluorescence data are very sensitive to extraneous oral factors such as exercise and temperature, and baseline characteristics are specific to individual locations within the oral cavity.
Funding: The work for this effort was funded under a subcontract from Science & Engineering Associates, SEA (aka Apogen Technologies) by the Department of Defense (DOD) Telemedicine and Advanced Technology Research Center (TATRC) under the Prime contract # W81XWH-07-2-0057.

#629

EVALUATION OF A NEW COMBINED TREATMENT PROTOCOL FOR MINIMALLY INVASIVE BODY CONTOURING

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Background: A new, minimally invasive combined-treatment protocol was evaluated for efficacy and patient satisfaction. Intraoperative laser-assisted tumescent liposuction was followed post-operatively by noninvasive body contouring. An FDA-cleared laser lipolysis device was used intra-operatively to mechanically and thermally disrupt targeted lipocytes with concomitant thermo-coagulation. An FDA-cleared non-invasive device incorporating bipolar radiofrequency, infrared light energy, negative pressure and mechanical tissue manipulation was used post-operatively.

Study: Patients received tumescent liposuction of the abdomen, flanks and/or outer thighs accompanied by intraoperative lipolysis with a 1064 nm Nd:YAG laser. Infused tumescent fluid for each patient was not more than 5 liters. Laser pulse energy was between 250 mJ and 800 mJ. Pulse length varied from less than 150 μsec to 800 μsec. Pulse rate was 15 Hz. Patients were evaluated by telephone within 6 hours of the procedure, in person one day, one week and two weeks post-operatively, and then every 2 to 4 weeks. Treatment with combined bipolar radiofrequency, infrared light energy, negative pressure and mechanical tissue manipulation was initiated 2 to 3 weeks post-liposuction and continued weekly for 4 to 10 weeks. Treatment efficacy was evaluated by assessment of contour improvement, by comparison of the pre and post-treatment circumference, and by photography. Patient satisfaction was assessed with questionnaires.
Results: The investigator, blinded evaluators and patients noted excellent contour improvement, circumferential reduction and skin tightening with the combination treatment protocol. Minor contour irregularities and/or tissue induration following laser-assisted liposuction resolved or improved significantly after treatment with the non-invasive body contouring device. Patients reported high levels of satisfaction. Adverse events following the combination treatment protocol were mild and transient.
Conclusion: Laser-assisted tumescent liposuction followed by noninvasive bipolar radiofrequency, infrared light energy, negative pressure and mechanical tissue manipulation produced excellent clinical results and patient satisfaction. This combined treatment protocol may synergistically enhance results from laser-assisted liposuction alone and optimize patient satisfaction.

#630

SUBMENTAL AND JOWL CONTOURING AND SKIN TIGHTENING DEMONSTRATED BY 3 DIMENSIONAL MEASUREMENTS USING 924 nm AND 975 nm LASER-ASSISTED LIPOSUCTION DEVICE

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Background: Small areas of lipohypertrophy and skin laxity pose a challenge to current liposuction techniques. An ideal treatment would enable accurate localized fat removal while simultaneously providing tissue tightening. In this pilot study, we examined the efficacy of a dual wavelength lipid- and water-selective diode laser system for laser-assisted liposuction of the submental and jowl regions. The results were demonstrated by a 3 dimensional measuring system.
Study: 11 subjects aged between 38 and 64 years old, skin type II–IV, underwent one treatment of laser assisted liposuction employing a 924 nm/975 nm wavelength diode laser (SlimLipo™, Palomar Medical Technologies, Inc.). Subject weights, standardized 2 and 3 dimensional photography (Vectra, Canfield Inc.) were taken at baseline and at 24–72 hours, 2 week, 6 week and 12 week post treatment. In addition, patient satisfaction as well as physician clinical impression evaluations, were completed. Treatment energy dosages ranged from 6–10 kJ per subject in 2- 3passes at 924 alone and/or 924/975 combination modes. Skin surface temperature was monitored with an IR external thermometer. Temperature ranges were 37–40 C at treatment endpoint. Minimal aspiration was performed averaging 10–50 cc.
Results: Significant improvement in lipohypertrophy and skin laxity were observed with minimal ecchymoses and edema. Quality validated 3 dimensional measurements (Vectra system, Canfied Inc) demonstrated a mean volume reduction of 26.0 cc at 2 week follow up, 61.8 cc at 6 week follow up and 61.2 cc at 12 week follow up. Skin tightening was also noted using this objective measuring device.
Conclusion: Laser assisted liposuction with 924 nm and 975 nm wavelength diode laser assisted liposuction device is a safe and effective modality of treatment for submental and jowl fat reduction and skin tightening.

#631

IMPROVEMENT IN UPPER ARM LIPODYSTROPHY, LAXITY AND STRIAE ALBA USING Nd:YAG LASER ASSISTED LIPOSUCTION

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Background: Small volumes of fat and skin laxity are a challenge to current standard liposuction procedures. Non-invasive technology, although helpful, has not been proven to be long lasting and requires multiple treatments. An ideal treatment would include fat reduction as well as tissue retraction and tightening accomplished during just one or two procedures with long lasting sculpting results. In this study, a water-selective 1064 nm laser assisted liposuction (LAL) Nd:YAG laser system was used to demonstrate sculpting and tightening. The heat and chromophore absorption is theorized to induce vascular coagulation and has been proven to induce neocollagenesis both of which permit a faster recovery time when compared with traditional surgical liposuction. We look at the application of this technique using 1064 nm Nd:Yag laser to treat lipodystrophy of the upper arms, one of the most commonly treated anatomical regions by surgical liposuction.
Study: Four female subjects aged between 33 and 46 years underwent 1 treatment of both the upper arms using a 1064 nm Nd:YAG laser device (Lipolite, Syneron Medical Ltd). Circumference measurements, standardized photographs and 3 dimensional photos as well as subject weights were taken at baseline and at 1 week, 3 week, 4 week, 6 week and 12 week follow up visits. Histology of treated sites to non-treated site of noted reduction of striae alba on upper arms was also evaluated.
Results: Quality validated 3 Dimensional photography measurements demonstrated the mean upper arm circumference in treated subjects decreased by 2.2 cm at 6 week follow up. Skin tightening was measured using 3D imaging. Histology overlying clinically improved striae, demonstrated increased density of dermal collagen.
Conclusion: Laser assisted liposuction using 1064 nm Nd:Yag laser results in effective circumference reduction of the upper arms as well as skin tightening. There was also histologic evidence to confirm clinical impression of striae alba improvement.

#632

FAT THICKNESS REDUCTION MEASURED BY DIAGNOSTIC ULTRASOUND AFTER BODY CONTOURING TREATMENTS USING COMBINATION OF ENERGY MODALITIES

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Background: Body treatments are becoming more common in the aesthetic arena. Subjects are looking for non invasive contouring treatments that also improve the skin surface. In this study, a combination of four different techniques- massage, vacuum, bipolar radiofrequency and infrared light were used simultaneously. Different scientific measurement tools were used to elucidate the underlying mechanism.

Study: Thirty three subjects seeking body contouring were recruited and treated in two clinical sites. Age ranged from 21 to 61. Patients received 6 treatments in different body areas either once or twice per week. Patients were evaluated using standardized photographs and various objective clinical measurements (including diagnostic ultrasound and cutometer device).

Results: Clinical assessments were carried out one and three month post treatment. Improvement in the different body areas was noticed at the follow up visits in 92% and 90% of the subjects for the 1 and 3 month respectively. At 3 month follow up visit, a high correlation of 0.93 was observed when comparing patient's and physician's improvement assessment. When comparing the results of once a week to twice a week treatments, a significant difference favouring two treatments a week was found only in the thigh treated area. Patients subjectively described comfort and satisfaction from treatment. 97% were satisfied with the results at the follow up visit. The thickness of the fat layer, showed 29% reduction between baseline and the 1 month follow up. Elasticity and firmness of the surface remained unchanged.

Conclusion: The described treatment demonstrated good results and the majority of the subjects and the physicians found the treatment efficient for the different body areas that were treated. These results are associated with the underlying mechanism of reduced volume of fat layer while the slightly tightened dermis keeps elasticity and firmness intact.

#633

LIPOSCULPTURE: NEW APROACH WITH 924 nm 975 nm LASER DEVICE

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Background: Body sculpting has been the objective of several procedures. This study presents a 1 year experience with a new approach in the laser lipolysis technique. The treatment focus in a combination of 2 different wavelength that allow its use for contour and laxity.

Study: 57 subjects, 42 female and 15 male, 18–48 years old, were submitted to a 1 laser lipolysis in one or 2 areas such as arms, abdomen, flanks and buttocks.

Results: The combination of 924 nm and 975 nm in laser lipolysis allowed to happen a faster, more efficient and with less adverse effects procedure. All subjects presented significant improvement in body contour and laxity. Adverse effects were limited to transitory, without needing any special care. Satisfaction rate reached 83%.

Conclusion: Laser lipolysis with 924 nm and 975 nm showed to be a efficient and safe technique for the treatment of body contour and laxity.

#634

ONE YEAR EXPERIENCE USING SHEAR WAVE TECHNOLOGY FOR BODY CONTOURING

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Background: Interest in contour improvement is more frequent than ever in daily practice. Several technologies and devices have come up with that objective. This study presents a one year experience with a new ultra-sound lipolysis system.

Study: 78 subjects, 19–60 years old, 6 male and 72 female, 52–82 Kg weight (66 Kg average), treated area—abdomen. Subjects were submitted to 4 sessions with 14 days in between each session.

Results: All subjects reported virtually no pain (minimal heat sensation) during all treatment. No adverse side effects were recorded during, after or during the follow-up. Blood-tests showed no signifficant alterations.

Conclusion: This new contour improvement method has proven to be safe and effective for the purpose and with a high subject satisfaction.

#635

EVALUATION OF INTERNAL AND SKIN SURFACE THERMAL EFFECTS OF 980 nm DIODE AND 1064, 1320 AND 1444 nm Nd:YAG LIPOLYSIS LASERS IN AN EX VIVO PORCINE MODEL

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Background: Lipolysis laser tissue interaction is dependent upon laser wavelength, energy profile, tissue delivery method and target tissue factors; with little variation among the latter three at similar power levels (pulsed laser energy delivered by optical fiber to subcutaneous tissues) laser wavelength becomes centrally important with regard to efficacy and safety. The novel 1444 nm neodymium YAG laser (AccuSculpt, Lutronic, Inc) and other lipolysis laser wavelengths (980, 1064 and 1320 nm) were evaluated to ascertain thermal tissue responses proximate and distant from the fiber tips.

Study: Fibers for 980, 1064, 1320 and 1444 nm lipolysis lasers were used to assess 1) relative thermal confinement and diffusivity ("external" or skin surface temperature model - fiber tips placed within ex vivo porcine fat with attached skin such that fiber tips were at uniform depth 10 mm below attached skin) and 2) relative absorption of radiant energy ("internal" or target tissue temperature model—fiber tips placed at surface of ex vivo porcine fat [skin detached]). To the extent possible uniform lasing parameters (eg, power, pulse energy, pulse frequency, total energy, fiber diameter) were used in all experiments. Internal and external temperature versus time response curves were generated using thermal videography (FLIR 325, 30 Hz sampling rate) and ThermaCAM Researcher Rev 2.9 data analysis software.

Results: Internal temperature response was greatest at 1444 nm (followed by 1320, 1064 and 980 nm); both the slope of temperature elevation and the magnitude of effect were greatest at 1444 nm during the first second of radiant energy exposure. External (skin) temperature elevation was highest at 1320 nm, followed by 980 and 1064 nm and least at 1444 nm.

Conclusion: Greater wavelength selectivity for fat and water decreases lipolysis laser tissue response time and improves thermal confinement.

#636

A NOVEL ENERGY ASSISTED LIPOLYSIS USING COMBINED RF AND LASER TECHNOLOGY

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Background: Liposuction is currently the most popular body sculpting procedure. Recently, new energy based technologies were developed to achieve effective subcutaneous fat removal with reduced bleeding, minimal down time and significant skin contraction, while making the procedure easier and shorter. Our aim was to further improve the lipolysis/liposuction procedure using a combination of RF and laser energy.

Study: Both ex-vivo experiments and theoretical modeling were used to evaluate simultaneous application of laser and RF power sources to adipose tissue. Probe design and power specifications were optimized for the following requirements: ease of cannula penetration into the tissue, speed of aspiration and uniformity of the temperature distribution over specified areas. Tissue resistance force, temperature inside of the adipose tissue and on skin surface, as well as aspiration speed were measured ex-vivo using tissue harvested during abdominoplasty. Theoretical modeling of the heat generation in tissue, flow dynamics, heat conduction and convection were performed using COMSOL Multiphysics finite element analysis software. Selected results of the theoretical modeling were tested in ex-vivo experiments.

Results: It was found that optimization of all the requirements cannot be effectively achieved using a single energy source. Laser fiber mounted in front of the probe allowed for easy and smooth advancement of the probe. Conversely, a high RF power yielded effective volumetric fat liquefaction, skin tightening and blood vessels coagulation with minimal risk of overheatingthe surrounding tissue. Computational modeling of tissue heating helped us to design the laser fiber and RF electrodes configuration such that optimal temperature distribution in tissue along the probe could be achieved. Results of ex-vivo experiments were consistent with computational modeling.

Conclusion: Laser was found to be best suited for opening the channel in tissue, while RF energy used in a bipolar configuration was an optimal choice for volumetric heating around the cannula, allowing for homogenous fat liquefaction. RF energy applied to the superficial skin layers provides uniform heating to hypodermis and dermis, which is important for effective coagulation of blood vessels, connective tissue remodeling and reorganization of the hypodermal architecture. It is our conclusion that a combination of RF and laser sources best addresses the diverse needs of lipolysis/liposuction.

#637

TREATMENT OF CELLULITE WITH THE SMOOTHSHAPES LASER: EARLY CLINICAL OBSERVATIONS

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Background: Cellulite is characterized by engorged fat cells, trapped in a network of fibrous septae located in the hypodermis. The SmoothShapes® laser combines two wavelength energies with a mechanical massage and a vacuum system. The 915 nm laser light is selectively absorbed by lipids and heats the content of the adipocytes. The 650 nm LED light has been shown to modify specifically the membrane permeability. These mechanisms facilitate the transfer of fat to the extracellular compartment, with subsequent drainage to the lymphatic system by the mechanical component of the treatment.

Study: 12 patients, age 25 to 60, were treated with SmoothShapes on thighs and buttocks of both legs (9 female patients with cellulite graded stage 2 on the Nürnberger-Müller scale) and on the abdomen area (2 male, 1 female). Each patient received a total of 8 SmoothShapes sessions, 15 minutes per treated area. The circumference reduction was measured at 2 height levels on the thighs, and at 3 levels on the abdomen. The texture of the skin and the patient's satisfaction were observed.

Results: An improvement of the skin texture, smoother with a better tone, was noticed early after 4 sessions and amplified after eight sessions. The mean circumference reduction was 0.93 ± 0.82 cm (range 0 cm–2.5 cm, $p < 0.01$, Wilcoxon test) and 1.12 ± 0.85 cm (range 0 cm–3 cm, $p < 0.01$, Wilcoxon test) at both measurement points of the thighs. The circumference reduction measured on the abdomen area ranged from 1 cm to 4.3 cm, depending on the patient and the measurement level.

Conclusion: The SmoothShapes device appeared to be effective in reducing cellulite of the thighs, providing a significant reduction in circumference and an improvement in skin texture.

#647

THIRTY CONSECUTIVE PATIENTS TREATED WITH A FRACTIONAL CO_2 LASER: HISTOLOGICAL COMPARISON AND CLINICAL RESULTS

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Background: Laser resurfacing, although popular, is often fraught with variability in clinical outcomes and settings. The purpose of this study is to perform target based facial resurfacing based on the histopathological evaluation of the acute injury pattern in abdominal panni using the Lumenis CO_2 laser.

Study: Thirty subjects were consented, enrolled and divided equally into 2 subgroups (deep treatment and superficial treatment). Subjects in both subgroups underwent a detailed facial analysis and had treatment settings chosen based on their classification and the acute pattern of injury noted from previous histology. After treatment, biopsies were harvested from the nasolabial fold of at day 0, 4, 14, 30 and 90. Biopsies were stained using Hematoxylin & Eosin and TUNEL staining to further assess the acute pattern of injury.

Results: Samples for subgroup 1 day 0, showed acute ablative columns averaging = 637 microns in depth (i.e. down into the reticular dermis). Clinically, the day 0 acute injury pattern correlated grossly with swelling, erythema, and serosanguinous oozing. The subgroup 2, day 0 samples displayed a pattern of injury confined to the epidermis (20 um). Clinically subjects in subgroup 2, had erythema and mild swelling on day 0. Day 4 samples for both groups showed resolution of acute microcolumns, an influx of inflammatory cells and loosening of the stratum corneum. Facial analysis at the day 4 time point showed erythema, peeling and swelling. Subgroup 2 samples showed epidermal thickening on day 4 and this finding extended through day 30. Day 14, 30 and 90 samples showed continuing healing while clinical subjects showed improvement in wrinkle score,

pigment among other clinical parameters through 90 day follow up.
Conclusion: An evidence based approach to resurfacing is important in helping to establish a pathway that will result in more uniform and predictable results.

#648

THIRTY CONSECUTIVE PATIENTS TREATED WITH A FRACTIONAL CO_2 LASER: A MEASUREMENT OF CLINICAL RESULT USING NON-INVASIVE OBJECTIVE FACIAL ANALYSIS

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Background: In 2007 over 647,707 laser resurfacing procedures were performed according to ASAPS statistics. Efficacy of treatment is measured subjectively causing wide variability in judging the final result. The purpose of this study is to measure the face using non-invasive, objective devices pre-treatment and post treatment as a method to evaluate treatment outcome.
Study: Thirty (30) subjects were consented and selected for various skin conditions including age spots, fine lines and wrinkles. Subjects were measured at pre-treatment and post treatment visits non-invasive measurement devices which included: DermaScan C 20 MHz HFUS; (Cyberderm Broomall PA); Tru Vu (Johnson and Johnson); BTC 2000 (SRLI Technologies Nashville, TN.); Derma Unit SSC3 (CK electronic, Köln Germany); and the Chromometer. Objective measurements were compared to evaluation by a five member blind panel.
Results: All 30 subjects completed the protocol, one subject experienced hyperpigmentation. All subjects showed objective improvement in a wide range of parameter including areas such as fine lines, wrinkles texture, and tone through 3 month follow up. The objective results showed correlation to response of the five member blind panel.
Conclusion: Subjective clinical evaluation has been the main method used to evaluate post-treatment results. This method, however, is often fraught with variability. Non-invasive facial analysis offers a method of evaluating a face in a fully objective manner which gives the patients tangible results and will allow for comparison of results on a large scale.

#649

SYNERGIC TREATMENT WITH IPL AND MICRO FRACTIONAL ABLATIVE LASER IN ONE SESSION. EVALUATION OF ITS RESULTS USING SPECTROMETRY, TOPOMETRY AND IN VIVO CONFOCAL MICROSCOPY

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Background: The skin's aging appearance is determined by a conjunction of factors:—The change in the absorption of light due to vascular and pigmentation changes.—Alterations in skin relief (pores size growth, wrinkles. . .) create shades and discontinuities in the skin texture. However, skin aging is also a structural in depth process. Changes in the epidermal basal layer and reticular dermis (cells and papillae size/number) can be observed. Changes also occur at the reticular dermis level, where collagen provides mechanic support to the skin. Our aim is: • To induce a skin redesign at both superficial and deeper levels using a combination of Intense Pulsed Light (IPL) (to improve chromatic uniformity of the skin) and Fractional Micro ablative Laser (for collagen restructuring and skin neosynthesis). • To develop a set of non-invasive quantitative measurements to determine objective results.
Study: A prospective study is conducted in 15 patients who showed evidence of photo aging. The treatment consists of one combined session of IPL (Ellipse; PLW: 400–720 nm.) with fractional microablative CO_2 laser (Deep Fx Ultrapulse Encore). The results evaluation is achieved by means of three non-invasive quantitative methods providing objective data: spectroscopy to determine pigmentation, fringe projection topometry to measure relief and texture in critical selected areas, and in vivo confocal microscopy imaging and analysis of the epidermal basal layer and reticular dermis. We also evaluate the recovery time of each patient as well as post-treatment collateral effects, considering the following symptoms: edema, skin rash and inflammation during the first 48 hs after the treatment as well as during the follow-up.
Results: This is an ongoing study. The final results are expected on February 2010.
Conclusion: The combination of synergic light treatments and non-invasive quantitative meausurements opens the door to more patient-friendly treatments with improved results as well as a better patient evaluation and treatment follow-up.

#650

NONABLATIVE FRACTIONAL PHOTOTHERMOLYSIS FOR DIFFERENT SUBTYPES OF POROKERATOSIS: A CASE SERIES

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Background: Porokeratosis is characterized by an expansion of mutated clones of keratinocytes. Several clinical subtypes have been described and malignant transformation of lesions is quite common. Therefore a treatment option beyond relieve of clinical symptoms is required. Treatment with ablative Laser techniques has been reported, but if used away from the face their use is limited due to the increased risk of side effects. Fractional Photothermolysis has been described as a treatment modality for actinic prokeratosis. To date it remains unclear whether it can be used for other subtypes of Porokeratosis. We evaluated the effectiveness of Fractional Photothermolysis for the treatment of different subtypes of Porokeratosis.
Study: Five patients with a histologically confirmed porokeratosis received up to 6 treatments with a non-ablative fractional photothermolysis laser (three cases of disseminated superficial actinic porokeratosis, one case of porokeratosis punctata palmaris et plantaris, and one case of linear porokeratosis). In two patients a histological work-up was performed at a follow-up investigation one month and one year after treatment.
Results: Linear and actinic porokeratosis responded with a near complete remission of disease. Porokeratosis punctata palmaris and plantaris showed a partial remission with a significant reduction in size and number of porokeratotic lesions. Untreated control areas did not show signs of clinical improvement in any patient. Apart from the typical side effects no negative long term

side effects from Fractional Photothermolysis could be observed. At a follow-up investigation after one year no recurrence could be observed.
Conclusion: Non-ablative Fractional Photothermolysis shows to be a promising treatment option for different subtypes of porokeratosis.

#651

FRACTIONAL ABLATIVE HEALING TIMES: THE RELATIONSHIP BETWEEN DEPTH, DENSITY AND THERMAL DAMAGE

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Background: We have been performing combination superficial erbium resurfacing and fractional erbium resurfacing since August 2006. As expected healing times are dependent upon multiple variables including fluence, fractional density and amount of thermal damage created. We sought to quantify these variables in a series of resurfacings.
Study: 10 patients underwent combination superficial and fractional erbium resurfacing with a Sciton Profile Erbium:YAG laser. Treatments were performed under topical anesthesia and adjunctive cold air anesthesia with the superficial full field peel being performed first followed by the fractional resurfacing. Settings varied from 2.5 j/cm^2–7.5 jcm^2 for the superficial peel and 37.5 j/cm^2–137.5 j/cm^2. Open wound care was instituted and all patients received perioperative antibiotics and antivirals. Post-operative photos were taken daily for 4 days then at 1 week to assess healing times and were assessed by 2 blinded investigators.
Results: There were no wound healing complications infections, hypopigmentation or hyperpigmentation noted. Healing occurred by 6 days in all patients and seemed to be more related to depth of superficial resurfacing than depth of fractional resurfacing.
Conclusion: Combination superficial and fractional laser resurfacing has minimal healing times than are more dependent upon depth of superficial peel than depth of fractional peel.

#652

OPTIMIZATION OF FRACTIONAL ABLATIVE LASER TREATMENT WITH COMBINED PHOTOTHERAPY

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Background: Fractional skin treatment using the CO_2 laser has proved a successful cosmetic and dermatological procedure. It relies on the healing process triggered by structured micro-injuries produced by a focused laser beam delivered by an automated scanner. The extent to which the biological response is provoked depends primarily upon the physical size of the laser induced micro-injuries. The low intensity 800–830 nm light phototherapy is known to activate the inflammatory cells group and 630–680 nm light therapy activated collagen-producing cells group. The objective of this work was to assess the value of using the low intensity 600–830 nm light phototherapy to facilitate and accelerate the skin epithelialization and collagen formation after fractional CO_2 laser treatment.
Study: A pulsed CO_2 laser (UltraPulse® Encore™) and micro ablative scanner (DeepFX™) were used at incremental energy levels to treat human skin in vivo. The square pattern of the scanner produced multiple micro ablative holes 120 μm in diameter. The skin was pretreated and post treated with continuous wave and pulsed laser diode irradiation at 800–830 nm and 630–680 nm. The laser irradiation doze varied from 150 to 400 J.
Results: We demonstrated that the skin pretreatment with 800–830 nm radiation accelerates the skin re-epithelialization and wound healing after the fractional CO_2 laser treatment.
Conclusion: The 800–840 nm light phototherapy is known to activate the inflammatory cells group and facilitate the wound healing process and 630–680 nm light therapy activated collagen-producing cells group. The skin preconditioning with mid-infrared irradiation helps to shorten the recovery time and potentially improve the outcome of the fractional ablative treatment.

#653

CLINICAL AND ECHOGRAPHIC ANALYSIS OF ABLATIVE FRACTIONATED CO_2 LASER IN THE TREATMENT OF PHOTODAMAGED FACIAL SKIN

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Background: Ablative fractional photothermolysis (AFP) is effective for changes in both skin pigmentation and texture associated with photoaging. We set out to compare the clinical changes in the skin signs of photoaging with the quantitative high resolution ultrasound measurements of total skin thickness and sub-epidermal low echogenic band thickness (SLEB).
Study: A prospective study for the treatment of photoaging with a fractionated ablative CO_2 laser in 10 subjects. Treatment was administered with an AFP device (DOT Laser, Eclipse Med, Dallas TX) with blinded physician photographic analysis of improvement at 3 months post-treatment. Skin thickness was measured prior to treatment and at the 3 month post-treatment follow-up on ultrasonograms evaluating (1) total skin thickness and (2) SLEB, the portion of the papillary dermis filled with solar elastosis.
Results: For dyschromia, the mean score improved 61.0%, for skin texture, the mean score improved 63.9% (95% CI: 60.4%, 67.4%), for skin laxity, the mean score improved 54.3% (95% CI: 51.6%, 57.0%) and for rhytides, the mean score improved 51.5%. For overall cosmetic outcome, the mean score improved 60.2% (95% CI: 56.8%,63.6%) at 3 months post treatment. Patients showed a significant decrease (baseline vs 3 months post-treatment) of the echographic findings of SLEB in all anatomic sites treated (.078 cm at baseline, .038 at 3 months post treatment, −40.0% change) ($p < .001$) **(Table 3)**. In addition, total skin thickness increased significantly with ablative fractionated CO_2 laser treatment (.163 cm at baseline, .188 cm at 3 months post treatment, +10.3% change) ($p < .05$). Additionally, the ratio of SLEB/total skin thickness decreased significantly with laser treatment (.382 at baseline, .161 at 3 months post treatment, 45.3% change) ($p < .001$).
Conclusion: In this study, an AFP device demonstrated significant efficacy in improvement of both pigmentary and textural components of photoaged skin. The degree of clinical improvement in photoaging parameters correlated with improvements in skin density and thickness on ultrasound. The decrease in proportion of the dermis affected by UVR induced

degeneration of elastic fibers (solar elastosis) also suggests a novel application of AFP in repair of UV induced skin changes and prevention of cutaneous malignancy.

#654

A HISTOPATHOLOGICAL COMPARISON OF ACUTE LASER INJURY IN HUMAN FACIAL AND ABDOMINAL SKIN

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Background: Clinical laser settings have traditionally been tested on abdominal skin as a method to predict and anticipate the pattern of injury in facial skin. This experimental approach may have limitations as facial skin and abdominal skin have differing properties that may influence patterns of injury in the respective tissues. The primary objective is to establish a comparison of the acute pattern of laser injury in abdominal skin and facial skin samples from the same subject. The secondary objective is to develop a mathematical relationship (coefficient or conversion factor) based upon laser treated abdominal skin that will reliably allow the prediction of the pattern of injury in facial skin.

Study: Fifteen (15) healthy subjects (18–89 years) were consented and screened. Two 2 mm spots on the face and abdomen were identified and measured for skin thickness, moisture content, sebum content, color, and elasticity among other parameters using non-invasive measurement devices. Each skin site was treated with the Lumenis Deep FX CO_2 laser (Lumenis Ltd., Yokneum, Israel), with an energy setting of 15 mj, 300 Hz at a density of 10. The treatment areas were then biopsied immediately and analyzed histologically using Hematoxylin & Eosin and TUNEL staining.

Results: The pattern of injury as measured by depth of tissue damage from H&E and TUNEL analyses demonstrated a difference between the facial and abdominal tissue. Column depths were found to be significantly shorter in facial tissue (mean depth 453 microns) in comparison to abdominal tissue (mean depth 591 micron) p value = 0.033, and microcolumns close to pilosebaceous units were noted to diverge around these structures instead of penetrating through them.

Conclusion: Laser generated injury patterns vary between facial and abdominal skin regions. In order to reliably predict the facial injury pattern based on the treatment of abdominal panni, a mathematical coefficient is required.

#655

FRACTIONATED CO_2 FOR RESURFACING OF RHYTIDS

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Background: Use of a novel after-market handpiece on a traditional CO_2 laser which allows fractionation of ablative energy for facial and extra-facial resurfacing indications. This case report examines clinical outcomes for 21 patients treated with the fractionated CO_2 laser for rhytids.

Study: 21 patients between the ages of 50–80 years old were treated with the fractionated CO_2 laser to the face and/or neck area(s). 19 of the 21 patients received one treatment only with a mean follow-up time of 4.8 months post-treatment. 2 patients received 2 treatment sessions at 3 month intervals with follow-up assessment done at 3 months after the last treatment. Treatment parameters were determined based on anatomic area and degree of rhytidosis. Clinical improvement comparing baseline and follow-up photodocumentation was graded by 3 blinded observers using a 5 point scale: 0 = 0% improvement, 1 = up to 25% improvement, 2 = 25–50% improvement, 3 = 50–75% improvement, 4 = 75–100% improvement. Biposy sample was collected from 1 patient comparing baseline and 3 month follow-up histology.

Results: Improvement of rhytids was seen in 19 of the 21 patients treated, with improvement scores ranging from 0.2–3.0, while no improvement was observed in 2 of the 21 patients. Mean improvement score was 1.46. Adverse effects were limited to temporary oozing, erythema and edema. There were no incidences of scarring or permanent dyspigmentation.

Conclusion: Fractionated ablative CO_2 laser resurfacing offers a benefit to rhytids with less risk factors and downtime than traditional CO_2 resurfacing.

#656

RACIAL ETHNIC GROUPS—FRACTIONAL CO_2 PROCEDURE

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Background: Ablative resurfacing in darker racial ethnic subjects has been a great challenge these past few years. The objective of this study is to present a 1 year experience with Fractional Deep Dermal Ablation (FDDA^{TM}) fractional CO_2 laser in phototype IV and V subjects.

Study: 63 subjects, 52 female and 11 male, 27–78 years old, phototype IV and V, submitted to 1 session of fractional CO_2 laser on full face or full face and neck.

Results: The results show that even in darker racial ethnic subjects, a fractional delivery of a 10600 nm CO_2 source improved significantly all the evaluation criteria, with a satisfaction rate of 79,5% according to the quartile scoring. Adverse effects, major or permanent were not observed. The procedure was well tolerated.

Conclusion: Facial and neck rejuvenation treatment for darker racial ethnic subjects with fractional CO_2 laser has proven to be efficient and with a high satisfaction rate of the subjects.

#657

AGE OF POST PARTUM STRIAE DISTENSAE IN DETERMINING OUTCOME OF COMBINATION NON-ABLATIVE FRACTIONAL RESURFACING PLUS RADIOFREQUENCY

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Background: Compare the effectiveness of combined monopolar radiofrequency (MPRF) and non-ablative fractional resurfacing (NAFR)in the treatment of postpartum striae in two groups of women: those with striae older than 2 years and those with striae less than 1 year duration. Assessment of morbidity, patient, satisfaction, skin tightening and overall improvement.

Study: Prospective study of 10 women with abdomenal striae, 5 with early striae (< 1 year) and 5 with late striae (> 2 years) as a result of pregnancy. All patients were treated with a single MPRF and 4 separate NAFR treatments (1550 nm). Patients received 4 treatment sessions, each session included NAFR. On either the first or second treatment session MPRF was also performed. Patient surveys were given after each individual treatment. Three assessors were given photographs marked before and after at various intervals during and after completion of all treatments.
Results: All patients saw significant improvement in the appearance of striae and in skin tightening. Patients in the early striae group saw more improvement that patients in the late striae group. Assessor evaluations paralleled patient perception.
Conclusion: Treatment outcomes are improved when striae are less than one year giving some incentive to treat early. The effectiveness of NAFR on striae is established as moderate. Addition of MPRF for collagen tightening is an advantage with postpartum striae when laxity is a significant portion of unsatisfactory appearance. Combined treatment of FDA approved treatments is proving to be valuable in overall results without increased morbidity.

#658

FRACTIONAL 2790 nm YSGG LASER TREATMENT OF RHYTIDES AND PHOTOAGING

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Background: The fractional 2,790 nm YSGG ablative laser (Pearl Fractional™, Cutera) delivers 300 micron diameter columns penetrating 300–1500 microns with 40–60 microns of Residual Thermal Damage (RTD). This study evaluates the safety and efficacy of this fractional device for the treatment of moderate to severe facial rhytides and photoaging as evaluated by a comprehensive grading scale.
Study: This was a prospective study of 10 subjects with Fitzpatrick skin types 1–3, moderate to severe rhytides and moderate to severe photoaging (minimum grade 2 out of 4). Each subject received a full face, single pass fractional treatment (mean fluence 160 mJ, density 8–12%), immediately followed by a second pass treatment (mean fluence 160 mJ, density 12%) over the deep rhytides. For pain management, a topical anesthetic and forced air cooler were used and pain levels during treatment were evaluated on a 10 point VAS scale. Analysis of outcomes on rhytides has been performed based on the grading scores collected from physician assessment of pre- and post-treatment photographs: None = 0, Mild = 1–1.5, Moderate = 2–2.5, Advanced = 3–3.5, Severe = 4.
Results: 10 subjects have completed at least one follow-up visit post-treatment with a mean follow-up interval of 3.7 months (+/−3.4) and the data shows a mean reduction of 0.45 (+/−0.23) in rhytides on a 4 point scale (95% CI: 0.2857, 0.6143 and p-value < 0.01). Immediately post treatment, all subjects had mild pinpoint bleeding and mild oozing, all of which resolved within 48 hours. No hyperpigmentation and scarring have been reported. Six month grading of rhytides and photoaging categories for all 10 subjects will be available in January 2010.
Conclusion. The treatment using fractionally ablative 2, 790 nm laser for facial resurfacing is well tolerated and safe and is effective in treating moderate to severe rhytides.

#659 Late Breaking

NOVEL USE OF ANESTHETIC TECHNIQUES FOR PAIN CONTROL DURING FRACTIONAL CO_2 RESURFACING OF THE SKIN

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Background: Prior to our pioneering of the novel technique described in this abstract, in order to complete a fractional resurfacing procedure, significant amounts of 1% Lidocaine with epinephrine, Vicodin or IM Demerol were needed to obtain moderate pain relief during the procedure. In some cases, the procedure itself had to be halted due to severity of the pain. We present a novel technique that uses a combination of anesthetic modalities that have enabled us to provide a significant improvement in the control of pain in patients undergoing Fractional CO_2 resurfacing thus avoiding the use of general anesthesia and narcotic medications.
Study: 20 patients undergoing fractional CO_2 laser (Fraxel re:pair) resurfacing of the face, neck and chest between March 2009 and October 2009 were studied. Following sterile preparation, a layer of 20% Lidocaine/7% Betacaine anesthetic ointment was applied to the facial, neck and chest skin. Tumescent anesthesia was infused into the areas being treated. Fractional CO_2 (fraxel re: pair) laser resurfacing was performed once the skin was sufficiently anesthetized. During the fractional CO_2 (fraxel re: pair) laser resurfacing, the additional modalities of a hand held vibrator and the application of cool air via a Zimmer® Cooler were used to augment the pain reduction.
Results: Using a 10 Point Numerical Rating Scale (NRS) where no pain is rated at 0, mild pain is rated between 1–3, all of our patients reported that their pain was between 0 to 2 during the procedure with this new technique.
Conclusion: We present a novel combination of multiple anesthetic modalities that significantly decreases the pain during the use of the delivery of Fractional CO_2 laser for resurfacing of the skin. We have also been able to forego the use of narcotic pain medications or general anesthesia thus making the procedures significantly less painful and much safer for patients.

#661

CLINICAL STUDY TO DETERMINE THE SAFETY AND EFFICACY OF A LOW-ENERGY, PULSED LIGHT DEVICE FOR HOME USE HAIR REM

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Background: The principle of selective photo-thermolysis has been studies extensively for hair removal applications in a medical setting. A new, portable, hand-held device featuring two filtered Xenon lamps that utilizes pulsed light in low optical fluencies for hair removal has been developed for consumer use. The purpose of this clinical study was to determine the efficacy and safety of this low energy, pulsed intense light device intended for home use hair removal.
Study: The treatment group consisted of 10 adults with skin types I–IV who possessed unwanted dark hair in the non-facial region. The subjects received between 4 and 6 treatments on a bi-weekly basis with the device by a trained member of the clinical staff. The clinical responses were evaluated by performing manual hair counts using magnified vision and photographs which were obtained prior to treatment and at each subsequent visit.

Results: Mean hair reduction was $36 \pm 2\%$ 4 weeks after the final treatment and $10 \pm 1\%$ 12 weeks after the final treatment. This resulted in a mean hair count reduction of $23 \pm 1\%$ over the two follow up appointments. There was no definitive correlation between customer satisfaction and hair count reduction. Adverse reactions were limited to transient, localized, post-treatment erythema. No complications were encountered.
Conclusion: This low energy pulsed light device is a quick, safe, and relatively effective at-home hair removal treatment option in patients with various skin phototypes.

#665

COMBINATION LASER TREATMENT FOR TATTOO REMOVAL IN A PORCINE MODEL: AN EVALUATION OF THE USE OF THE Er:YAG LASER AS AN ADJUNCT TO IMPROVE TATTOO REMOVAL WITH THE Nd:YAG Q-SWITCH LASER

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Background: Over the years tattoo inks have changed along with tattooing techniques. These factors can often make tattoo removal difficult with the q-switch laser alone. The purpose of this study is to evaluate the Er: YAG laser as an adjunct to improve laser tattoo removal with the Q-switch laser.
Study: Three Yorkshire pigs were tattooed by a professional tattoo artist using commercially available tattoo inks from Dynamic (Dynamic Color Company FT. Lauderdale, Florida) and Eternal (Eternal Tattoo SupplyBrighton MI) ink companies. Thirty days after tattooing the tattoos were treated with a combination of the Er: YAG laser, Pro-fractional (Sciton, Inc., Palo Alto, CA) and the Nd: YAG q-switch laser (**HOYA ConBio, Fr**emont, CA). Biopsies were harvested on day 0, 14 and 30 post laser treatment and stained using hematoxylin & eosin.
Results: Tattoo ink depths ranged from 300–800 microns. Day 0 post treatment specimen demonstrated Nd: YAG q-switch laser penetration down to the superficial papillary dermis and was most effective against darker pigments. Specimens treated with the erbium laser showed ablation past the deepest tattoo ink deposits. Acute samples from the combination laser treatment area displayed columns with minimal coagulation, columns for egress of the dispersed tattoo ink created by the Nd: YAG q-switch laser.
Conclusion: The Er: YAG laser is a viable tool to improve the efficacy of tattoo removal. The Er: YAG allows for: 1) removal of all pigment types equally; 2) reduced scarring and coagulation due to the lower thermal component of the laser; 3) the ability to penetrate deeper than the tattoo pigment without causing collateral damage like the q-switch laser; 4) channels of egress for dispersed tattoo pigment; 5) and a possible channel for drug delivery which could further improve tattoo removal.

#666

A NOVEL 0.65 MSEC PULSED Nd:YAG 1064 nm LASER FOR REMOVAL OF PIGMENTED LESIONS DUE TO SUN DAMAGE

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Background: The removal of pigmented lesions due to sun damage has historically not been successful using 1064 nm Nd:YAG lasers with pulse durations in excess of 1 millisecond. This study was conducted to evaluate a shorter pulsed 0.65 msec Nd:YAG laser for pigmented lesion removal.
Study: Six females with skin types II–IV and an average age of 64.7 were enrolled for treatment of pigmented lesions due to sun damage on the hands as well as some facial areas including cheek, forehead, nose and upper lip. Subjects had hairs in the treatment areas shaved immediately prior to treatment and all makeup and lotions were removed; one subject had microdermabrasion treatment both before and after the two laser sessions. One subject was treated once and all others were treated two times with the laser, with treatment sessions spaced approximately one month apart. In each session, subjects were treated using one pass at fluences of 21–28 J/cm^2 on a 6 mm spot size, followed by one pass at fluences of 159–223 J/cm^2 on a 2 mm spot size. No cooling, gel or lotion was used; moisturizing cream was applied after treatment. A 1064 nm Nd:YAG laser, LightPod Neo^{TM} (Aerolase, Tarrytown, NY) with a 0.65 msec pulse was used to perform all treatments. All subjects were asked to rate their satisfaction with the procedure after the final treatment, on a scale of Low, Moderate, High or Very High. Also, these were older patients who exhibited chronic joint and muscle pain in their hands and because they all received treatment on the hands, and since the laser used for the pigmented lesion removal is also known to reduce joint and muscle pain, subjects were asked to rate their level of pain both before and after the course of treatments.
Results: All subjects experienced a temporary darkening of the lesions immediately upon treatment, with mild crusting in some cases; the affected tissue sloughed off within 2-3 weeks of each treatment, exposing lighter pigmented tissue or an absence of darker pigment beneath. None of the subjects experienced any complications. The reduction of pigmentation exceeded 75% on average after two monthly treatments, based upon visual observation; all subjects graded satisfaction ranging from High to Very High. In terms of joint and muscle pain reduction in the hands stimulated by the laser treatment, subjects reported a major improvement, with a pain rating averaging 9 prior to treatment and averaging 2 after the course of treatments (based on a scale of 1 to 10 with1 being very low and 10 being very high).
Conclusion: This study shows that a 0.65 msec Nd:YAG laser is effective and safe for the removal of pigmented lesions due to sun damage. The treatment is well tolerated without any anesthesia or any form of skin cooling.

#667

COMPARISON OF LOW FLUENCE Q-SWITCHED ALEXANDRITE LASER vs Q-SWITCHED Nd:YAG LASER FOR THE MELASMA TREATMENT OF ASIAN PATIENTS

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Background: Melasma is common and can cause major psychological impact. To date, the mainstay of treatment, including various hypopigmenting agents and chemical peels, is ineffective and can cause adverse effects. Low flurenve Q-switchied Laser teatment is a new approach and is yet to be explored for its efficacy and safety.To compare low flurence Q-switched alexandrite laser (Accolade, Cynosure, Boston, USA)

(QSAL) with Q-switched Nd:Yag laser (Medlite@C6, HOYA Combio, CA, USA)iQSYLjin the treatment of refractory melasma.
Study: Six females- skin types III to IV, age from 20s to 50s were treated with QSAL on one side of the face and QSYL on the other side- with eight laser sessions each at our clinic. Cosmetic skin rejuvenation was accomplished using two wavelengths of 755 nm fluence of 1.6 J/cm^2 and 1064 nm fluence of 3.0 J/cm^2, a pulse repetition rate of 10 Hz.
Results: Treatment sites were evaluated compared with the baseline (pre-treatment) regarding the skin texture, pore size, fine wrinkles, melasma. Transient hypo pigmentation and contact dermatitis were observed in few patients.
Conclusion: For melasma treatment, there were no difference between QSAL and QSYL but QSALshowed a better result than QSYL in wrinkle reduction. Long-term follow-up and a larger number of cases are required to determine its efficacy and safety for refractory melasma.

#668

LASER TATTOO REMOVAL: AN IN DEPTH ANALYSIS OF THE PROCESS OF REMOVAL OF TATTOO INK

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Background: Laser tattoo removal is currently the main method of tattoo removal; however this method has challenges, including incomplete removal, hypo-pigmentation, and the need for multiple treatments. The purpose of this study is to evaluate the process of tattoo removal using the Nd: YAG q-switch laser to improve the efficacy of the laser tattoo removal process.
Study: The abdominal area of three Yucatan pigs were tattooed by a professional tattoo artist using commercially available tattoo inks from Dynamic (Dynamic Color Company, FT. **Lauderdale, Florida**) and Eternal (Eternal Tattoo Supply, Brighton MI) ink companies. After 30 days, tattooed areas were treated using the Nd: YAG q-switch laser (energy = 4.5–6 J/cm^2, spot size = 3–4 cm). Biopsies were taken of the treatment areas at day 0, 4, 7, 10 and day 30 post laser treatment and stained hematoxylin & eosin.
Results: Day 0 pre treatment samples showed tattoo ink confined between the superficial papillary dermis and the superficial reticular dermis. Day 0 post treatment samples demonstrated dispersed tattoo within superficial papillary dermis with destruction of surrounding structures in the same level. Higher energy settings (6 J/cm^2) did not increase dispersion of tattoo ink, but did however increase peripheral tissue damage. Day 4 biopsies showed inflammation and re-uptake of the previously dispersed tattoo ink. Remaining biopsies at 7, 10 and 30 days showed continued healing with residual tattoo ink in the deeper planes.
Conclusion: Laser tattoo removal is currently the major method of tattoo removal. This method can be improved in several ways: 1) increasing the depth of penetration; 2) providing more pathways for dispersed tattoo ink to exit the treatment area prior to day 4; 3) delaying the reuptake of dispersed tattoo ink; 4) Increasing the migration of inflammatory cells containing pigment away from the tattooed area.

#669

LONG PULSED Nd:YAG LASER EFFECTIVE FOR AMIODARONE HYPERPIGMENTATION

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Background: Amiodarone is an anti-arrhythmic medication, which is known to produce a blue-grey or purple pigmentation. Effective treatment has been reported in the past with the use of the Q-switched ruby laser. We report the first successful treatment of this condition with a long pulsed Nd-YAG laser.
Study: A 75 year old male presented for evaluation of a slow onset purple discoloration on his face after taking amiodarone for a heart condition for many years. At the time of evaluation the department's q-switched laser had just been removed from the facility. He was offered a test spot with a 1064 nm Nd-YAG laser at 50 j/cm^2 and 10 ms pulse duration. He returned to the clinic approximately 6 weeks later, and a subtle improvement was noted. The patient wished to undergo complete treatment of his entire face. The patient returned for a total of 5 treat therapy sessions spaced 4–6 weeks apart with subsequent treatment parameters of 60 j/cm^2 and 10 ms. One pass with non overlapping pulses was performed.
Results: After each treatment the patient's skin was slightly erythematous, but otherwise looked normal. Following his last session of therapy, marked diminution of pigmentation was noted and the patient was satisfied with the results. There were no complications from the treatment.
Conclusion: Even though long pulsed lasers, such as the Nd-YAG laser, utilize the same wavelengths as Q-switched machines, they are thought to be ineffective for the treatment of amiodarone pigmentation due to their longer pulse durations. This report demonstrates the 1064 nm Nd-YAG laser may in fact be useful for this purpose. The mechanism of action for this laser's efficacy is unknown, but may result from dermal remodeling induced by laser injury, which results in removal of the pigmented histiocytes from the affected tissue.

#670

RANDOMIZED CONTROLLED PILOT TRIAL COMPARING PULSED DYE LASER TO CURRETTAGE AND ELECTRODESSICATION FOR THE TREATMENT OF DERMATOSIS PAPULOSA NIGRA

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Background: Dermatosis papulosa nigra is a common variant of seborrheic keratoses in darkly pigmented individuals. Pulsed dye laser has been shown to be efficacious in previous studies for seborreheic keratoses. We theorized that this technique could provide therapeutic results similar to two other traditional methods of treatment, curettage and electrodessication.
Study: This was a randomized, controlled, single-center, evaluator-blinded trial of 10 patients. Patients were recruited from a University-based dermatology clinic. Inclusion criteria included at least 4 clinically diagnosed lesions of dermatosis papulosa nigra. Exclusion criteria included history of keloids or collagen vascular disease. Four lesions were chosen for treatment, numbered, and randomized to the following treatment groups: 1) Pulsed dye laser, 2) Curettage, 3) Electrodessication, 4) Control. Patients were seen between 6–12 weeks after treatment and asked to complete a visual analog scale questionnaire to rate their

pain and rate their perceived cosmetic outcome with each modality. They were also asked to choose their preferred method of treatment. A blinded physician evaluator also determined percent clearance of each lesion, presence of adverse outcomes, and result quality with each modality.
Results: A total of 10 patients enrolled completed the study. Curettage had the greatest mean percentage of clearance (96%) followed by electrodessication (92.5%) and laser (88). Electrodessication and curettage had an overall result quality rated as "good " for most patients. Electrodessication was favored as the best cosmetic outcome by 5 out of 10 patients, followed by laser (3 out of 10), and then curettage (1 out of 10). One patient could not choose his preferred method. There were no significant differences between the treatment groups for any of the measured outcomes. The most common adverse outcome was hyperpigmentation. There were no significant adverse events.
Conclusion: The efficacy of pulsed dye laser in the treatment of dermatosis papulosa nigra is not significantly different from the already established treatment modalities of electrodessication and curettage.

#671

DIODE LASER FOR PERMANENT HAIR REDUCTION USING SHR VOLUMETRIC HEATING TECHNIQUE: 2448 SUBJECTS EXPERIENCE

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Background: Photoepilation is one of the most used aesthetic treatment in the world. Several laser devices such as alexandrite, diode, ruby, Nd:yag are used for such purpose. This study aims to present a 3 year experience with diode laser, using volumetric heating with SHR^{TM} technology.
Study: 2448 subjects were treated in different areas with a 810 nm diode laser with 6–10 J fluence per cm^2, 1,2 cm^2 spot size, 10 Hz repetition rate. (Soprano XL, Alma Lasers Ltd., Caesarea, Israel). The treatment technique employed multiple in-motion, repetitive passes on a pre marked 10×10 cm grid, up to 12 KJ cumulated. Clinical endpoints were considered as epidermal and perifollicular erythema and edema.
Results: This method did not present any major or permanent complications in any subject. Another major point of the treatment was the fact that subjects referred only a slight temperature increase in the treated area (virtually no pain). Subjects satisfaction within 3 and 6 months follow-ups reached a 90% good and great evaluation.
Conclusion: Volumetric heating technique has proven to be an effective and safe technique with a great subject satisfaction evaluation for photoepilation.

#672

COMPARATIVE STUDY OF THE EFFICACY AND INCIDENCE OF POST INFLAMMATORY HYPER-PIGMENTATION IN DIFFERENT DEGREES OF IRRADIATION WITH Q-SWITCHED LASER FOR REMOVING PIGMENTED LESIONS

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Background: Q-switched lasers are well known as an effective treatment in removing pigmented lesions. However, high incidence of post inflammatory hyper-pigmentation (PIH) is a concern in darker skin types. This study aimed to determine the influence of aggressive and mild Q-switched laser irradiation to reduce the incidence of PIH.
Study: 98 females with solar lentigo larger than 8 mm in size on the face, skin types III and IV, were randomly divided into two groups, A and B, and received single treatment using Q-switched 694 nm Ruby laser and results were photographed after four weeks to evaluated the efficacy and adverse effects by two blinded assessors. All cases were followed by applying steroids plus antibiotics for seven days and topical hydroquinone until the evaluation visit. Group A was treated "aggressively_Ewith 6–8 J/cm^2; endpoint was very obvious immediate whitening phenomenon (IWP) of the lesion, Group B was treated "mildly_Ewith 4–6 J/cm^2; endpoint was very slight IWP of the lesion. In addition, 49 subjects were treated "mildly_Ewith Q-switched 532 nm Nd:YAG laser with 0.8–1.5 J/cm^2 as group C to confirm the result of mild treatment with a different wavelength.
Results: Degree of clearance was almost the same in all three groups with no significant difference. However, the incidence of PIH was very different, 34.7%, 8.1% and 10% in groups A, B and C, respectively. Statistical difference between aggressively irradiated group and mildly irradiated group (A and B, A and C) were statistically significant ($p < 0.001$). But there were no significant differences between mildly irradiated two groups (B and C).
Conclusion: Aggressive irradiation of Q-switched laser had high incidence of PIH, but had no advantage in efficacy. This study showed the importance of mild irradiation in two different wavelengths of Q-switched laser. For darker skin types, mild irradiation reduces the risk of PIH with no disadvantage in efficacy.

#673

TREATMENT OF MELASMA USING LONG PULSED ALEXANDRITE LASER WITH LOW FLUENCE

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Background: Melasma is one of the most common esthetic problems and is difficult to treat. Recently frequent treatment with low fluence using Q-switched Nd:YAG laser has been very popular in Korea to treat melasma, which has been considered as one of the most effective treatments. However, that technique sometimes shows side-effects such as rebound hyperpigmentation and/or mottled hypopigmentation, which probably caused by too short pulse width. The purpose of this preliminary study is to assess the efficacy and to determine more efficient parameter of long pulsed alexandrite laser in the treatment of melasma.
Study: Fifteen Korean patients with melasma were treated randomly with 8 sessions of weekly alexandrite laser treatment with 0.25 ms pulse duration and fluence 6–9 J/cm^2 in one cheek and with 3 ms pulse duration and 10–20 J/cm^2 in the other cheek, respectively. Efficacy was evaluated by digital photograph and patients' subjective response using a quartile grading scale ($0 = < 25\%$, $1 = 25$–50%, $2 = 51$–75%, $3 = > 75\%$).
Results: All fifteen patients showed improvement in pigment reduction. Mean clinical improvement score was 2.2. Five, 8, and 2 of patients had $> 75\%$, 51–75%, and 25–50% improvement after 8 session of treatments, respectively. Transient erythematous wheals developed at two patients right after the treatment, which

resolved well without any medication. There were no complications in the other patients.
Conclusion: Frequent treatment with low fluence using long pulsed alexandrite laser was effective and very safe, which might provide an alternative modality for melasma.

#674

NON-ABLATIVE FRACTIONAL LASER THERAPY AS TREATMENT FOR ASHY DERMATOSIS AND POSTINFLAMMATORY HYPER-PIGMENTATION: A PILOT STUDY

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Background: No effective treatment is available for ashy dermatosis (AD) and treatments for postinflammatory hyperpigmentation (PIH) often show disappointing results. The aim of this study was to assess efficacy and safety of non-ablative fractional laser therapy (FLT) for AD and PIH.
Study: Patients with AD and PIH were included in two randomized controlled (split lesion) and observer blinded trials. In each patient, two square test regions of 5–10 cm^2 were randomized to either four or five non-ablative FLT sessions (Fraxel re:store, Solta Medical Inc., 15 mJ/microbeam at 1,550 nm, coverage 14–17%, 3 weeks inter-treatment interval). FLT was combined with intermittent daily topical bleaching (to prevent laser-induced PIH) or the same intermittent regimen of topical bleaching alone (to allow comparison of the regions). Three and six months after the last FLT session, clearance of hyperpigmentation was assessed by the physician's global assessment (PhGA), melanin index, reflectance spectroscopy, patient's global assessment (PGA) and patient's satisfaction. In addition, biopsies of both treated and control sides were evaluated by an independent blinded pathologist at 3 months follow-up.
Results: Eight patients with AD (skin types IV and V) en six patients with PIH (skin type II–V) were included. Direct side effects of FLT were mild, and consisted of erythema and a burning sensation. In the majority of the patients, in both the AD en PIH group, the PhGA showed no improvement in the hyperpigmentation at 3 months follow-up. The melanin index and reflectance spectroscopy, for both treated and control side at 3 months follow-up did not significantly differ compared to baseline. The PGA at three months follow-up was 3.6 and 4.5, and the patient's satisfaction was 5.7 and 4 for the AD and PIH patients (Visual Analogue Scale 0–10).
Conclusion: In this pilot study, non-ablative FLT showed to be not effective in AD and PIH.

#675

THE EFFICACY OF Q-SWITCHED YAG LASER WITH TRILUMA ON DERMAL AND EPIDERMAL MELASMA: A REDUCTION IN MASI SCORE AND IMPROVEMENT IN SKIN TONE AND TEXTURE

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Background: Melasma continues to be one of the most difficult to treat skin conditions despite advances in medical and photomedical science. The efficacy of the q switched YAG laser utilizing a carbon based solution and Triluma(hydroquinone, retinoic acid, and cortisone) in a two step laser procedure was assessed to determine the efficacy of combined dermal and epidermal laser treatments along with a topical agent.
Study: Thirteen patients underwent pre-treatment assessment to determine appropriateness of treatment. Patients were excluded if they had undergone any treatment for melasma within the previous 3 months or if there were any contraindications to the use of a laser or combination retinoic acid, hydroquinone, or cortisone product. Patients underwent Visia analysis prior to the initiation of the study and before each subsequent treatment. Assessment parameters included pore size, texture, wrinkle score, and pigmentation compared to a normalized population. Patients were treated with a q switched YAG laser for 8 weeks. Treatment included a two step procedure involving the use of a carbon based solution for epidermal melasma and laser toning for dermal melasma. Additionally the use of Triluma was prescribed during the 8 week course. Improvement was based on the reduction in the masi score as well as improvement in skin tone, texture, wrinkle score, and reduction in spot score as determined by Visia analysis.
Results: Thirteen patients completed the 8 week study. An overall reduction in the masi score of 59.5 percent was achieved. Patient satisfaction at the completion of treatment for pore size reduction, improvement in texture, wrinkle reduction, improvement in pigmentation was 86.6 percent.
Conclusion: The combination of q-switched YAG treatment with a unique carbon based solution indicated for the treatment of epidermal and dermal melasma along with the use of a hydroquinone, retinoic acid, and cortisone significantly improved dermal and epidermal melasma both objectively thru Visia analysis as well as from two subjective treatment assessments including the masi score and overall patient satisfaction score. Additional benefits to skin texture, pore size, wrinkle reduction were also realized.

#676

Q-SWITCHED Nd:YAG LASER TREATMENT OF NEVUS OF OTA IN DARK SKIN: A CASE SERIES

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Background: Nevus of Ota can be effectively and safely treated since the arrival of q-switched lasers in dermatology. However available literature does not report the treatment of Nevus of Ota in skin types darker than IV.
Study: We report a first case series of four Fitzpatrick phototype V patients treated with a Q-switched Nd;YAG laser at 1064 nm for Nevus of Ota. Pulse diameter for the treatments was 2 mm and pulses were applied typically in a non-overlapping fashion. Treatment energies ranged from 4.1 to 9.5 J/cm^2.
Results: All four patients of our case series showed significant cosmetic improvement. Improvement ratings based upon pre- and post-treatment photographs from blinded investigators were in between 7 and 10 on a 10 point scale. Side effects were mostly short termed and typical for this laser techniques. No post inflammatory hyperpigmentation was observed however one case of permanent hypopigmentation was encountered.

Conclusion: The treatment of Fitzpatrick skin type V patients with Nevus of Ota with a q-switched Nd:YAG laser at 1064 nm appears to be a very effective and also reasonably safe approach.

#677

ABLATIVE FRACTIONAL LASER THERAPY AS TREATMENT FOR BECKER'S NEVUS: A PILOT STUDY

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Background: Becker's nevus (BN) is a benign epidermal disorder characterized by hyperpigmented patches, textural changes of the skin and sometimes hypertrichosis. To date, no effective treatment is available. The aim of this study was to assess the efficacy and safety of ablative fractional laser therapy (FLT) in the treatment of BN.

Study: A randomized controlled observer blinded study was conducted including 11 patients with skin types ranging from II–V. In each patient two similar square test regions of 5–10 cm^2 were randomized to either three treatments with a fractional CO_2 laser (Fraxel re:pair, Solta Medical Inc., 10 mJ/microbeam at 10.6 μm, coverage 35–45%, with six and four weeks inter-treatment interval) in combination with intermittent daily topical bleaching (to prevent laser-induced postinflammatory hyperpigmentation) or the same regimen of topical bleaching alone (to allow comparison of the regions). Three and six months after the last laser treatment, clearance of hyperpigmentation was assessed by melanin index, reflectance spectroscopy, and patient's and physician's global assessment. In addition, a biopsy of both treated and control site was evaluated by an independent blinded pathologist at three months follow-up.

Results: To date, 10 of 11 patients were seen at three months follow-up. Six patients showed an average improvement of 37% compared to control, according to reflectance spectroscopy. Direct side effects of ablative FLT were mild to moderate, and consisted of erythema, edema and crusting. One patient showed no improvement and three patients developed postinflammatory hyperpigmentation after one or more laser treatments. Average patient's global assessment was 3.8 (Visual Analogue Scale 0–10), and patient's satisfaction was 5.1 (Visual Analogue Scale 0–10).

Conclusion: In this study ablative FLT showed to be a relatively safe and effective treatment option in 60% of patients with BN. However, given the relatively high rate of postinflammatory hyperpigmentation, further optimization of laser parameters is mandatory.

#678

A COMBINATION APPROACH TO TREAT MELASMA

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Background: Additionally to the increase in pigmentation, melasma lesions have more elastosis and vascularization as compared to perilesionnal skin. The objective of this study was to evaluate the interest of combining the fixed triple combination cream to pulsed dye laser (PDL).

Study: Prospective controlled comparative split face study with central randomization. *Inclusion criteria*: Melasma, phototypes I to IV. *Non inclusion criteria*: phototypes V, allergy to cream components. *Intervention*: stabilized triple combination cream (TriLuma, Galderma©) applied once a day for 4 months on the entire face. PDL (Vbeam, Candela©) started after 1 month of triple combination cream, 3 sessions (every 3 weeks) on 1 split face, 1st passage with vitropression hand piece 10 mm, 1.5 ms, 7 J/cm^2, 2nd passage with hand piece 7 mm, 20 ms, 10 J/cm^2, DCD 30/40. *Evaluation*: MASI score performed by an independent physician blinded to treatment on standardized digital photos (VISIA, Canfield©). Final visit after one summer.

Results: Eighteen patients were included. One patient dropped out. Analysis in ITT. Cream and cream + PDL, both provided significant improvement in MASI score at the end of the treatment as compared to baseline ($p < .01$ and $p < .001$, respectively). After the summer only the combination approach still showed significant improvement ($p < .025$). The combination of cream and PDL provided better results than the cream alone at the end of treatment and after the summer ($p = .031$ and $p < .001$, respectively). In light phototypes (II and III) the combination approach leaded to an even greater improvement while the adjunction of laser in darker phototypes (IV) did not do better than the cream alone. Three patients (all phototype IV) had post-inflammatory pigmentation with PDL. The satisfaction of the patients was higher for the combination approach ($p < .05$) except for phototype IV patients.

Conclusion: The combination of the Triluma cream and PDL induced a significant decrease in the pigmentation as compared to cream alone.

#679

MELASMA TREATMENT BY NEW ACCOLADE Q-SWITCHED ALEXANDRITE LASER IN KOREAN SKIN

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Background: Melasma is known as difficult conditions to treat especially in Asian skin. Recently, laser toning, consisting of Q switched ND:YAG laser treatment with low fluence has been successful in the treatment of melasma. So, we designed melasma treatment by Q switched alexandrite laser. To evaluate the safety and efficacy profile of a new Accolade Q switched alexandrite laser for melasma removal in Korean skin with skin types III–V.

Study: Total of 20 patients, with skin types III–V, were treated with new Accolade Q switched alexandrite laser. The fluences varied between 1.6–1.8 J/cm^2 at 70 nanosecond pulse durations with a 5 mm handpiece and 1.6–2.0 J/cm^2 at 150 microsecond pulses with a same handpiece. All subjects were treated at least 4 times and at most 10 times, depending on patient satisfaction level, at 1–2 times per month and were observed for up to 6 months after the last treatment. The results were evaluated based on clinical photos before and after each session, subjective and objective ratings, Melanin Area and Severity Index(MASI) score.

Results: 18 patient showed moderate to good improvement. The MASI score of the lesions decreased after a new Accolade Q switched pulsed alexandrite laser therapy. Rarely, hyperpigmentation appeared.
Conclusion: Treatment of melasma with new Accolade Q switched alexandrite laser is an effective and safe among Korean patients.

#680 Late Breaking

COMPARATIVE STUDY WITH SMALL SPOT SHORT WAVELENGTH IPL WITH Q-SWITCHED RUBY LASER FOR TREATMENT OF SOLAR LENTIGINES IN ASIAN SKIN

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Background: Both Intense Pulsed Light (IPL) and Q-switched lasers have been used for removing epidermal pigmentation, but those methods have drawbacks when treating darker skin types. Generally, conventional IPLs have low risk of post inflammatory hyper-pigmentation (PIH), but need multiple treatments, while Q-switched lasers need only one to two treatments, but have a high risk of PIH. The purpose of this study is to compare the efficacy and safety of a small-spot, controlled wavelength IPL and Q-switched Ruby laser (QSRL).
Study: 56 females, skin types III and IV, with facial solar lentigines larger than 8 mm in size were randomly divided into two groups and received single treatments with a 500–635 nm, 6.35 mm spot size IPL using 12–16 J/cm^2, pulse width of 8–10.6 ms, or 694 nm, 5.0 mm spot size QSRL using 4.0–6.5 J/cm^2, pulse width of 20 nsec and followed by applying antibiotics containing steroid ointment for seven days and 5% hydroquinone for four weeks. Pigment clearance and adverse effects were evaluated four weeks after the treatment by two blinded assessors. Degree of clearance was evaluated by five grade scale of percent improvement, excellent: 75–100%, very good: 55–74%, good: 25–54%, poor: 0–24% and worsen: PIH.
Results: All cases showed improvement that evaluated as excellent or very good except for PIH cases. Although QSRL treated group showed more excellent cases (60.7% in QSRL treated group and 35.7% IPL treated group), incidence of PIH was higher in the group (14.3% in QSRL treated group and 3.6% in IPL treated group), but there were no significant differences ($p > 0.05$). Prolonged erythema was seen in both groups but there was no scarring and hypo-pigmentation.
Conclusion: QSRL and small-spot, controlled wavelength IPL used in this study were both effective for removing solar lentigines in Asian skin. Safety of small spot size allowed higher clearance of pigment than typical IPLs.

#694

NON-INVASIVE OBJECTIVE FACIAL ANALYSIS: A VIABLE METHOD OF PRE-TREATMENT PATIENT EVALUATION FOR FRACTIONAL LASER RESURFACING

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Background: Laser resurfacing treatment settings are largely based on facial analysis and clinical experience. This is somewhat problematic as these two inputs can be variable. The purpose of this study is to measure the face using non-invasive, objective devices as a method help reduce variability in facial analysis and subsequently variability in outcomes for laser resurfacing.
Study: Eighty eight subjects between the ages of 18 and 80 were consented and enrolled in this study. Facial analyses were performed by clinical evaluation and utilizing non-invasive objective devices which included the DermaScan C 20 MHz HFUS, (Cyberderm Broomall PA), Tru Vu (Johnson and Johnson), BTC 2000 (SRLI Technologies Nashville, TN.), Derma Unit SSC3 (CK electronic, Köln Germany), and the Chromometer, which measured skin thickness, skin tone, clogged pores, UV damage, fine lines, wrinkles, skin elasticity, moisture content, sebum content, pH and skin color.
Results: Non invasive devices were shown to be consistent and accurate through repeated measurements at each of the anatomical points. Chromometer measurements were precise and categorized patients into Fitzpatrick levels accurately. DermaScan imaged the skin with 60 by 130 micron resolution and 5–10 mm penetration, facial thickness ranged from 3.0 mm on the forehead to 1.4 mm on the neck. Skin thicknesses changed with increasing age, with forehead and jowl thickness decreasing on average by 200 microns. Derma Unit SSC 3 demonstrated differences in sebumeter, corneometer readings while pH remained consistent from subject to subject. The Derma Unit SSC 3 also showed correlation with Tru Vu readings for clogged pores and bacterial activity.
Conclusion: The use of objective non-invasive facial analysis is a method that is accurate and eliminates the variability of subjective measurements. Objective measurements will help reduce variability in laser resurfacing outcomes by making it possible to compare patients pre treatment in an objective fashion.

#695

OPTICAL COHERENCE TOMOGRAPHY IMAGING OF EX VIVO HUMAN KIDNEY

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Background: Optical coherence tomography (OCT) is an interferometric imaging technique that obtains cross-sectional images of tissue from backreflected near-infrared light. OCT is potentially useful in a clinical setting due to its very high resolution (2–20 μm), small size, and portability. However, the penetration depth of OCT is only about 1–2 mm, so imaging of kidney must be performed during a surgical or laparoscopic procedure. OCT has been streamlined into very small devices that can be implemented in vivo endoscopically. Our laboratory has developed imaging systems with rigid and flexible endoscopes 2–5 mm diameter.
Study: Following an IRB-approved protocol, surgical discard tissue was obtained from full and partial nephrectomies of 20 patients. For each patient, a sample each of diseased and normal tissue was imaged with an OCT system using a 2 mm diameter endoscope, with 4 μm axial and 10 μm lateral resolution.

A series of images approximately 10 mm lateral by 1.4 mm deep was obtained at 1 mm increments. Following imaging, the tissue was fixed in Histochoice, paraffin embedded and processed according to standard protocol. Diagnosis was confirmed by a pathologist, who also examined corresponding OCT and histology sections to identify common features.
Results: Significant differences were seen between OCT images of normal and cancerous tissues. In normal tissue, the collecting ducts and glomeruli were clearly visible. Cancerous tissue was identified by a disordered structure with frequent featureless regions.
Conclusion: OCT appears to be able to differentiate normal from cancerous kidney tissue, based on visibility of normal kidney structure. OCT may be useful in verifying clear surgical margins during partial nephrectomy. Conventional OCT cannot visualize cell nuclei, which would be ideal for diagnosis. Optical coherence microscopy (OCM) with 2×5 μm resolution is currently being investigated for this purpose.

#696

REDUCTION OF ANGIOFIBROMAS IN TUBEROUS SCLEROSIS PATIENT USING NOVEL FRACTIONAL RADIOFREQUENCY DEVICE

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Background: The incidence of tuberous sclerosis is 1 in 10000 births. Up to 80% of affected individuals have cutaneous manifestations of which angiofibromas are the most characteristic. These telangiectatic papules occurring on the face, periungually and on the scalp, appear in childhood and increase in size and number until adolescence, after which they remain static. These lesions pathognomic for tuberous sclerosis as well as the multiple endocrine neoplasia disorders, although benign, cause a great deal of cosmetic anxiety for patients and their families. Several methods have been employed to treat these lesions including shave excision, dermabrasion and ablative lasers. All of which have variable efficacy and side effect profile, in particular in darker skin type patients. Radiofrequency does not target a chromophore in the skin and therefore is safer to use in darker skin types. Fractional radiofrequency has been demonstrated to have tunable ablation and coagulation properties to target telangiectastia and excess fibrous tissue. We look at the application of fractional radiofrequency in minimizing the clinical appearance of angiofibromas in a skin type VI subject.
Study: A female subject aged 13 years underwent 2 treatments on the right side of the face using a fractional bipolar radiofrequency device (Matrix RF, Syneron Medical Ltd). Standardized photographs were taken at baseline and at 1 week, 3 week, 4 week, 6 week and 12 week follow up visits. Treated to non-treated sides of face were compared to evaluate results.
Results: There were no complications experienced during the procedure. Comparing the treated face side to non-treated side, demonstrated a significant reduction in clinical appearance of the treated angiofibromas. There was significant patient satisfaction.
Conclusion: Fractional bipolar radiofrequency results in effective reduction in the appearance of facial angiofibromas. This case represents a novel effective and safe treatment option for a difficult cutaneous disease, in particular in darker skin type patients.

#697

INITIAL EXPERIENCE WITH A NOVEL CONTACT COOLING DEVICE FOR LOCAL ANESTHESIA

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Background: Patients increasingly request the most minimally invasive treatment options available. Patient anxiety, inconvenience and low but real risk are features associated with sedation anesthesia. At the same time, maximizing patient comfort during non-sedation treatments is critical to patient satisfaction. This paper presents early experience using a novel non-invasive skin cooling device for local anesthesia during surgical procedures.
Study: A non-invasive skin cooling device (Zeltiq Breeze™ System, Zeltiq Aesthetics, Pleasanton, CA) was used to obtain anesthesia prior to minor plastic surgical procedures in the abdominal area. The system draws the tissue into a vacuum cup and into contact with two cooling panels, which extract heat at a prescribed heat flux, or CIF (Cooling Intensity Factor) and time duration selected by the operator. After the cooling cycle is complete, the tissue is numb for some period of time during which a variety of procedures can be performed. Patients treated with the cooling device for temporary local anesthesia prior to a surgical procedure were asked to rate the discomfort on a scale of 0 to 10 at intervals during the procedure. Nadir score and duration at that score were recorded as well as attributes of the magnitude and duration of the surgical treatment and any associated adjunctive local anesthesia employed.
Results: Cooling cycles ranged from 10–15 min at a cooling intensity factor (CIF) of 42 (maximum available). Discomfort scores ranged from 1 to 3 out of 10. This level of anesthesia was maintained for a minimum of 15 min in all patients either allowing completion of the surgical procedure or pain free infiltration of adequate local anesthesia. Procedures performed included suction lipectomy with laser lipolysis, fat harvest for autogenous transplantation and cutaneous and subcutaneous excisions.
Conclusion: Contact cooling is effective in providing cutaneous and subcutaneous anesthesia even for highly stimulating surgical interventions. The role in procedures performed at the bony, muscle or facial planes has not been explored in this study. Duration of effect with even a short cooling cycle is at least 15 minutes. Scope of effect typically exceeds the zone of tissue directly cooled within the applicator. This technology allows conversion of some procedures to local infiltration only while optimizing patient comfort and avoiding the inconveniences and risks of intravenous sedation.

#698

1444 nm ACCUSCULPT LASER: A NEW MODALITY FOR TREATMENT OF AXILLARY BROMHIDROSIS AND HYPERHIDROSIS

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Background: Bromhidrosis is a disease which presents mal-odor caused by interaction between discharge of apocrine gland and bacteria. Main therapeutic modalities are topical agent apply, laser intervention, liposuction surgery and elective surgery. Among these modalities, elective surgery which removes apocrine sweat gland is reported to be most effective one, but the

effectiveness largely varies on surgeon's technique and other side effects such as hematoma and scar are occasionally reported. Currently, CO_2 laser and 1064 nm Nd:YAG laser therapy is being used, but as it is not specific spectrum for appocrine sweat gland, there always was limitations for these therapies. Recently, 1444 nm wavelength ACCUSCULPT(Lutronic corp., Seoul, Korea) laser was developed which is now commonly used for facial fat plasty and laser liposuction therapy. And to use this laser for bromhidrosis therapy targeting appocrine sweat gland located in subcutaneous fat is being discussed. But still, there is no reports of cases of practical use, efficacy and side effects of the ACCUSCULPT laser.

Study: In this study, authors recruited 20 bromhidrosis and hyperhidrosis patients who visited out patient department for the laser therapy, and compared efficacy of the therapy by measuring mal-odor severity, sweating index using iodine starch test and overall satisfaction by questionnaire. We also performed punch biopsy at post operation day 1 and 30 to compare histopathological changes after laser irradication. Post operation day 1, 7, 30 days follow up was done and we check for other complications and recurrence rate.

Results: Severity measurement was done with 10 point scale and higher point indicated higher severity The average severity of remaining bromhidrosis was 1.2 on 7th day and 1.4 on 30th day follow up. Average severity of pain after procedure was 1.5 on 7th day and 0.79 on 30th day. Average severity of limitation of mobility after procedure wa 2.6 on 7th day and 1.2 on 30th days. The subject severity of remaning sweating was 1.4 and 1.3 on 7th and 30th postoperation day. Overall satisfaction was 9 on 7th day and also 9 on 30th day. 2 patient had full thickness skin necrosis. Bulla, mild ecchymosis and bruise on operation site were observed in all patient which complitely cleared before day 30.

Conclusion: As there are no large case controlled prospective clinical trial using ACCUSCULPT laser for treatment of axillary sweat gland disorders, authors would like to introduce and propose this modality as treatment of choice for bromhidrosis and hyperhidrosis.

#699

GREENLIGHT HPSTM LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY: DOES AGE AFFECT ITS EFFICACY AND SAFETY?

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Background: We evaluate the efficacy and safety of GreenLight HPS^{TM} laser PVP for the treatment of lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH) in patients of different age groups.

Study: We prospectively evaluated our GreenLight HPS^{TM} laser PVP experience. Patients were stratified into two groups: age < 70 (group I) and age $= 70$ (group II) years. Transurethral PVP was performed using a 120 W GreenLight HPS^{TM} side-firing laser system. Voiding trials were performed two hours post surgery. American Urological Association Symptom Score (AUASS), Quality of Life (QoL) score, maximum flow rate (Qmax) and post void residual (PVR) were measured preoperatively and at 1 and 4 weeks and 3, 6, 12, 18 and 24 months postoperatively.

Results: 166 consecutive patients were identified (I: 91, II: 75). Except for prostate volume (I: 62.1 ± 36.7, II: 78.2 ± 43.8 mL, $p = 0.012$), there were no significant differences in the preoperative parameters [AUASS (I: 23.4 ± 6.2, II: 22.1 ± 6.1, $p = 0.186$), QoL (I: 4.7 ± 1.1, II: 4.4 ± 0.9, $p = 0.076$), Qmax (I: 8.5 ± 4.8, II: 8.7 ± 4.4 mL/sec, $p = 0.789$), PVR (I: 108.1 ± 160.7, II: 103.1 ± 133.9 mL, $p = 0.843$)]. As well, there were no significant differences in the parameters of laser utilization (I: 13.3 ± 9.5, II: 13.8 ± 9.2 minutes, $p = 0.741$) and energy usage (I: 89.2 ± 64.2, II: 92.7 ± 62.2 kJ, $p = 0.731$). Clinical outcomes (AUASS, QoL, Qmax and PVR) were significantly improved post surgery within each group. AUASS, QoL had Qmax showed immediate and stable improvement during the follow-up period. There were no significant differences in the postoperative clinical outcome parameters between the two groups ($p > 0.05$). The incidence of adverse events were low in both groups.

Conclusion: Our experience suggests that age has little effect on the efficacy and safety of GreenLight HPS^{TM} laser PVP.

#700

RADIO FREQUENCY DEEP TISSUE MASSAGE vs MANUAL DEEP TISSUE MASSAGE

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Background: Tension headaches, secondary too upper back and neck spasm are the most common form of headaches and is common in today's overworked society. This causes loss in employee productivity, family time and intimacy. Usually related to contraction and spasm in the trapezoids and rhomboids which then effect tension on the frontal and occipital bands. This can cause severe debilitating pain,torticollis, photo phobia and nausea. The objective of this study is to show that radio frequency deep tissue penetration is as effective or more so than manual deep tissue massage in the relaxation of the muscles in spasm and the relief of symptoms.

Study: 10 subjects were treated randomly with manual deep tissue massage or radio frequency deep tissue massage for 15 minutes over the distribution of the trapezium muscles involving the neck andupper back. They were then given a 5 point questionnaire describing their experience and relief of symptoms this was repeated again in 14 and 28 days. At the end of 4 weeks persons were given alternative deep tissue massage that they did not receive the first treatment and same questionnaire was given at 1, 14 & 28 days. The radio frequency machine used was Alma's Accent XL the uni-polar hand piece with the depth of penetration of 20 mm. 200–300 watts were used with a total of 150 kj deposited in each treatment subject for 15 minutes. The deep tissue massage was done by a trained massage therapist who used manual stimulation technique of the same area for 15 minutes. The 5 point questionnaire was as follows with numerical score given for each answer of 1–4 with the most improved score equaling a total of 20 and the least improved score of 5:

1. Do you have relief of your headache?
   no relief mild relief moderate relief complete relief
2. Do you feel relaxed in your neck & upper back?
   no relief mild relief moderate relief complete relief
3. Was this a relaxing treatment?
   not relaxing mildly relaxing moderately relaxing completely relaxing
4. Has this treatment improved your quality of life?
   no somewhat yes
5. Would you recommend this treatment for the relief of tension headaches secondary to muscle spasms?
   no yes

Results: 8 out of 10 of the subjects treated on their evaluation score questionnaire rated the radio frequency deep tissue massage

superior to the manual deep tissue massage in the category of immediate relief in pain and symptoms. Again in the 14 and 28 days, they had increased satisfaction scores on the relief of pain and symptoms. Two of the patients noticed no difference between radio frequency deep tissue massage and the manual deep tissue massage in the 1, 4 and 28 day scores on their questionnaires. No patient rated manual deep tissue massage superior to radio frequency deep tissue massage. All patients recommended both treatments as a form of relief from tension headaches.
Conclusion: Radio frequency deep tissue massage seems superior to manual deep tissue massage in treating patients with tension headaches related to upper back andneck muscle spasms.

#701

A RETROSPECTIVE COMPARATIVE ANALYSIS OF THE MANAGEMENT OF ACNE POST-INFLAMMATORY HYPERPIGMENTATION USING TOPICAL TREATMENT, LASER TREATMENT OR A COMBINATION OF TOPICAL AND LASER TREATMENTS IN ORIENTAL PATIENTS

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Background: Post-inflammatory hyperpigmentation (PIH) is characterized by an acquired increase in pigmentation secondary to an inflammatory process, and can be considered the default pathophysiological response to cutaneous injury in Fitzpatrick type III to VI patients.
Objective: To determine the effectiveness and safety of using topical treatment, laser treatment, or combination topical and laser treatments to treat acne PIH in Oriental patients.
Study: 34 Chinese patients with acne PIH were divided into three groups, and treated with topical agents, 595 nm long pulsed dye laser and/or 1064 nm Q-switched Nd:YAG, or combination topical and laser treatments. An independent clinician assessed pre and post treatment photographs using visual analogue scales to determine efficacy and timing to visible and optimum improvement.
Results: There was significant global and focal improvement of acne PIH in patients in all 3 groups. However, no significant difference was found between the groups. An investigator global assessment showed improvement with all treatment modalities, with the largest improvement (70.6%) seen in the combination treatment group. Visible and optimum improvement was seen by 3 months in majority of patients treated. Only 1 patient developed PIH as a result of laser treatment.
Conclusion: Topical treatment, laser therapy, and combination topical and laser treatments appear to be effective for acne PIH in Fitzpatrick type III and IV skin after 3 months with little complications. Topical agents may be considered as first line therapy for acne PIH, taking into consideration its effectiveness, ease of use and cost. Combined topical and laser therapy is also effective, and may be considered as second line treatment.

#702

THERMOGRAPHY, LASER DOPPLER FLOWMETRY AND LASER SPECKLE IMAGING AS PARAMETERS FOR DISEASE ACTIVITY IN NON-SEGMENTAL VITILIGO: A PILOT STUDY

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Background: To date, a useful parameter for disease activity in vitiligo is lacking. Thermography and laser Doppler flowmetry have been reported as useful techniques to evaluate disease activity in other skin diseases. Laser speckle imaging is another technique that provides an image of the blood flow by generating a speckle pattern when tissue is illuminated by laser light. Aim of this study was to investigate thermography, laser Doppler flowmetry and laser speckle imaging, for the assessment of disease activity in non-segmental vitiligo.
Study: Both thermal and visual images of vitiligo lesions were taken in 55 patients using a high resolution Thermoview Ti55 IR FlexCam (Fluke Corporation, Everett, WA) with a temperature indication resolution sensitivity of 0.05°C. Temperatures from the centre and the edge of the vitiligo lesion and perilesional normal skin were assessed. Laser Doppler flowmetry and laser speckle imaging of lesional and perilesional skin was performed in another group of 44 patients using a Laser Doppler Line Scanner and a Full-field Laser Perfusion Imager (MoorFLPI, Moor instruments Ltd., Axminster, UK). In all patients, disease activity was assessed anamnestically.
Results: From the 55 patients, who were included for thermography, 24 had active vitiligo and 31 had stable disease. No statistically significant difference in temperature was found between normal and vitiligo skin. Furthermore, no correlation was found between skin temperature and disease activity. Laser Doppler flowmetry and laser speckle imaging was performed in 44 patients. Nineteen patients reported recent progression of their vitiligo versus 25 patients with stable disease. No statistically significant difference in cutaneous perfusion was seen when comparing lesional and perilesional skin.
Conclusion: In this pilot study, temperature and perfusion, as assessed with thermal imaging, laser Doppler flowmetry and laser speckle imaging, were not found to be useful to assess disease activity in non-segmental vitiligo. The authors have no conflict of interest to declare. The equipment was kindly provided by Fluke Corporation (Everett, WA) and Moor instruments Ltd. (Axminster, UK), exclusively for the purpose of this study.

#703

CLINICAL EVALUATION OF INTENSE PULSED LIGHT vs A COMBINED TREATMENT WITH INTENSE PULSED LIGHT AND NDYAG LASER FOR FACIAL REJUVENATION IN LATIN-AMERICAN WOMEN

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Background: Non-ablative facial rejuvenation has not been widely assessed in Latin-American skin types. The aim of this study was to compare the clinical effectiveness of two non-ablative techniques for facial rejuvenation in Latin-American skin types.
Study: 36 consecutive patients with moderate-to-advanced photoaging were treated with IPL or a combination IPL/NdYAG laser (Syncro HP, Deka, Italy); each received two sessions one

month apart. Treatment parameters: IPL 550–950 nm: spot size 18 mm × 83 mm, fluency 8.5–11 J/cm^2, 3 pulses, pulse duration 5 msec, delay 110 msec, 2 passes; NdYAG laser 1064 nm long pulse: spot size 15 mm, fluency 52 J/cm^2, 3 pulses, pulse duration 15 msec, delay 125 msec, frequency 1 Hz, 4 passes. NdYAG laser was applied immediately after IPL. All patients used sunscreen SPF 30+ and a preparation of hydroquinone/retinoic/hydrocortisone daily. Clinical improvements were assessed by two external blinded physicians with comparative photographs at baseline and 30 days after two treatments using a quartile grading scale to evaluate fine lines, deep wrinkles, pigmentation, redness, laxity and global appearance of the skin. The results were compared with a non-parametric statistical test, the Mann-Whitney U test. Side effects were reported.

Results: 18 patients received treatment with IPL (average age 49 ± 7; Fitzpatrick III = 33%, IV = 61%, V = 6%) and 18 with combination IPL/NdYAG laser (average age 53 ± 8; Fitzpatrick III = 22%, IV = 67%, V = 11%). Significant differences between baseline and 30 days post-treatments were observed for all features. Outcomes achieved with IPL/NdYAG were significantly higher: fine lines ($p = 0.0044$), deep wrinkles ($p = 0.0006$), pigmentation ($p = 0.0025$), redness ($p = 0.0415$), laxity ($p = 0.0001$), global appearance ($p = 0.0004$). Side effects were limited to mild transitory erythema.

Conclusion: Non-ablative treatment with IPL or combination IPL/NdYAG laser long pulse for facial rejuvenation are safe and effective techniques in Latin-American skin types with almost no side effects. Outcomes achieved with IPL/NdYAG laser were higher than using IPL alone in this study.

#704

TREATMENT OF IDIOPATHIC GUTTATE HYPOMELANOSIS WITH 2940 nm ERBIUM YAG LASER

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Background: Although very common, idiopathic guttate hypomelanosis has no truly satisfactory treatment. Medical treatment with topical tretinoin has been proposed. However, long term applications are required and the repigmentation is almost always partial. Surgical approaches appear to give the best results. Mechanical dermabrasion is often effective but the treatment of numerous lesions is long and tiresome. The most used method is the short applications of 3 to 5 seconds liquid nitrogen. Such treatment is often effective although targeting accurately the hypopigmented lesions remains difficult. Numerous lesions also require relatively long sessions of treatments.

Study: A 66-year-old woman presented with acquired hypomelanotic macules of the legs progressively spreading to the tights and the forearms. Lesions were asymptomatic and were 2 to 10 mm in diameter. Those clinical aspects were characteristic of idiopathic guttate hypomelanosis. With the agreement of the patient we treated some target lesions on the right leg. Several hypopigmented lesions of the same area remained untreated and served as controls. After topical anesthesia with lidocaine and prilocaine cream, one treatment session with 2940 nm Erbium YAG (Er:YAG) laser (Quantel SA, France) was performed on the 6 target lesions. The treated area was located using anatomical marks and photographs were done. The parameters used were a fluency of 13.5 J/cm^2 with a 3.5 mm spot size.

Results: After 6 weeks, all the treated lesions had fully repigmented while none of the control lesions did. The patient reported mild discomfort during the treatment with no real pain. A slight erythema was still observed on some lesions. No other side effect was noted.

Conclusion: The efficacy and good tolerance of the treatment of idiopathic guttate hypomelanosis with the 2940 nm Er:YAG laser have to be confirmed in a larger series of lesions and patients but it appears as a promising therapeutic approach.

#705

IS THE EFFICIENCY OF GREENLIGHT HPSTM LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY DECREASED BY LONG-TERM 5 ALPHA-REDUCTASE INHIBITION THERAPY?

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Background: Hemoglobin is the primary chromophore of the potassium-titanyl phosphate (KTP) laser. The efficiency of the GreenLight HPS^{TM} laser PVP in patients on long-term 5ARI, which reduce angiogenesis in benign prostatic tissue, may be decreased. We evaluate GreenLight HPS^{TM} laser PVP as treatment for benign prostatic hyperplasia (BPH) in patients on long-term 5ARI.

Study: We prospectively evaluated our GreenLight HPS^{TM} laser PVP experience in patients with (5ARI+) and without (5ARI-) long-term 5ARI therapy. Transurethral PVP was performed using a GreenLight HPS^{TM} side-firing laser system with normal saline irrigant. American Urological Association Symptom Score (AUASS), quality of life (QoL) score, maximum flow rate (Qmax) and post void residual (PVR) were measured preoperatively and at 1 and 4 weeks and 3, 6, 12, 18 and 24 months post surgery. Serum PSA and TRUS were also obtained at the 12 week follow-up interval.

Results: 178 consecutive patients were identified; 55 5ARI+ were on either finasteride or dutasteride for more than 6 months and 123 5ARI- were not. Mean prostate volumes were 68 ± 36 and 74 ± 46 mL ($p = 0.46$) and mean PSA values were 2.2 ± 2.4 and 3.0 ± 4.0 ng/ml ($p = 0.21$), respectively. There were no significant differences in laser utilization (14 ± 9 vs 13 ± 9 minutes, $p = 0.62$) and energy usage (88 ± 63 vs 89 ± 62 kJ, $p = 0.96$). All were outpatient procedures with most patients catheter-free at discharge. All patients discontinued their prostate medications following surgery. The mean rates of prostate vaporization (2.7 ± 1.3 vs 3.6 ± 2.4 mL/min, $p = 0.08$; 0.61 ± 0.81 vs 0.53 ± 0.36 mL/kJ, $p = 0.47$) and TRUS volume 12 weeks post surgery (37 ± 21 vs 36 ± 30 mL, $p = 0.86$) were similar between groups. AUASS, QoL, Qmax and PVR values showed immediate improvement in each group ($p < 0.05$), but showed no significant difference ($p > 0.05$) between the two groups during the follow up interval.

Conclusion: 5ARI do not have a detrimental effect on the efficiency and efficacy of GreenLight HPS^{TM} laser PVP.

#706

TREATMENT OF STRETCH MARKS WITH LASER PULSED DYE

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Background: Stretch marks frequent skin lesions that cause considerable aesthetic and psychological problems. In Algeria, the marketing free oral corticosteroids in recent years have caused a growing number of patients seeking care for stretch marks. Many publications using laser acting as the vascular component has been tested with encouraging results. Study: Thirty two (32) patients were treated at a rate of one session per month with a total of four sessions. They all had red stretch marks and without skin atrophy with phototype III–IV. The laser used is the V Beam 595 nm (Candela) to 9 j/cm^2, 6 ms pulse duration with the cold DCD 30/30 and 7 mm diameter spot. The appreciation of the improved s\' is done by photos taken before and after meetings. Only three (03) patients did not complete treatment.
Results: Nineteen patients (19) had an improvement considered good or excellent after the treatment. No side effects were found and no sensation of pain has been felt by patients.
Conclusion: The PDL may be an attractive and alternative therapeutic for the immature striae in all skin types.

#708 Late Breaking

OPTICAL IMAGING USING VEGF RECEPTOR-TARGETED PROBE IN AOM-TREATED MICE

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Background: At sites of tumor angiogenesis, vascular endothelial growth factor (VEGF), and its associated receptor (VEGFR) may be overexpressed, initiating the growth of endothelial cells and increasing tumor vasculature. In a previous study conducted in our lab, a VEGFR-targeted fluorescent dye probe was visualized *in vivo* to accumulate in tumor areas. However, an untargeted probe also accumulated in tumors. The purpose of this study is to determine if the mechanism for accumulation differs between targeted and untargeted probes.
Study: The targeted probe was created by attaching single chain (sc) VEGF to Cy5.5 maleimide (scVEGF-Cy5.5). The aa fragment of the scVEGF was scrambled for the untarged probe (inVEGF-Cy5.5) (SibTech, Inc., Brookfield, CT). Colon cancer was induced in A/J strain mice by 5 weekly injections of azoxymethane (AOM). Dye was introduced via colon lavage. A combined system of Optical Coherence Tomography (OCT) and Laser Induced Fluorescence (LIF) was used to visualize fluorescent dyes *in vivo* in tumor and normal colon in 4 animals. Post imaging, the colon was harvested, opened longitudinally, frozen, and multiple sections taken at 8 longitudinal positions. Sequential section were stained with H&E (for diagnosis), immunostained for VEGFR-2, and left unstained for Cy5.5 dye visualization.
Results: Initial analysis indicates that scVEGF-Cy5.5 is co-located with regions of VEGFR-2 immunostaining, a correlation not seen with inVEGF-Cy5.5 probe. inVEGF-Cy5.5 accumulated in lymphoid aggregates, normal structures often co-located with tumors in diseased regions.
Conclusion: Both probes showed non-specific accumulation on the surface of the colon, perhaps due to the mode of application. Results suggest that both probes will co-localize with tumors, but utilizing different mechanisms.

#709 Late Breaking

TREATMENT OF GRANULOMA ANNULARE WITH THE 595 NM PULSED DYE LASER, A PROSPECTIVE MULTICENTER STUDY

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Background: The treatment of granuloma annulare (GA) remains highly challenging. Most of treatments are based on case reports and none gives truly satisfactory results. The objective of this study was to evaluate the Pulsed Dye Laser (PDL) in treating GA.
Study: Prospective study conducted in 6 centers by the Laser Group of the French Society of Dermatology. *Inclusion criteria*: At least 2 lesions of GA, phototypes I to IV. *Intervention*: 3 sessions (1/month) of PDL parameters hand piece 7 mm, 1.5 ms, 12–15 J/cm^2, DCD 40/10 and 2 ms, 11–14 J/cm^2, maximum cooling, for Vbeam, Candela© and Vstar, Cynosure©, respectively. At least one lesion had to remain untreated and served as control. *Evaluation*: Investigator global assessment for each lesion performed 2 months after the third session. Patient satisfaction and pain were evaluated on a visual analogical scale.
Results: Twelve patients, all women (4 with a localized form and 8 with generalized GA) were included. One patient dropped out. Analysis in ITT. No worsening of the lesion was observed. Twenty one lesions (36.8%) remained unchanged, improvement of less than 50% was observed in 22 (38%) and 13 (32%) had more than 50% of clearing. Only 14% of lesions in generalized GA had more than 50% of improvement while 50% of localized GA lesions did. Three control lesions showed partial improvement. Transient hyperpigmentation and crusting were observed in almost all cases. Pain and patient's satisfaction were rated at 7.4 and 4.5 (10 was maximum score), respectively. The median follow-up was 6 months (2–12) and 10 lesions recurred after initial clearing.
Conclusion: Despite encouraging first case reports, the treatment of GA with PDL appears disappointing. Only localized forms showed significant improvement in half of the treated lesions but pain, side effects and high rate of recurrences strongly limit the use of PDL in this indication.

#716

INTRALESIONAL PHOTODYNAMIC THERAPY OF NONMELANOMA SKIN CANCER

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Background: Although topical application of 20% d-aminolevulinic acid (ALA) solution followed by illumination with incoherent blue light source or pulse dye laser (PDL) may effectively treat thin actinic keratoses and superficial basal cell carcinomas, it is unable to resolve thicker lesions due to the lack of penetration of the ALA. In this study, we evaluated whether injection of the ALA into nodular basal cell carcinomas could be an efficacious treatment alternative in the management of thicker nonmelanoma tumors.
Study: A prospective study enrolling 10 patients (8 F, 2 M, median age 49 years) with 16 biopsy proven nodular basal cell carcinomas was performed. Following anesthetization with 1% lidocaine with epinephrine 1;100,000, tumors were injected with 20% ALA solution until blanched, covered with a topical layer of

ALA, bandaged and allowed to incubate for 1 hour. Lesions were then exposed to incoherent blue light (irradiance of 10 mW/cm^2 for 1000 sec, total dose of 10 J/cm^2 per exposure). Clinical clearance and cosmetic outcome was evaluated at 8 weeks, 16 weeks, and 1 year post treatment. A second treatment was performed if residual tumor was detected clinically at the 8 week follow-up visit.
Results: 15 of 16 basal cell carcinomas were evaluated at 8 weeks post treatment, with one patient having been lost to follow-up. After one PDT treatment, complete clinical clearance was noted in 8 of 15 basal cell carcinomas, partial clearance in 6 of 15 basal cell carcinomas, and no clearance in 1 basal cell carcinoma. A second PDT treatment was performed in the 7 tumors with either partial or no clearance, with 6 out of the 7 achieving complete clearance at the 16 week evaluation, and one still awaiting evaluation. In summary, after 1 or 2 PDT treatments, 14 out of 15 tumors showed complete clinical clearance, with one still awaiting evaluation. Histological clearance was evaluated by follow-up biopsies 16 weeks after initial treatment. 12 treated sites showed histological clearance while only 2 demonstrated residual tumor. Cosmetic outcome was noted to be excellent or good in 12 of 13 treated sites evaluated at 16 weeks, with only one having a fair cosmetic outcome. To date, one-year follow-up visits have been completed for 3 patients, who continue to have complete clearance of the treated tumors.
Conclusion: Intralesional photodynamic therapy may offer a novel non-surgical treatment modality for nonmelanoma skin cancers.

#717

COMPARISON OF 5-ALA ALONE, PDT ALONE AND A COMBINATION OF SEQUENTIAL 5-ALA AND PDT IN THE TREATMENT OF ACTINIC KERATOSES AND PHOTOREJUVENATION

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Background: andBroad area photodynamic therapy treatment with ALA plus activation with visible light has been shown previously to be as effective as topical 5-fluorouracil (5-FU) in the treatment of actinic keratosis (AK). However, the possibility of combining both modalities in the treatment of the same patient to increase clinical clearance rates has never been investigated. The purpose of this study was to assess the efficacy and tolerability of using both topical 5-FU and PDT using short incubation time, broad area treatment with ALA plus activation with low level red light in the treatment of actinic keratosis of the face and scalp.
Study: or30 subjects with biopsy proven actinic keratoses of either the face or scalp were randomized into three groups: one group to receive application of ALA for 1 hour followed by activation with red light, one group to receive topical 5-FU 0.5% cream only, and one group to receive both in monthly sequence. Efficacy was evaluated at three months after treatment by grading AK lesions and photoaging signs using clinical and photographic assessments by blinded observers. Histologic improvement was also assessed biopsy analysis. Tolerability was assessed by evaluating for crusting/erosions, erythema and stinging/burning.
Results: Treatment with photodynamic therapy using ALA plus visible light was as effective as topical 5-FU in clearing AK. However combining both modalities provided the greatest clinical and histologic improvement. All treatments also led to improvements in signs of cutaneous photoaging. Treatments were tolerated equally with minimal side effects.
Conclusion: Broad area PDT treatment with ALA plus activation with visible light appears to be as effective as 5-FU in the treatment of AK, but combining both modalities provides the greatest clinical improvement.

#727

SIRTUIN 2 MEDIATED PROMOTION OF NEUTROPHIL EXTRACELLULAR TRAPS FORMATION BY RED LIGHT

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Background: There are two kinds of antimicrobial activities of Polymorphonuclear neutrophils (PMNs), respiration burst and neutrophil extracellular traps (NETs) consisting of chromatin and granular proteins. The photobiomodulation on the respiration burst and its signal transduction has been found before. The effects of red light (640 ± 15 nm) from light emitting diode array (RLED) on the NETs formation and its mechanism were studied in this paper. Sirtuin 2(SIRT2) is an tubulin deacetylase. Colchicine and taxol can disrupt and stabilize microtubules, respectively. Exercise can elevate sirtuin activities.
Study: PMNs were treated with 1 μmol/L dexamethasone as the *ex vivo* PMN model of inflammation(ePMI). ePMI was irradiated with RLED at 0, 0.2, 0.3 and 0.4 mW/cm^2 for 150 s, and PMNs were treated with taxol and colchicine, respectively, and then treated with 100 mU/ml glucose oxidase to induce NETs formation.
Results: 0.4 mW/cm^2 RLED increased the amounts of NETs produced by ePMI to the one produced by normal PMNs and SIRT2 expression in ePMI ($P < 0.05$). Colchicine at 10 and 100 μmol/L increased more NETs than the control, respectively, while there were no effects of Taxol on NETs formation. SIRT2 level and NETs amounts in athletes were higher than the ones in non-athletes, respectively.
Conclusion: RLED may have promote NETs formation of ePMI, which might be mediated by SIRT2. *It is supported by National Science Foundation of China.

#728

EFFECTS OF LOW-INTENSITY HeNe LASER IRRADIATION ON RAT SKELETAL MUSCLE INJURY AFTER ECCENTRIC EXERCISE

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Background: Delayed onset muscle soreness is often induced in unaccustomed exercise or eccentric exercise, but its photobiomodulation has been left unsolved. The effects of low intensity He-Ne laser irradiation (LHNL) on rat muscle injury after eccentric exercise were investigated in this study.
Study: Seventy-two Sprague-Dawley rats were randomly divided into five groups: sedentary control group, exercise control group and three exercise-plus-laser groups. Downhill running was used to induce muscle injury in the gastrocnemius muscle. LHNL was administered to the injured muscles immediately and at 18 and

42 h after exercise in the three exercise-plus-laser groups at 12, 28, and 43 J/cm^2, respectively.
Results: LHNL at 43 J/cm^2 obviously inhibited muscle inflammation, and significantly reduced the extent of elevation in serum creatine kinase (CK) activity and the loss of muscle desmin as compared to the exercise control group at both 24 and 48 h after exercise. LHNL at 43 J/cm^2 also significantly enhanced muscle superoxide dismutase activity, lowering muscle malondialdehyde (MDA) level, and significantly enhanced muscle nitric oxide synthase activity and nitric oxide level at the same times. There were no significant differences in the serum CK activity and muscle MDA level between the laser group receiving 43 J/cm^2 and the sedentary control group. LHNL at 12 or 28 J/cm^2 reduced muscle inflammation and significantly inhibited serum CK activity at 48 h after exercise only.
Conclusion: LHNL promoted the rehabilitation of eccentric exercise-induced muscle injury in rats. The beneficial effects might be through enhancing sirtuin 1 activity in muscular tissue.

#729

REHABILITATION OF RED LIGHT ON THE PROTEOSTASIS OF C2C12 MYOBLASTS AND MYOTUBES FROM THE NOVOBIOCIN PRETREATMENT

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Background: Novobiocin, heat shock protein 90 (Hsp90) antagonist, disrupts proteostasis, the eukaryotic protein homeostasis. Its photobiomodulation with red light (640 ± 15 nm) from light emitting diode array (RLED640) was studied in this paper.
Study: {[c],[t]} meant the cells were cultured with novobiocin at c mmol/L for t h. For C2C12 myoblasts, we had the non-radiant groups {[0, 0.03, 0.2, 0.3, 0.4, 0.6, 0.8, 1.0],[0, 12, 24, 48]} and the radiant groups {[0, 1.0],[0, 12, 24, 48]} irradiated with RLED640 at 0.25, 0.6, 0.8, and 1.0 mW/cm^2 for 15 min, respectively. For C2C12 myotubes, we had the non-radiant groups {[0, 0.2, 0.4, 0.6, 0.7, 0.8, 1.0],[24]} and the radiant groups {[1.0],[24]} irradiated with RLED640 at 1.0 mW/cm^2 for 15 min. The proliferation/mitochondrial-function and the apoptosis have been assessed by MTT assay and acridine orange/ethidium bromide double fluorescence stain, respectively.
Results: The non-radiant groups {[0.03, 0.2, 0.3, 0.4, 0.6, 0.8, 1.0],[12, 24]} inhibited C2C12 myoblast proliferation($P < 0.05$), the radiant groups {[1.0],[12]} at 1.0 mW/cm^2 and the radiant groups {[1.0],[24]} at 0.6 mW/cm^2 promoted the proliferation($P < 0.01$), respectively, but there were no photobiomodulation in the radiant groups {[0],[0]} and {[1.0],[48]}. The non-radiant groups {[0.6],[24]} induced C2C12 myoblast apoptosis, but the radiant groups {[0.6],[24]} at 0.6 mW/cm^2 inhibited the apoptosis. The non-radiant groups {[0.2, 0.7, 0.8, 1.0],[24]} inhibited C2C12 myotube mitochondrial function ($P < 0.01$), but the radiant groups {[1.0],[24]} at 1.0 mW/cm^2 promoted the mitochondrial function ($P < 0.01$).
Conclusion: RLED640 may promote the proteostasis recovery of C2C12 myoblasts and myotubes from the novobiocin pretreatment. It is supported by National Science Foundation of China.

#733

FACELIFTING AND LASER RESURFACING: NEW APPROACH USING FRACTIONAL ABLATIVE TECHNOLOGY

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Background: Facelifting and laser resurfacing has been a challenging and controversial combination of procedures due to risk of flap compromise. Since the introduction of fractional ablative technology we have modified our approach to combination facelifting and laser resurfacing and sought to review the results in this study.
Study: Since August 2006, 40 patients underwent facelifting and full facial laser resurfacing with a Sciton Profile Erbium:YAG laser. Treatments were performed under general anesthesia with the facelift being performed first and other adjunctive surgery followed by resurfacing. 19 patients also had facial fat grafting performed after laser resurfacing. Patients underwent full field deep resurfacing with or without fractional resurfacing of the forehead, periocular, nasal and perioral regions and fractional treatment only of the undermined flap. Open wound care was instituted and all patients received perioperative antibiotics and antivirals.
Results: All patients tolerated their treatment. There were no wound healing complications infections, hypopigmentation or hyperpigmentation noted. One patient with more significant photodamage needed additional resurfacing of the facial flap
Conclusion: Combination facelifting and laser resurfacing with flap ablative fractional treatment is a useful, safe rejuvenative tool.

#734 Late Breaking

REVIEW OF EARLOBE KELOIDS TREATED WITH THE CO_2 LASER OR COLD STEEL DEBULKING SURGERY

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Background: Many medical and surgical modalities have been recommended for keloid treatment but the response is often slow with frequent recurrent. CO_2 laser has been found to stimulate b fibroblast growth factor (bFGF) secretion and inhibit transforming growth factor—ß1(TGF-ß1) secretion in fibroblasts in-vitro, which may lead to normalized wound healing. We compared the outcomes after debulking surgery or CO_2 laser ablation of earlobe keloids in our patients to determine if there was less recurrence after CO_2 laser ablation.
Study: We reviewed the records of patients managed in our hospital with earlobe keloids from 2003 to 2009.
Results: We managed 16 patients during the period; 87.5% were females and the mean age was 20 years (range 15 years to 48). 12 patients had received prior treatment (10 had intralesional triamcinolone acetonide 10 mg/ml or 40 mg/ml, cryotherapy or silicone gel sheets while 2 had diathermy ablation or pulsed dye laser ablation). 8 patients underwent CO_2 laser ablation (Lasering USA, Slim Evolution E30 CO_2 laser with AT0096 handpiece, spot size 0.15 mm, superpulse, continuous mode, power 5 watts), 6 patients underwent surgery, 1 patient had both surgery and CO_2 laser while 1 patient received only intralesional triamcinolone

acetonide 40 mg/ml. 4 patients were followed-up for 1 to 24 months post procedure while 2 defaulted. All 13 patients who had either CO_2 laser or surgery had recurrence of keloid growth at 2 to 18 weeks post procedure, requiring adjuvant intralesional triamcinolone acetonide therapy (10 mg/ml or 40 mg/ml). The patient who received intralesional triamcinolone acetonide therapy alone had only partial response to therapy.
Conclusion: Both the CO_2 laser and surgery were useful in reducing the size of the earlobe kelois but were ineffective in preventing regrowth of the keloids and adjuvant intralesional steroid was needed. Our conclusion is limited by the small number of cases analysed.

#736

EVALUATION OF THE IMPACT OF FRACTIONAL LASER (MATRIX IR) AND FRACTIONATED RADIOFREQUENCY (SUBLATIVE RF) ON THE IMPROVEMENT OF ACNE SCARS

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Background: Options for acne scarring include dermabrasion and laser resurfacing. eLaser (Syneron, Irvine, CA) employs a fractionated, integrated technology (Matrix IR) that combines optical (infared diode) and radiofrequency energies along with a fractionated bipolar radiofrequency hand piece (Sublative RF).
Study: Study objective was to determine the safety and efficacy with Matrix IR/Sublative RF in acne scars and skin texture. Affected regions were treated with Matrix IR 60–70 J/cm^2/80–100 J/cm^3 (10% overlap, two passes), and one pass Sublative RF 19–25 J (Program C, 5% coverage). Patients received five, monthly treatments. Acne scar assessment (based on number, severity, and type of scars; 1–84) was performed at each visit. Investigator assessment of overall improvement of scarring, texture, and pigmentation (4-point scale) occurred at day 30, 60, 120, 150, and 210. Patient's discomfort (5-point scale) was assessed at each treatment visit. Patients participated in questionnaires assessing overall improvement and satisfaction (4- point scales) at day 60, 120, 150, and 210.
Results: 15 patients (12 females, 3 males), aged 20–72 years old (mean 42), Fitzpatrick skin types II–IV, completed the study. Treated areas included the forehead (1), cheeks (15), temples (3), perioral (2), and chin (5). Acne scar scale found a significant decrease of 79.98% (9.4 to 2.54, p-value < 0.001). Similarly, investigator assessment of overall improvement of scarring and texture showed improvement from day 30 to day 150 of 67.25% (2.69, p-value < 0.001) and 65.38% (2.62, p-value < 0.001), respectively. Average patient discomfort during Matrix IR and Sublative RF were 2.04 and 1.19, respectively. There was no difference in the investigators assessment of pigmentation. Patient satisfaction score showed no significant change over time. However, there was a significant improvement, 57.41% (1.47 to 2.31, p-value 0.04), in patient evaluated overall improvement scores.
Conclusion: There was investigator-rated improvement in acne scarring and texture. Patient satisfaction scores did not improve, though overall improvement scores did. Sublative RF was better tolerated than Matrix IR.

#742

INFRARED LIGHT DEVICE (1100–1800 nm) USING MOBILE DELIVERY FOR THE TREATMENT OF FACIAL AND NECK SKIN LAXITY

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Background: Recent histological studies using infrared light devices have shown collagen and elastin stimulation in the dermis. This prospective study assesses the safety, efficacy, and pain profile of infrared light with a mobile delivery method for the treatment of facial and neck skin laxity as assessed by a tested, quantitative grading scale.
Study: In this study, 38 subjects with a minimum laxity grade of 2 out of 4 on the face and neck received 1 to 3 treatments with infrared (1100–1800 nm) light at intervals of 2 to 4 weeks. Treatments were performed using a mobile technique, moving the handpiece vertically and laterally to maximize subject comfort. Approximately 300 to 450 pulses were applied using fluences of 44 to 46 J/cm^2 on the face, mandible, and neck. Clinical results were evaluated using photographs at 1-month, 3-month and 6-month follow-up visits employing the same 4-point laxity grading scale as the baseline. Pain ratings were recorded using VAS immediately post-treatment.
Results: Based on initial data collection of 22 of 38 subjects, the mean treatment number was 2.1 (+/−0.9) and the mean follow-up interval was 1.9 (+/−1) months. Quantitative evaluations demonstrated a statistically significant difference with a mean difference of 0.4 +/−0.3 in laxity grades (paired t-test, $p < .0001$). Mean percent improvement in laxity scores was 14.1 +/−11.3%. Treatment discomfort was rated as a mean of 0.7 (+/−0.6) on a 10 point scale. Minimal erythema resolved within 1 to 3 hours immediate post-treatment. No crusting, dyspigmentation, or scarring was observed. Data from the additional 16 subjects and longer term follow-up data from all 38 subjects will be available in January, 2010.
Conclusion: The mobile delivery of infrared light appears to be safe, clinically effective, and painless in reducing facial and neck laxity. The clinically observable and quantified decreases in skin laxity were statistically significant.

#743

LONG TERM ANTI WRINKLE REDUCTION USING A NOVEL MULTISOURCE RF PHASE-CONTROLLED RADIOFREQUENCY TREATMENT SYSTEM

Yoram Harth, Itzhak Vider, Monica Elman, Avner Shemer, Varda Gottfried, Amy Kamin

Medical OR Herzlya, Israel; Beit harofim, Holon, Israel; Sackler School of Medicine, Tel Aviv, Israel; EndyMed, Ltd., Cesarea, Israel; EndyMed, New York, NY

Background: It is well documented that dermal heating has an immediate effect on collagen structure resulting in skin tightening and longer term effect of neocollagenesis resulting in improved skin texture and decrease in wrinkles. First generation radiofrequency device were proven to be effective for ant wrinkle effect and skin tightening but their use was limited by pain or unpredictable results. We tested a new technology implementing Phase Controlled Multisource radiofrequency (3DEEP technology, EndyMed PRO™, Endymed Ltd. Cesarea, Israel).
Study: The study included 32 patients specifically treated for face wrinkles, that were followed for 3 months after last treatment (5

months follow up). Patients received 6 treatments and were scheduled for follow-up visits after one month and three months following the last treatment. Pre and post-treatment photos were introduced to two impartial dermatologists for blinded evaluation according to Fitzpatrick Wrinkle Scale.
Results: Out of the 32 patients treated for face wrinkles, two patients could not complete the protocol because of personal reasons not related to the study itself. Some patients experienced mild local erythema and edema that resolved within 10 to 30 minutes. None experienced pain, burns, skin breakdown, or scarring. Score differences was found to be statistically significant while comparing baseline score to the scores obtained at following 6 treatments, 1 month follow-up and 3 month follow-up (First reviewer: 2.07($\pm$1.53), 2.45($\pm$1.62), 3.43($\pm$1.59) and the second reviewer 1.67($\pm$1.06), 1.93($\pm$1.16) and 3.23($\pm$1.22) respectively. ($p < 0.0001$).
Conclusion: The results of this study clearly indicate that the EndyMed PRO™ system offers a non invasive, very effective, safe and virtually painless treatment solution for long term wrinkle reduction.

#744

USE OF A NOVEL COMBINED RADIOFREQUENCY AND ULTRASOUND SKIN TIGHTENING DEVICE TO TREAT CELLULITE AND FOR LIPOLYSIS—THE FIRST 25 PATIENTS

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Apollo Hospitals Hyderabad, India

Background: A recently introduced device incorporating selective ultrasound to cause lipolysis and noninvasive high-energy radiofrequency (RF) to heat the subcutaneous tissue, was evaluated. No published reports exist on the efficacy of this combination. OBJECTIVE: To assess the efficacy and safety of a novel radiofrequency and ultrasound device for the treatment of cellulite, body shaping and circumference reduction.
Study: 25 healthy patients (29–66 years) with visible bilateral cellulite (grade 1 to 3) on the abdominal wall and/or thighs received 3 treatment sessions each (fortnightly), each session comprising of ultrasound followed by unipolar RF. A total of 96 treatments were performed on 22 abdomens and 10 pairs of thighs. Photographs to document contour and superficial changes, and circumferential measurements of each area were obtained prior to, after each treatment and 4 weeks after the last treatment. The dermatologist evaluated clinical changes, using a quartile grading scale.
Results: The treatments were well tolerated. The mean reduction in thigh circumference was 3 cm ($\pm$0.8 cm) with a 5.5 cm reduction in 1 subject. The mean reduction in infraumbilical circumference was 8 cm ($\pm$2.2 cm) with a 12 cm reduction in 1 subject. Upto 25% improvement in skin tone, texture, and the appearance of cellulite was observed in all. In 4 patients, the output RF power was reduced during treatment due to thermal discomfort.
Conclusion: The Radiofrequency and selective ultrasound system is effective and safe for modest improvement in the appearance of cellulite and for body shaping (6–8 sessions recommended by manufacturer). Also, comparative studies are required to determine if the ultrasound component actually contributes to better results as claimed.

#745

STABILIZED HYALURONIC ACID BASED GEL OF NON-ANIMAL ORIGIN ASSOCIATED WITH MONOPOLAR CAPACITIVE RADIOFREQUENCY IN BODY CONTOURING AND VOLUME RESTORATION

Tiziana Lazzari, Gino Luca Pagni

Altopascio (Lucca), Italy; Genova, Italy

Background: The search for a youthful and good-looking perception of the image of the whole body is the main responsible for the increased demand for minimally invasive cosmetic procedures which is driving the overall growth of the cosmetic industry. The new Thermage® CPT System represents a leap forward in contouring technology. The new tips deliver enhanced heat distribution and uniformity, and improve volumetric heating. A greater volume of tissue is heated till optimal temperatures with better distribution in the treatment area. Restoring volumetric loss and reshaping profile is important to achieve complete rejuvenation and body contouring. To address the need for an injectable, and safe procedure for body contouring and volume restoration, a new implant comprising hyaluronic acid based gel of non-animal origin (NASHA™ gel) was developed in Sweden. The objective of this study was to investigate the potential use of NASHA™ gel for volume restoration associated with Thermage® to reach body contouring.
Study: Study partecipants were women aged 39–60 years ($nr = 10$), with loss of volume and skin laxity in arms ($nr = 2$), buttocks ($nr = 6$) and inside thigh ($nr = 2$). Eight patients received one session of body thermage associated with NASHA™ gel injection in local anesthesia and two patients in general anesthesia. All the areas were massaged carefully to aid proper distribution of the gel. Results were evaluated at 6, 12 and 24 weeks.
Results: All patients had good results, especially for relaxation of buttocks and inside thigh. Appropriate patient selection, accurate pre-operative markings and planning of the procedure were crucial for a good outcome.
Conclusion: NASHA™ gel is a promising biocompatible material for minimally invasive and well tolerated body volume restoration. Its use in association with Thermage® open new horizons in body contouring.

#746

INTENSE FOCUSED ULTRASOUND FOR FACIAL TIGHTENING: A REPORT OF 22 PATIENTS IN ASIAN

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Background: The Intense focused ultrasound is a novel modality for skin laxity, can produce thermal effects at various depths sparing the overlying tissue.This study assessed the safety and efficacy of intense focused ultrasound (Ulthera LLC, Mesa, AZ) for facial tightening of Asian skin.
Study: 22 patients with facial laxity were evaluated. Mean age was 48.5 years (range, 38–73). All patients were treated with intense focused ultrasound. Three available hand pieces with different focal depths were used with a single pass at 1–2 mm apart. Skin biopsies were taken on 5 patients before and at 2 months after the treatment. All specimens were stained with

hematoxylin and eosin(H&E) and Victoria blue. The results were evaluated based on clinical photos before and after, subjective and objective ratings.
Results: Objective physician evaluation found good improvement at 2-month evaluation. Histologic evaluation by hematoxylin and eosin(H&E) and Victoria blue showed slightly increased collagen fibers.
Conclusion: Intense focused ultrasound can be used as a noninvasive skin tightening in Asian facial skin.It was shown to be effective and safe.

#747

SKIN TIGHTENING WITH THE MPX SMARTLIPO AND AFFIRM CO_2 LASERS

Sherry Collawn

University of Alabama, Birmingham, AL

Background: Skin tightening with the MPX Smartlipo and Affirm CO_2 lasers (Cynosure, MA) occurs when used singularly or in combination. Significant tightening of the neck and jowls occurs with the MPX Smartlipo immediately at the time of treatment and improves over months. Skin improvement with the Affirm CO_2 laser occurs in the first 2 weeks and improves over months. When used in combination, skin rejuvenation is further enhanced.
Study: From 7-13-09 until 10-16-09, 63 patients have undergone treatments with the Affirm fractional CO_2 laser and 21 patients have undergone treatments with the MPX Smartlipo. Settings for the MPX Smartlipo were 3 watts of 1320 nm and 6 watts of 1064 nm on the necks using the 600 micron fiber. For abdomens the 1000 micron fiber was used at 12 watts 1320 nm and 24 watts 1064 nm. Internal and external skin temperatures were monitored. The Affirm CO_2 laser was used on the face for rhytides, scars, and acne scars and settings varied based on the condition and skin type being treated.
Results: Smartlipo MPX resulted in immediate tightening in the neck and jowl regions. The skin retraction and smoothness along the mandible persisted 4 months after treatment. External skin temperatures in the neck did not exceed 42°C at the time of treatment. To further improve superficial rhytides and skin laxity, the Affirm CO_2 laser was performed. Improvement was seen in the first 2 weeks and continued to improve over months. There were no complications such as burns with either device. Fever blisters have not been a problem after Affirm CO_2 laser treatments since patients are placed on prophylactic antivirals. One melasma patient did develop hyperpigmentation after sun exposure following her CO_2 laser treatment. There was minimal discomfort or downtime for the patient with these laser treatments.
Conclusion: In summary, laser treatments with the MPX Smartlipo and Affirm CO_2 decrease rhytides and increase skin tightness. Combining both lasers sequentially results in faster and greater improvement than when either laser device is used alone.

#748

IMPROVEMENT OF WRINKLES BY BIPOLAR PARALLEL RADIOFREQUENCY

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Background: Thermal action of radiofrequency stimulates the renewal of collagen fibers leading to skin tightening with improvement of wrinkles.
Study: The study was performed to assess efficacy of bipolar parallel radiofrequency on different body sites. 10 patients with different areas (crow's feet, upper and lower eyelid, glabella, upper lip, nasolabial fold, cheek, neck, upper arm, hand, abdomen) were included. Five treatments were given using the Radiofrequency Module by Asclepion Laser Technologies; First and second at 1 week, second through fifths at 2 weeks interval without any downtime for the patient. Three handpieces for different areas were used at the tolerated energy and 2–3 passes done: handpiece small periocular (density 25–65 J/cm^3, pulse duration 2 sec, vacuum level 1–2), handpiece medium face, neck, hand (density 20–60 J/cm^3, pulse duration 2–3 sec, vacuum level 2–3) and handpiece large upper arms, abdomen (density 10–20 J/cm^3, pulse duration 2–3 sec, vacuum level 1–2). Before, and at week 4 and 12 after last treatment documentation was done by standardized photo documentation and 3D measurement. Patients rated improvement of wrinkles and skin, overall satisfaction and acceptance. Therapist and doctor evaluated improvement and side effects. Photo documentation was assessed by doctor, therapist and independent observer using a VAS (visual analogue scale) from 0 to 100.
Results: The improvement depends on body site. Best responding areas were at 1 month hands and lower eyelids, worst upper arms and after 3 month hands and upper arms, worst cheeks. All 4 evaluators verified a better result at three compared to one month ($p < 0{,}001$). Patients rated the mean improvement for all sites at 1 month 5.0 and at 3 month 19.66 better than the others ($p < 0{,}003$). At 3 month the mean efficacy was rated by all evaluators for hands 20.0, upper arms 12.5 and cheeks 4.37 (best = 100). Patients' satisfaction was high, no side effects were seen.
Conclusion: Bipolar parallel radiofrequency is effective and safe to treat mild to moderate wrinkles. The improvement was seen by patient and therapist, is statistically significant and increases up to 3 month.

#749

STRIAE REDUCTION FOLLOWING LASER LIPOLYSIS

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Background: Laser lipolysis has been shown to tighten normal skin and has demonstrated greater skin tightening than that seen following mechanical liposuction alone. The purpose of this study was to determine the effects of laser lipolysis on striae (stretch marks) and then to compare them to the effects of mechanical liposuction alone on striae.
Study: Ten subjects with localized lipodystrophy and bilateral abdominal striae underwent body contouring under local tumescent anesthesia by a single surgeon. On one side, a single treatment of laser lipolysis using a 980 nm CW diode laser followed by fat aspiration using a 3.7 mm cannula and 30 cm H_2O vacuum suction was performed. On the other side, mechanical liposuction was performed using a 3.7 mm and 30 cm H_2O vacuum suction. Striae width, measured by temporary tattoos, and skin biopsies were obtained before and 6 months after treatment. Patient assessments were noted.
Results: Striae width decreased by 32 ± 8 % following laser lipolysis compared to 11 ± 4 % following liposuction alone

($P < .05$). Histologically, there was greater papillary dermal thickness ($P < .05$) and qualitatively more stratified collagen within the laser lipolysis treated striae when compared to striae treated by liposuction alone. Greater patient satisfaction was also identified following laser lipolysis.
Conclusion: Striae are comprised of damaged dermal architecture with a disorganized and irregular collagen matrix. In this study, laser lipolysis was effective in reducing abdominal striae and in achieving a greater decrease in striae width than that observed after liposuction alone. New collagen deposition and dermal contraction were most likely responsible for these findings. Laser lipolysis may prove useful in improving the aesthetic appearance and textural quality of these unsightly problems.

#753

LASER TREATMENT OF FAMILIAL GLOMANGIOMATOSIS: 2 CASES

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Background: Surgical approaches, sclerotherapy and CO_2 laser can be used to treat familial glomangiomatosis but they frequently induce cicatricial sequelae. The only selective approach reported is the use of the 595 nm pulse dye laser (PDL). However, the use of a longer wavelength such as 1064 nm that could penetrate deeper and better to target the venous malformation appears more suitable for such a syndrome. We report 2 cases of familial glomangiomatosis treated with 595 nm and 1064 nm lasers.
Study: The first case was a 22-year-old man with familial history of glomangiomatosis presenting with a dozen of blue nodular vascular lesions mainly located on the thorax. The second case was a 19-year-old woman with the same history and more than 20 lesions distributed over the body. On the first patient we made a test session with 595 nm PDL (VBeam®, Candela), spot size 7 mm, 20 ms, fluency 12 J/cm^2 on one lesion and 1064 nm Nd:YAG laser (GentleMax®, Candela), spot size 3 mm, 40 ms, fluency 240 J/cm^2 on one other. One month after, the lesion treated with PDL had improved by 50% while the one treated with Nd:YAG was almost completely cleared. We then decided to treat both patients with the Nd:YAG laser.
Results: All the lesions cleared completely after 1 or 2 sessions depending on their size. Pain was rated to 8/10 and 7/10 on visual analogical scale. Minimal scarring wad observed in the largest lesions. Satisfaction was rated 9/10 by both patients.
Conclusion: The 1064 nm laser appears to be an effective and safe treatment of familial glomangiomatosis. Although direct comparison with PDL was done in only one case, the superiority of Nd:YAG appeared so clearly that we decided to continue the treatment only with this device. Early diagnosis and treatment are required as the smallest lesions showed the best esthetical results.

#754

THE USE OF A JET-PHORESIS TRANSDERMAL DELIVERY SYSTEM FOR PAIN CONTROL

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Background: Conventional cutaneous numbing using topical xylocaine formulations is an extremely popular practice prior to medical or cosmetic procedures obliveating the use of sub-dermal needle injections.
Study: This prospective study was undertaken to compare prospectively lidocaine jet-phoresis trans-cutaneous anesthesia to EMLA 5% topical cream to determine whether or not it is possible to improve cutaneous numbing by increasing the anesthetic effect and shorting the application time using the jet-phoresis concept.
Results: Twenty patients that were scheduled to undergo needling roller for upper lip rhytids enrolled into the study. Each patient served as his own control, so all in all, forty upper-lips were studied. Half of the upper lip was coated with 5% EMLA cream for 45 minutes and dressed with nylon sheet to achieve maximal anesthetic effect. The contra-lateral portion of the lip was treated with lidocaine 3% jet-phoresis for 5 minutes. Pain in the upper lip was elicited with needling roller uniformly applied to the whole of the upper lip. Pain response was measured using standardized pain ruler.
Conclusion: There was statistically significant advantage of pain control in the lidocaine jet-phoresis group compared to the EMLA group ($p < 0.005$). Jet-phoresis lidocaine pain control was better or comparable to EMLA cream, in more than 82% of lips (In 14 lips better, in 19 lips comparable, and in 7 lips less). This was further confirmed reversing the sides of the tested lips in the same subjects. We noticed marked improvement in anesthetic effect using higher 3% licodaine concentration. This study confirmed that: 1) Jet-phoresis facilitates cutaneous pre-operative anesthesia in a very short 5 min. application, in contrast to common practiced non-invasive time consuming methods, and 2) Jet-phoresis concept is painless, soothing experience, and easily applicable in an out-patient office setting.

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Abstract	Author	Fin. Grant	Equip	Consult. Fees	Disc.	Travel Exp.	Salary	Stock-holder	Res. Grant	Royalties	Honoraria	Equity Position	Intellectual Property Rights	Other	Clinical Pres.	Non-FDA Approved or Off Label Use
Basic Science/Optical Diagnostics																
1	Ash, Caerwyn		X			X	X									
	Bjerring, Peter															
	Lanigan, Sean															
	Clement, Marc			X												
	Town, Godfrey			X												
2	Bui, Albert															
	Choi, Bernard															
	Teves, Kathleen															
3	Jia, Wangcun								X							
	Sun, Victor															
	Choi, Bernard															
	Phung, Thuy															
	Liu, Tom						X									
	Mihm, Martin															
	Nelson, J. Stuart		X						X							
4	Milanic, Matija															
	Jia, Wangcun															
	Nelson, J. Stuart															
	Majaron, Boris															
5	Haedersdal, Merete															
6	Sliney, David			X		X										
	Smirnov, Michail						X									
	Wilson, Stewart						X									
	Laznicka, Oldrich															
	Bradley, Oksana						X									
	Jacked, Stephanie						X									
	Wang, Guangming						X									
	Altshuler, Gregory						X									
	Zenzie, Henry															
	Yaroslavsky, Ilya						X									
7	Ash, Caerwyn					X	X					X				
	Donne, Kelvin															
	Daniel, Gwenaelle															
	Town, Godfrey			X		X										
	Clement, Marc			X								X				
8	Jung, Bongsu															
	Lomeli, Eulises															
	Gupta, Sharad															
	Anvari, Bahman															
9	Pattani, Varun P.														X	X
	Campbell, Matt														X	X
	Tunnell, James W.														X	X
10	Abliz, Erkinay														X	X
	Tata, Darrell														X	X
	Waynant, Ronald														X	X
	Collins, Joshua														X	X

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	Friedberg, Joseph														X	X
	Kumar, Ajith														X	X
	Bell, Howard														X	X
11	Altshuler, Gregory															
	Yaroslavsky, Ilya															
	Tabatadze, David															
	Belikov, Andrey															
	Dierickx, Christine															
	Genina, Elina															
	Dolotov, Leonid															
	Bashkatov, Alexey															
	Tuchin, Valery															
12	Viator, John															
	Gupta, Sagar															
	Bhattacharyya, Kiran															
	Bell, Brooke															
13	Winkley, Amy															
	Antonelli, Maria Rosaria															
	Jacques, Steven															
	Barton, Jennifer															
14	Zaman, Raiyan															
	Gopal, Ashwini															
	Zhang, Xiaojing															
	Welch, Ashley															
	Rylander, Henry															
15	Kachur, Xenia															
	Leung, Sarah															
	Behunin, Samantha															
	Bobnick, Michael															
	Romanowski, Marek															
16	Huang, Liyi														X	X
	Timur, Zhiyentayev														X	X
	Dulat, Azhibek														X	X
	Yi, Xuan														X	X
	Hamblin, Michael														X	X
17	Li, Chao															
	Zhao, Jie															
	Anderson, R. Rox															
	Lin, Jennifer															
18	Tierney, Emily		X												X	X
	Hanke, C. William		X												X	X
19	Valentine, Ronan														X	X
	Ibbotson, Sally														X	X
	Brown, Tom														X	X
	Wood, Kenny														X	X
	Moseley, Harry														X	X
20	Bahmani, Baharak															

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	Jung, Bongsu															
	Gupta, Sharad															
	Anvari, Bahman															
22	Rosenberg, Avner						X								X	X
	Adanny, Yossi						X								X	X
	Toft, Ulrich						X								X	X
	Vaynberg, Boris						X								X	X
	Amir, Ruthie						X								X	X
23	Lemberg, Vladimir						X									
	Verdaasdonk, Rudolf			X												
	Jadczak, Chris			X												
	Choye, Ray						X									
24	Franco, Walfre						X									
	Kothare, Amogh						X									
	Goldberg, David															
25	Franco, Walfre						X								X	X
	Kothare, Amogh						X								X	X
	Ronan, Stephen J.														X	X
	Grekin, Roy C.			X											X	X
	McCalmont, Timothy H.			X											X	X
26	Izquierdo-Roman, Alondra															
	Rylander, Christopher															
27	Jagdeo, Jared															
	Adams, Lauren															
	Bernstein, David															
	Stewart, Michael						X									
	Intintoli, Alfred						X									
	Brody, Neil															
	Siegel, Daniel													X		
28	Kosoglu, Mehmet															
	Chen, Ye															
	Rylander, Christopher															
29	Lin, Jui-teng															
	Hong, Yu-Ling															
30	Knez, Mitja															
	Milanic, Matija															
	Majaron, Boris															
31	Mordon, Serge															
	Leclere, Franck															
	Auger, Florent															
	Buys, Bruno															
32	Durkin, Anthony														X	X
	Kelly, Kristen														X	X
	Sry, Kelly														X	X
	Kondru, Clement														X	X
	Yafi, Amr														X	X
	Saager, Rolf														X	X

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34	Makowski, Alexander															
	Davidson, Jeffrey						X		X							
	Mahadevan-Jansen, Anita						X									
	Jansen, E. Duco						X		X	X						
35	Masters, Daniel															
	Walsh, Alex															
	Welch, Ashley															
	Mahadevan-Jansen, Anita															
36	Paithankar, Dilip						X						X			
	Kolb, Juergen								X				X			
	Scully, Noah								X				X			
	Schoenbach, Karl								X	X			X			
37	Purschke, Martin															
	Anderson, R. Rox															
	Manstein, Dieter															
38	Qiu, Jinze															
	Neev, Joseph															
	Wang, Tianyi															
	Gamez, David															
	Milner, Thomas															
39	Rajaram, Narasimhan														X	X
	Nichols, Brandon														X	X
	Reichenberg, Jason														X	X
	Tunnell, James														X	X
	Migden, Michael														X	X
40	Santos, Moises															
	Zezell, Denise															
	Zorn, Telma															
	Zanardi, Anderson															
	Lacerda, Davi															
	Vieira, Nilson															
	Samad, Ricardo															
41	Walsh, Alex															
	Masters, Daniel															
	Welch, Ashley															
	Mahadevan-Jansen, Anita															
42	Adanny, Yossi						X									
	Rosenberg, Avner						X									
	Dubitsky, Dima						X									
	Vaynberg, Boris						X									
	Amir, Ruthie						X									
43	Elkhalil, Hossam	X	X												X	X
	Akkin, Taner														X	X
	Bischof, John	X	X												X	X
44	Phung, Thuy														X	X
	Rojano, Rafael														X	X
	Hsieh, Phyllis														X	X

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	Mihm, Martin														X	X
	Nelson, Stuart														X	X
	Benjamin, Laura														X	X
45	Weiss, Robert		X						X		X				X	X
46	Castro, Jose															
	Luo, Yuan															
	Harwell, Jennifer															
	De Leon, Erich															
	Kostuk, Raymond															
47	Elmaanaoui, Badr								X							
	Dwelle, Jordon								X							
	McElroy, Austin															
	Paranjape, Amit								X							
	Liu, Shuang								X							
	Rylander, Henry								X							
	Milner, Thomas								X							
49	Joseph, Cecil															
	Yaroslavsky, Anna															
	Goyette, Thomas															
	Giles, Robert															
	Nixon, William															
50	Patil, Chetan														X	X
	Krishnamoorthi, Harish														X	X
	Mackanos, Mark														X	X
	van Leeuwen, Ton														X	X
	Ellis, Darrel														X	X
	Mahadevan-Jansen, Anita														X	X
51	Weiss, Elliot															
	Barzilai, Ori															
	Brightman, Lori															
	Desai, Sheel															
	Chapas, Anne															
	Hale, Elizabeth															
	Karen, Julie															
	Bernstein, Leonard															
	Geronemus, Roy															
52	Wilmink, Gerald															
	Rivest, Benjamin															
	Ibey, Bennett															
	Roach, William															
53	Wilmink, Gerald															
	Ibey, Bennett															
	Thomas, Tongue															
	Shulkin, Brian															
	Peralta, Xomalin															
	Rivest, Benjamin															
	Roach, William															

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54	Sheth, Samir															
	Curry, William															
	Farell, Christopher															
	Barker, Fred															
	Yaroslavsky, Anna															
55	Yaroslavsky, Anna															
	Mroz, Pawel															
	Park, Jesung															
	Hamblin, Michael															
56	Wang, Tianyi															
	Qiu, Jinze															
	Paranjape, Amit															
	Ma, Li															
	Li, Xiankai															
	Ryoo, Seungyup															
	Johnston, Keith															
	Feldman, Marc															
	Milner, Thomas															
Cutaneous Laser Surgery																
58	Desai, Sheetal														X	
	Brightman, Lori														X	
	Weiss, Elliot														X	
	Karen, Julie														X	
	Chapas, Anne														X	
	Hale, Elizabeth														X	
	Bernstein, Leonard														X	
	Geronemus, Roy														X	
59	Morrison, Andrea														X	
	Gold, Michael				X				X		X				X	
	Khatri, Khalil		X	X		X						X			X	
	Weiss, Robert		X	X											X	
	Hails, Kelley		X												X	
	Fournier, Nathalie		X	X											X	
60	Brightman, Lori														X	X
	Desai, Sheetal														X	X
	Weiss, Elliot														X	X
	Karen, Julie														X	X
	Chapas, Anne														X	X
	Hale, Elizabeth														X	X
	Bernstein, Leonard														X	X
	Geronemus, Roy														X	X
61	Zachary, Christopher		X						X						X	X
	John, Allison														X	X
	Saedi, Nazanin														X	X
62	Shek, Samantha Y.														X	
	Yeung, C.K.														X	
	Ho, Stephanie G.Y.														X	

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	Chan, Nicola P.Y.														X	
	Chan, Henry H.L.														X	
63	Burns, A. Jay		X	X	X	X			X						X	X
	Allison, John														X	X
	Bachelor, Eric		X						X						X	X
	Dover, Jeffrey		X	X	X	X			X		X				X	X
	Coleman, Sydney		X	X	X	X			X						X	X
	Fitzpatrick, Richard		X	X	X				X						X	X
	Garden, Jerome		X		X				X						X	X
	Geronemus, Roy		X	X	X	X		X	X		X				X	X
	Goldberg, David		X		X				X						X	X
	Kilmer, Suzanne		X	X	X	X		X	X						X	X
	Kramer, Scott		X						X						X	X
	Levinson, Mitchell														X	X
	Tanzi, Elizabeth		X	X	X	X		X	X		X				X	X
	Weiss, Robert		X		X				X						X	X
	Zelickson, Brian		X	X	X	X		X	X		X				X	X
	Mayoral, Flor		X		X				X						X	X
	Okamoto, Eric		X						X						X	X
	Riopelle, Jeffrey		X						X						X	X
64	Weiss, Robert								X						X	
65	Holcomb, J. David				X	X					X	X			X	
	Baek, S-J														X	
66	Wanner, Molly		X												X	X
	Avram, Mathew		X												X	X
	Mihm , Martin		X												X	X
	Farinelli, William		X												X	X
	Klein, Jeffrey		X					X							X	X
	Anderson, R. Rox		X												X	X
67	Hann, Seung-Kyung														X	
	Cho, Moo-Yon														X	
	Jin, Sang-Hyun														X	
	Lee, Guen-Soo														X	
68	Narurkar, Vic			X											X	X
	Struck, Steven			X											X	X
	Jiang, Kerrie						X					X			X	X
	England, Laura						X					X			X	X
	MacFalls, Heather						X					X			X	X
69	Ribe, Adriana														X	
	Ribe, Natalia														X	
70	Dierickx, Christine		X						X						X	
	Ross, Victor	X	X	X					X		X				X	
	Kauvar, Arielle		X												X	
	Doherty, Sean		X						X						X	
	Erofeev, Andrei						X								X	
	Tabatadze, David						X								X	
	Yaroslavsky, Ilya					X	X					X			X	

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	Altshuler, Gregory					X	X					X			X	
71	Liu, Yan						X								X	X
	van Hal, Robbert						X								X	X
	Verhagen, Rieko						X								X	X
	Habbema, Loek														X	X
72	Ciocon, David														X	
	Engelman, Dendy														X	
	Hussain, Mussarrat														X	
	Goldberg, David														X	
73	Bowen, Robert														X	
	Davis, Deborah														X	
	Kress, Donald														X	
	Bowen-Pasfield, Sarah														X	
	Lin, Michael														X	
	Grove, Phillip														X	
	Gordon, Rachel														X	
74	Kaufman, Joely		X								X				X	
	Baumann, Leslie		X	X					X		X			X	X	
	Grunebaum, Lisa		X						X		X				X	
	Murdock, Jennifer															
	Kaufman, Joely															
75	Kapoor, Rinky														X	
	Shome, Debraj														X	
	Jain, Vandana														X	
76	Narurkar, Vic														X	X
77	LaTowsky, Brenda														X	
	Abbasi, Naheed														X	
	Arndt, Kenneth														X	
	Dover, Jeffrey								X		X				X	
	Kaminer, Michael			X					X						X	
	Rohrer, Thomas			X					X		X				X	
	Wesley, Naissan														X	
	MacGregor, Jennifer														X	
78	Almeida, Guilherme				X										X	
	Almeida, Leicia														X	
	Marques, Elaine														X	
	Facci, Andreza														X	
	Notarageli, Thais														X	
	Paes, Marcia														X	
79	Ancona, Dvora														X	
	Antonioli, Chiara														X	
80	Haedersdal, Merete														X	X
	Katsnelson, Julia														X	X
	Sakamoto, Fernanda														X	X
	Farinelli, William														X	X
	Doukas, Apostolos														X	X
	Tam, Josh														X	X

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	Anderson, R. Rox														X	X
81	Katz, Bruce			X								X			X	
	Ancona, Dvora														X	
82	Kofford, Mark														X	
83	Almeida, Guilherme		X												X	
	Marques, Elaine														X	
	Almeida, Leticia														X	
	Facci, Andrezza														X	
	Paes, Marcia														X	
	Notarangeli, Thais														X	
84	Kositratna, Garuna														X	X
	Manstein, Dieter														X	X
85	Hædersdal, Merete														X	X
	Sakamoto, Fernanda H.														X	X
	Farinelli, William A.														X	X
	Doukas, Apostolos G.														X	X
	Tam, Josh														X	X
	Anderson, R. Rox														X	X
86	Tierney, Emily														X	
	Hanke, C. William														X	
87	Ross, E. Victor	X	X	X					X		X				X	
	Vasily, David			X					X						X	
	Doherty, Sean		X	X											X	
	Seckel, Brooke		X	X							X				X	
	Cerino, Mary														X	
88	Stumpp, Oliver														X	X
	Bedi, Vikramaditya														X	X
	Chan, Kin														X	X
	Saedi, Nazanin														X	X
	Zachary, Christopher		X						X						X	X
89	Willey, Andrea															
	McClaren, Marla															
	Wadhera, Akhil															
	Kilmer, Suzanne								X					X		
90	Sakamoto, Fernanda H.														X	X
	Doukas, Apostolos G.														X	X
	Farinelli, William A.														X	X
	Tannous, Zeina														X	X
	Anderson, R. Rox														X	X
	Purschke, Martin														X	X
91	Tannous, Zeina														X	X
	Anderson, Rox														X	X
	Avram, Mathew														X	X
92	Fitzpatrick, Richard			X				X							X	X
93	Barolet, Daniel		X												X	X
	Auclair, Mathieu						X								X	X
	Barolet, Francois						X								X	X

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	Barolet, Virginie C.						X								X	X
	Lussier, Isabelle			X											X	X
501	Rosales-Berger, Ivan A.														X	X
	Diliz-Perez, Elsa S.														X	X
	Allison, John														X	X
94	Anderson, R. Rox					X						X			X	
	Slayton, Michael											X			X	
	Miller, Randall						X					X			X	
	Call, Aaron						X								X	
95	Alam, Murad								X						X	
	Arndt, Kenneth								X						X	
	Dover, Jeffrey								X						X	
	Zelickson, Brian								X						X	
	Ross, E. Victor								X						X	
96	Chan, Nicola P.Y.														X	
	Shek, Samantha Y.														X	
	Ho, Stephanie G.Y.														X	
	Yeung, C.K.														X	
	Kono, T.														X	
	Chan, Henry H.L.														X	
97	Tanaka, Rica		X												X	
	Fukui, Tsuyoshi		X												X	
	Miyasaka, Muneo		X												X	
98	Chan, Henry							X							X	
	Groff, William										X				X	
	Kono, Taro				X	X					X				X	
	Sakurai, Hiroyuki														X	
99	Slayton, Michael											X			X	X
	Lyke, Stephanie														X	X
	Miller, Randall						X					X			X	X
100	Yeo, Un-Cheol														X	X
	Lee, Doo-Rak														X	X
	Lim, So-Dug														X	X
101	Alexiades-Armenakas, Macrene								X						X	
	Willey, Andrea								X						X	
	Kilmer, Suzanne								X						X	
	Goldberg, David														X	
	Garden, Jerome								X						X	
	Berman, David								X						X	
	Stridde, Braden								X						X	
	Hantash, Basil M.								X						X	
	Renton, Bradley		X												X	
	Newman, James								X						X	
102	Leyden, James		X	X		X									X	
	Stephens, Thomas		X	X											X	
103	Brandt, Fredric		X												X	X
	Cazzaniga, Alex														X	X

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	Spencer, James														X	X
	Vasily, David														X	X
	Cerino, Mary														X	X
	Seckel, Brooke														X	X
	Weiss, Robert														X	X
104	Sadick, Neil														X	
	Laver, Zahava														X	
	Laver, Lior														X	
105	Brightman, Lori															
	Desai, Sheetal															
	Weiss, Eliott															
	Karen, Julie															
	Chapas, Anne															
	Hale, Elizabeth															
	Bernstein, Leonard															
	Geronemus, Roy															
106	Town, Godfrey			X												
	Ash, Caerwyn															
107	Narurkar, Vic														X	X
	Hsu, Michael														X	X
	Stevenson, Fang														X	X
	Tatustani, Kristine														X	X
	Wetschler, William														X	X
108	Alam, Murad														X	X
	Rommel, Jennee														X	X
	Fife, Douglas														X	X
	Kim, Natalie														X	X
	Keyes, Ashley														X	X
	Yoo, Simon														X	X
	Khan, Misbah														X	X
	Rademaker, Alfred														X	X
109	Geronemus, Roy							X							X	X
	Weiss, Elliot														X	X
	Chapas, Anne			X											X	X
	Desai, Sheel														X	X
	Brightman, Lori														X	X
	Hale, Elizabeth														X	X
	Karen, Julie														X	X
	Bernstein, Leonard														X	X
110	Tierney, Emily P.														X	X
	Hanke, C. William														X	X
	Reddy, Kavitha K.														X	X
111	Konnikov, Nellie														X	X
	Jarell, Abel														X	X
	Tannous, Zeina														X	X
112	Izikson, Leonid		X												X	
	Farinelli, William		X												X	

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	Tannous, Zeina														X	
	Sakamoto, Fernanda														X	
	Anderson, R. Rox		X												X	
113	Weiss, Elliot														X	X
	Geronemus, Roy							X							X	X
114	Saladi, Rao														X	
	Fox, Joshua														X	
	Fisse, Caroline														X	
115	Brown , Alia														X	
	Jow, Tiffany														X	
	Hussain, Mussarrat														X	
	Goldberg, David														X	
116	Mazer, Jean-Michel														X	
	Fayard, Virginie														X	
	Arigon, Valérie														X	
117	Kamel, Messaoud Nacer														X	X
118	Ross, E. Victor														X	
	Smirnov, Mikhail														X	
	Yaroslavsky, Ilya														X	
	Altshuler, Gregory														X	
119	van Drooge, Anne Margreet														X	
	Wolkerstorfer, Albert														X	
	van der Veen, Wietze														X	
	Nieuweboer-Krobotová, Ludmila														X	
	Bos, Jan														X	
	Beek, Johan														X	
121	Zhou, Guoyu														X	
	Shen, Linyue														X	
	Li, Pinpin														X	
	Xu, Qing														X	
208	Ibrahimi, Omar															
	Tannous, Zeina														X	X
	Sakamoto, Fernanda														X	X
	Anderson, R. Rox														X	X
122	Letada, Philip		X			X									X	
	Shumaker, Peter		X												X	
	Uebelhoer, Nathan		X												X	
	Landers, John		X												X	
123	Landau, Jennifer														X	X
	Vergilis, Irene														X	X
	Goldberg, Leonard														X	X

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	Marquez, Denise														X	X
	Kimyai-Asadi, Arash														X	X
	Friedman, Paul														X	X
124	Braun, Martin		X						X						X	
125	Halachmi, Shlomit														X	
	Lapidoth, Moshe		X												X	
126	Bakus, Abnoeal D.								X						X	
	Garden, Jerome M.		X												X	
	Yaghmai, Dina								X						X	
	Massa, Mary														X	
127	Wasserman, Daniel	X	X												X	X
	Lin, Jennifer		X												X	X
	Avram, Mathew M.		X												X	X
	Anderson, R. Rox		X												X	X
128	Chan, Nicola P.Y.														X	
	Ho, Stephanie G.Y.														X	
	Yeung, C.K.														X	
	Shek, Samantha Y.														X	
	Kono, T.														X	
	Chan, Henry H.L.														X	
129	Park, EunSoo														X	X
	Moon, YooJin														X	X
	Kim, YongBae														X	X
130	Chan, Henry							X							X	
	Groff, William										X				X	
	Kono, Taro				X	X					X				X	
	Sakurai, Hiroyuki														X	
131	Sakamoto, Fernanda H.														X	X
	Anderson, R. Rox														X	X
	Tannous, Zeina														X	X
	Izikson, Leonid														X	X
132	Chern, Peggy		X												X	X
	Domankevitz, Yacov						X								X	X
	Ross, E. Victor	X	X						X		X				X	X
133	Wind, Bas														X	
	Kroon, Marije														X	
	Meesters, Arne														X	
	Wolkerstorfer, Albert														X	
	Van der Veen, Wietze														X	
	Nieuweboer-Krobotová, Ludmila														X	
	Bos, Jan														X	
	Beek, Johan														X	
134	Bernstein, Eric		X												X	
	Bhawalkar, Jay														X	
	Clifford, Joan														X	
	Hsia, James														X	
135	Chan, Nicola P.Y.														X	

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	Ho , Stephanie G.Y.														X	
	Yeung, C.K.														X	
	Shek, Samantha Y.														X	
	Chan, Henry H.L.														X	
136	Ho, Stephanie G.Y.														X	
	Chan, Henry H.L.														X	
	Chan, Nicola P.Y.														X	
	Yeung, C.K.														X	
	Shek, Samantha Y.														X	
	Kono, Taro														X	
138	Le Duff, Florence								X						X	
	Fontas, Eric														X	
	Giacchero, Damien														X	
	Sillard, Laura														X	
	Lacour, Jean-Philippe														X	
	Ortonne, Jean-Paul														X	
	Passeron, Thierry														X	
139	Wind, Bas														X	
	Kroon, Marije														X	
	Meesters, Arne														X	
	Beek, Johan														X	
	van der Veen, Wietze														X	
	Nieuweboer-Krobotova, Ludmila														X	
	Bos, Jan														X	
	Wolkerstorfer, Albert														X	
Dentistry/Oral and Maxillofacial																
140	Nammour, S.														X	X
141	Heysselaer, D.														X	X
	Tielemans, M.														X	X
	Nammour, S.														X	X
142	Zanardi, Freitas Anderson															
	Raele, Marcus Paulo															
	Colodette, Hindra															
	Sanglard, Luciana															
143	Todea, Carmen														X	X
	Balabuc, Cosmin														X	X
	Semez, Gianfranco														X	X
	Locovei, Cosmin														X	X
	Raduta, Aurel														X	X
	Filip, Laura														X	X
	Sinescu , Cosmin														X	X
	Bradu, Adrian														X	X
	Podoleanu, Adrian														X	X
144	Zezell, Denise Maria								X						X	X
	Ana, Patricia Aparecida								X						X	X

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	Benetti, Carolina														X	X
	Quinto Jr., Jose														X	X
	Pereira, Thiago Martini														X	X
	Goulart, Viviane														X	X
145	Rocca, Jean Paul														X	X
146	Miller, Janine														X	
	Hanneman, Kaija														X	
	Baron, Elma														X	
147	Kornblit, Roly														X	X
	Romeo, Umberto														X	X
	Del Vecchio, Alessandro														X	X
	Nammour, Sam														X	X
	Polimeni, Antonella														X	X
148	Tielemans, M.														X	X
	Heysselaer, D.														X	X
	Nammour, S.														X	X
149	Holtzman, Jennifer														X	X
	Pharar , Jessica														X	X
	Lee, Kenneth														X	X
	Ahn, Yeh-chan														X	X
	Tucker, Travis														X	X
	Sabet , Sharareh														X	X
	Chen, Zhongping														X	X
	Osann, Kathryn														X	X
	Wilder-Smith , Petra														X	X
	Gukasyan , Ripsik														X	X
150	Wilder-Smith, Petra														X	X
	Na, Jihoon														X	X
	Lee, ByeongHa														X	X
	Baek, Jae														X	X
151	Romeo, Umberto														X	X
	Del Vecchio, Alessandro														X	X
	Kornblit, Roly														X	X
	Palaia, Gaspare														X	X
	Tenore, Gianluca														X	X
	Namour, Samir														X	X
	De Luca, Massimo														X	X
	Polimeni, Antonella														X	X
152	Stoianovici, Charles														X	X
	Wilder-Smith, Petra														X	X
	Choi, Bernard														X	X
	Youssef, Joseph														X	X
153	Mang, Thomas														X	X
	Mikulski, Lynn														X	X
	Mang, Scott														X	X
	Thorsrud, Kyle														X	X

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154	Sun, Yang														X	X
	Sun, Yinghua														X	X
	Xie, Hongtao														X	X
	Elson, Daniel														X	X
	Lam, Matthew														X	X
	Farwell, Gregory														X	X
	Cannata, Jonathan														X	X
	Shung, Kirk														X	X
	Marcu, Laura														X	X
502	Ranken, Der.ek-Dunn														X	X
	Sung, ERIC														X	X
	Çhuch, Pęter														X	X
	Rizoiu, X(Salary), IoAnA														X	X
155	Le, Anh															
	Messadi, Diana														X	X
	Epstein, Joel														X	X
	Wilder-Smith, Petra														X	X
502	Rankin,Derck Dunn															
	Sung, ERic															
	Chuch,Peter															
	Rizoiu,Ioana						X									
Nursing/Allied Health																
156	Ball, Kay	X														
157	Freedman, Bruce														X	
	OHara, Elizabeth														X	
158	Moynihan, Kevin														X	X
159	Muhlenforth, Tracy														X	
	Galletta, Karyn														X	
	Roth, Annie														X	
	Ethier, Rachel														X	
	Olin, Wendy														X	
	Martorano, Danielle														X	
	Weiss, Elliot														X	
	Geronemus, Roy														X	
160	Muhlenforth, Tracy														X	
	Galletta, Karyn														X	
	Roth, Annie														X	
	Ethier, Rachel														X	
	Olin, Wendy														X	
	Martorano, Danielle														X	
	Weiss, Elliot														X	
	Geronemus, Roy														X	
Photobiomodulation																
161	Tuby, Hanna														X	X
	Maltz, Lidya														X	X
	Sorin, Vladimir														X	X
	Czerniak, Abraham								X						X	X
	Sheffer, Gabi														X	X
	Oron, Uri								X						X	X
162	Chen, Aaron														X	X
	Doukas, Apostolos														X	X
	Hamblin, Michael														X	X
163	McDaniel, D.H.		X	X	X			X	X			X	X		X	X
	Mazur, C.														X	X
	Wilson, S.														X	X

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	Geronemus, R.G.		X		X			X				X			X	X
	Weiss, R.A.		X		X			X				X			X	X
	Weiss, M.		X		X			X				X			X	X
164	McDaniel, D.H.		X	X	X			X	X			X	X		X	X
	Mazur, C.														X	X
	Wilson, S.														X	X
	Geronemus, R.G.		X		X			X				X			X	X
	Weiss, R.A.		X		X			X				X			X	X
	Weiss, M.		X		X			X				X			X	X
165	Wu, Xingjia														X	X
	Alberico, Stephanie						X								X	X
	Erbele, Isaac					X									X	X
	Moges, Helina														X	X
	Pryor, Brian							X					X		X	X
	Anders, Juanita		X												X	X
166	Johns, Lennart		X												X	X
	Zhang, Xiaozhu														X	X
	Davison, Elizabeth														X	X
	Pasay, Jered														X	X
	Straub, Stephen														X	X
169	Lanzafame, Raymond		X	X		X			X		X		X		X	X
	Stadler, Istvan		X						X						X	X
	Cunningham, Ryan														X	X
	Kasaraneni, Jennifer														X	X
	Khan, Fred														X	X
	Soltz, Barbara						X		X			X	X		X	X
	Soltz, Robert						X		X						X	X
170	Lipovsky, Anat														X	X
	Tzitrinovich, Zeev														X	X
	Nitzan, Yeshayahu														X	X
	Gedanken, Aharon														X	X
	Lubart, Rachel														X	X
	Applerot, Guy														X	X
171	Liu, Timon Cheng-Yi														X	X
	Wu, Min														X	X
	Qu, Xue-Mei														X	X
	Liu, Song-Hao														X	X
	Li, Cheng-Zhang														X	X
172	McDaniel, D.H.		X	X	X			X	X			X	X		X	X
	Mazur, C.														X	X
	Wilson, S.														X	X
	Geronemus, R.G.		X		X			X				X			X	X
	Weiss, R.A.		X		X			X				X			X	X
	Weiss, M.		X		X			X				X			X	X
173	Wu, De-Feng														X	X
	Wang, Yong-Qing														X	X
	Zhu, Ling														X	X

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	Liu, Timon Cheng-Yi														X	X
	Liu, Song-Hao														X	X
174	Zhu, Ling														X	X
	Li, Xiao-Yun														X	X
	Liu, Timon Cheng-Yi														X	X
	Liu, Song-Hao														X	X
175	Wu, QiuHe														X	X
	Huang, Ying-Ying														X	X
	Chen, Aaron C-H														X	X
	Hamblin, Michael R.		X	X					X			X			X	X
176	Whelan, Harry														X	X
	Henry, Michele														X	X
	Maroney, Colleen														X	X
	Buchmann, Ellen														X	X
177	Raymond, Lanzafame		X	X		X			X				X		X	X
	Stadler, Istvan								X						X	X
	Cunningham, Ryan														X	X
	Kasaraneni, Jennifer														X	X
	Khan, Fred														X	X
	Soltz, Barbara						X		X				X		X	X
	Soltz, Robert						X		X				X		X	X
178	Moges, Helina														X	X
	Wu, Xingjia														X	X
	McCoy, Jennifer														X	X
	Anders, Juanita														X	X
179	Wu, Xingjia														X	X
	Moges, Helina						X								X	X
	Tarney, Christopher														X	X
	DeTaboada, Luis							X							X	X
	Streeter, Jackson							X							X	X
	Anders, Juanita		X						X	X			X		X	X
180	McDaniel, D.H.		X	X	X			X	X			X	X		X	X
	Mazur, C.														X	X
	Wilson, S.														X	X
	Geronemus, R.G.		X		X			X				X			X	X
	Weiss, R.A.		X		X			X				X			X	X
	Weiss, M.		X		X			X				X			X	X
181	Prabhu, Vijendra														X	X
	Rao, Bola Sadashiva Satish														X	X
	Rao, Nageshwar														X	X
	Aithal, Kiran														X	X
	Mahato, Krishna Kishore														X	X
	Kumar, Pramod														X	X
182	Lin, Jui-teng														X	X
	Hong, Yu-Ling														X	X
	Lu, Pen-Li														X	X
	Yen, Chen-Tung														X	X

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	Jaw, Fu-Shan														X	X
183	Bjerring, Peter								X						X	X
	Christiansen, Kaare								X						X	X
185	Maloney, Ryan			X									X		X	X
	Shanks, Steven							X					X		X	X
	Maloney, Jillian														X	X
186	Daia, Hadi														X	
	Crow, Heidi														X	
	Mang, Thomas														X	
187	Gupta, Aditya														X	X
	Pollak, Richard														X	X
	Goffe, Bernard														X	X
	Lanzafame, Raymond														X	X
	Harris, David														X	X
188	Podichetty, Vinod			X											X	X
	Bourassa, Daniel														X	X
189	Maloney, Ryan			X									X		X	X
	Shanks, Steven						X	X					X		X	X
	Maloney, Jillian														X	X
	Zimmerman, Edward														X	X
191	Maloney, Ryan			X									X		X	X
	Shanks, Steven							X					X		X	X
	Maloney, Jillian														X	X
	Zimmerman, Edward														X	X
Surgical Applications																
192	Becker, Brian														X	X
	MacLachlan, Robert														X	X
	Lobes, Louis														X	X
	Riviere, Cameron														X	X
193	Peyman, Gholam														X	X
	Tsiprusky, Michael														X	X
	Gohel, Parin														X	X
	Conway, Mandi														X	X
194	Gotkin, Robert				X									X	X	
	Goldman, Alberto					X									X	
195	Millard, John		X												X	
196	Sadick, Neil															
	Rochon, Phillippe															
	Mordon, Serge															
197	Chen, Bo					X	X									
	DiBernardo, Barry				X				X							
	Reyes, Jennifer								X							
	Mirkov, Mirko					X	X									
	Sierra, Ray					X	X									
198	Burns, A. Jay															
	Burns, John															
	Doherty, Sean						X									

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	Seckel, Brooke		X	X		X			X							
	Childs, James					X	X									
	Tabatadze, David						X									
	Erofeev, Andrei						X									
	Altshuler, Gregory					X	X									
199	Swierzewski, Stanley														X	X
	Subocz, Kelly-Ivy														X	X
	Swierzewski, Leeza														X	X
200	Nevoux, Pierre														X	X
	Colin, Pierre														X	X
	Leroux, Bertrand														X	X
	Puech, Philippe														X	X
	Villers, Arnauld														X	X
	Mordon, Serge														X	X
	Betrouni, Nacim														X	X
201	Colin, Pierre								X						X	X
	Betrouni, Nacim														X	X
	Labourre, Marie														X	X
	Jallageas, Antoine														X	X
	Auger, Florent														X	X
	Villers, Arnauld														X	X
	Puech, Philippe														X	X
	Mordon, Serge														X	X
202	Kaushik, Dharam														X	X
	Tepley, Benjamin														X	X
	Stepan, Caleb														X	X
	Hemstreet, George														X	X
203	Perkash, Inder														X	X
204	Gu, Xiao														X	
	Strom, Kurt														X	
	Spaliviero, Massimiliano														X	
	Wong, Carson			X											X	
205	Strom, Kurt H														X	
	Xiao, Gu														X	
	Spaliviero, Massimiliano														X	
	Wong, Carson			X											X	
206	Strom, Kurt														X	
	Xiao, Gu														X	
	Spaliviero, Massimiliano														X	
	Wong, Carson			X											X	
207	Strom , Kurt H														X	
	Gu, Xiao														X	
	Spaliviero, Massimiliano														X	
	Wong, Carson			X											X	
208	Ben-Yakar, Adela		X												X	X
	Hoy, Christopher														X	X
	Everett, W. Neil														X	X

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	Kobler, James														X	X
209	Mordon, Serge														X	X
	Petropoulos, Loannis														X	X
	Buys, Bruno														X	X
210	Bublik, Michael														X	X
	Udewitz, Matthew														X	X
	Sercarz, Joel														X	X
211	Zahoor, Tosief														X	
	Carr, Simon														X	
	Makura, Zvoru														X	
213	Mordon, Serge														X	X
	Leclère, Franck														X	X
	Buys, Bruno														X	X
	Schoofs, Michel														X	X
214	Nguyen, John															
	Ferdman, Jillian															
	Zhou, Minguri															
	Huland, David															
	Saqqa, Shatha															
	Ma, Jan															
	Nishimura, Nozomi															
	Schwartz, Theodore															
	Schaffer, Chris															
215	Gainer, Christian														X	X
	De Silva, Channa														X	X
	Romanowski, Marek														X	X
216	Dowlat, Kambiz		X	X								X	X			
Plenary																
N/A	Anderson, R. Rox									X				X	X	X
N/A	Townes, Charles														X	X
N/A	Ross, E. Victor	X	X						X		X				X	X
N/A	Chan, Henry		X					X	X						X	X
N/A	Biesman, Brian			X					X						X	X
N/A	Lennox, Krystie															
ePosters																
601	Halmi, Bill			X											X	X
	Slayton, Michael											X			X	X
	Lyke, Stephanie						X								X	X
	Makin, Inder											X			X	X
	Link, Denise	X													X	X
	Anderson, R. Rox											X			X	X
602	Lee, Seung Yoon Celine														X	X
618	Wall, R. Andrew														X	X
	Bonnema, Garret T.														X	X
	Barton, Jennifer K.														X	X
619	Berube, Dany														X	X
	McGill, Scott														X	X

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	Hantash, Basil			X								X			X	X
620	Oberto, Gilles														X	X
	Guerif-Ferreira, Yolene														X	X
	Cucumel, Karine														X	X
	Fouque-Parachini, Linda														X	X
	Dal Farra, Claude														X	X
	Domloge, Nouha														X	X
623	Sabet, Sharareh														X	X
	Lee, Kenneth														X	X
	Saggese, Steve														X	X
	Wilder-Smith, Petra														X	X
629	Sundaram, Hema		X												X	
	Elbashir, Rania														X	
630	Brightman, Lori														X	
	Desai, Sheetal														X	
	Weiss, Elliot														X	
	Karen, Julie														X	
	Chapas, Anne														X	
	Hale, Elizabeth														X	
	Bernstein, Leonard														X	
	Geronemus, Roy														X	
631	Brightman, Lori														X	
	Desai, Sheetal														X	
	Weiss, Elliot														X	
	Karen, Julie														X	
	Chapas, Anne														X	
	Hale, Elizabeth														X	
	Bernstein, Leonard														X	
	Geronemus, Roy														X	
632	Adatto, Maurice				X										X	
	Grietje , Morren														X	
633	Nunes, Rafael														X	
	Nunes, Daniela														X	
	Di Nubila, Gustavo														X	
	Silva, Leticia														X	
	Nunes, Guilherme														X	
634	Nunes, Rafael														X	X
	Nunes, Daniela														X	X
	Camara, Luciana														X	X
	Silva, Leticia														X	X
	Nunes, Guilherme														X	X
635	Holcomb, J. David				X	X					X	X			X	X
	Ko, Kwangchon														X	X
636	Epstein, Haim						X								X	X
	Nachlieli, Tal			X											X	X
	Magid, Avi						X								X	X
	Vaynberg, Boris						X								X	X

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	Palanker, Daniel			X											X	X
	Amir, Ruthie						X								X	X
637	Angel, Sylvie														X	
647	Bailey, Steven														X	
	Abtahi, Fatemeh														X	
	Richardson, James														X	
	Hoopman, John														X	
	Barton, Fritz														X	
	Brown, Spencer								X						X	
	Kenkel, Jeffrey								X						X	
648	Bailey, Steven														X	
	Abtahi, Fatemeh														X	
	Richardson, James														X	
	Hoopman, John														X	
	Barton, Fritz														X	
	Brown, Spencer														X	
	Kenkel, Jeffrey														X	
649	Ciscar, Eva														X	
	Buendia, Gabriel														X	
	Pons, Marta														X	
	Caicedo, Patricia														X	
650	Bayer, Hans		X										X		X	X
	Manstein, Dieter		X												X	X
	Metze, Dieter														X	X
	Luger, Thomas Anton														X	X
	Laubach, Hans Joachim		X										X		X	X
651	Pozner, Jason		X		X						X				X	
	Simonelic, Kevin														X	
	Lennox, Krystie														X	
	Goldberg, David		X												X	
652	Lemberg, Vladimir						X								X	X
653	Tierney, Emily														X	
	Petersen, Jeffrey														X	
	Hanke, C. William														X	
654	Bailey, Steven														X	
	Abtahi, Fatemeh														X	
	Richardson, James														X	
	Hoopman, John														X	
	Brown, Spencer														X	
	Barton, Fritz														X	
	Kenkel, Jeffrey														X	
655	Laughlin, Sharyn														X	
	Kim, Sunny														X	
	Dudley, Denis														X	
656	Nunes, Rafael														X	
	Nunes, Daniela														X	
	Camara, Luciana														X	

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	Silva, Leticia														X	
	Nunes, Guilherme														X	
657	Van Dyke, Susan		X												X	
	Anderson, Heather														X	
	Hays, Geoffrey														X	
658	Alexiades-Armenakas, Macrene								X							
659	Cobos, Renee					X					X				X	
661	Zelickson, Brian	X	X													
	Walgrave, Susan															
	Wallander, Irmina															
	Elm, Courtney															
665	Bailey, Steven														X	X
	Abtahi, Fatemeh														X	X
	Richardson, James														X	X
	Hoopman, John														X	X
	Richards, Britt														X	X
	Barton, Fritz														X	X
	Brown, Spencer														X	X
	Kenkel, Jeffrey														X	X
666	Kipervas, Yelena														X	
	Martinho, Tatyana														X	
667	Fujimoto, Takahiro														X	
668	Bailey, Steven														X	X
	Abtahi, Fatemeh														X	X
	Richardson, James														X	X
	Hoopman, John														X	X
	Richards, Britt														X	X
	Barton, Fritz														X	X
	Brown, Spencer														X	X
	Kenkel, Jeffrey														X	X
669	Bagheri, Sepideh														X	X
	Campbell, Tracy														X	X
	Eisen, Daniel														X	X
670	Garcia, Miki														X	X
	Campbell, Tracy														X	X
	Eisen, Daniel														X	X
671	Nunes, Rafael														X	
	Nunes, Daniela														X	
	Yume, Tatiana														X	
	Conceicao, Katleen														X	
	Nunes, Guilherme														X	
672	Negishi, Kei														X	
	Akita, Hirotaka														X	
	Tanaka, Shiho														X	
	Ichikawa, Satoko														X	
	Matsunaga, Kayoko														X	
	Wakamatsu, Shingo														X	

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673	Kim, Bangsoon														X	
674	Kroon, Marije														X	X
	Wind, Bas														X	X
	Meesters, Arne														X	X
	Wolkerstorfer, Albert														X	X
	van der Veen, Wietze														X	X
	Nieuweboer-Krobotova, Ludmila														X	X
	Bos, Jan														X	X
	Beek, Johan														X	X
675	Duplechain, Kevin			X											X	
676	Thierry, Fusade														X	
	Lafaye, Severine														X	
	Laubach, Hans-Joachim														X	
677	Meesters, Arne														X	X
	Wind, Bas														X	X
	Kroon, Marije														X	X
	Beek, Johan														X	X
	van der Veen, Wietze														X	X
	Nieuweboer-Krobotova, Ludmila														X	X
	Bos, Jan														X	X
	Wolkerstorfer, Albert														X	X
678	Passeron, Thierry														X	
	Fontas, Eric														X	
	Kang, Hee Yang														X	
	Bahadoran, Philippe														X	
	Lacour, Jean-Philippe														X	
	Ortonne, Jean-Paul			X											X	
679	Kim, Hyun-Joo														X	
	Suh, Dong-Hye														X	
	Ryou, Ji-Ho														X	
	Park, Jee-Young														X	
680	Negishi, Kei														X	
	Tanaka, Shiho														X	
	Yokoyama, Yusuke														X	
	Akita, Hirotaka														X	
	Matsunaga, Kayoko														X	
	Wakamatsu, Shingo														X	
694	Bailey, Steven														X	
	Kashefi, Natalie														X	
	Maxted, Micheal														X	
	Stewart, Collin														X	
	Cheriyan, Salim														X	
	Maluso, Patrick														X	
	Jones, Caroline														X	
	Abtahi, Fatemeh														X	
	Brown, Spencer														X	
	Kenkel, Jeffrey														X	

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695	Luttmann, Amber														X	X
	Hariri, Lida														X	X
	Rice, Photini Faith														X	X
	Winkler, Amy														X	X
	Bracamontec, Erika														X	X
	Sokoloff, Mitchell														X	X
	Nguyen, Mike														X	X
	Barton, Jennifer														X	X
696	Brightman, Lori														X	X
	Desai, Sheetal														X	X
	Weiss, Elliot														X	X
	Karen, Julie														X	X
	Chapas, Anne														X	X
	Hale, Elizabeth														X	X
	Bernstein, Leonard														X	X
	Geronemus, Roy														X	X
697	Bass, Lawrence				X										X	
698	Kim, Il-Hwan	X	X			X			X						X	
	Lee, Kyung Goo														X	
	Kim, Jae Hwan	X	X			X			X						X	
	Yi, Sang Min														X	
	Choi, Jae Eun														X	
	Ro, Ki Woong														X	
699	Xiao, Gu														X	
	Strom, Kurt														X	
	Spaliviero, Massimiliano														X	
	Wong, Carson			X											X	
700	Hamel, John														X	X
701	Ho, Stephanie G.Y.														X	
	Yeung, C.K.														X	
	Chan, Nicola P.Y.														X	
	Shek, Samantha Y.														X	
	Kono, Taro														X	
	Chan, Henry H.L.														X	
702	Kroon, Marije W.														X	
	Wind, Bas S.														X	
	Meesters, Arne A.														X	
	Wolkerstorfer, Albert														X	
	Van der Veen, Wietze J.P.														X	
	Nieuweboer-Krobotov, Ludmilla														X	
	Bos, Jan D.														X	
	Beek, Johan F.														X	
703	Ruiz, Aura														X	
	Rivero, Martha														X	
704	Passeron, Thierry														X	X
	Mantoux, Frederic														X	X
	Lacour, Jean-Philippe														X	X

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	Ortonne, Jean-Paul														X	X
705	Gu, Xiao														X	
	Strom, Kurt H.														X	
	Spaliviero, Massimiliano														X	
	Wong, Carson			X											X	
706	KAMEL, MESSAOUD NACER														X	X
708	Zong, Yue														X	X
	Rice, Photini Faith														X	X
	Winkler, Amy M.														X	X
	Barton, Jennifer K.														X	X
709	Passeron, Thierry														X	X
	Fusade, Thierry														X	X
	Vabres, Pierre														X	X
	Bousquet-Rouaud, Régine														X	X
	Collet-Vilette, Anne-Marie														X	X
	Toubel, Gerard														X	X
716	Warchya, Melanie														X	X
	Chapas, Anne M.														X	X
	Weiss, Elliot														X	X
	Desai, Sheetal														X	X
	Brightman, Lori														X	X
	Hale, Elizabeth														X	X
	Karen, Julie														X	X
	Bernstein, Leonard														X	X
	Geronemus, Roy														X	X
717	Ciocon, David														X	
	Hussain, Mussarrat														X	
	Goldberg, David														X	
727	Wu, Min														X	X
	Lv, Kang Tao														X	X
	Liang , Ya														X	X
	Liu, Timon Cheng-Yi														X	X
	Liu , Song-Hao														X	X
728	Liu, Xiao-Guang														X	X
	Zhou, Yong-Jian														X	X
	Li, Jiang-Hua														X	X
	Liu, Timon Cheng-Yi														X	X
729	Yang, Zheng-Ping														X	X
	Li , Jiang-Hua														X	X
	Liu, Timon Cheng-Yi														X	X
733	Pozner, Jason		X		X	X					X				X	
	Simonelic, Kevin														X	
	Wagner, Kurt														X	
	Lennox, Krystie														X	
	Goldberg, David		X												X	
734	Ang, Chia-Chun														X	
	Tay, Yong-Kwang														X	

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	Kwok, Colin	X													X	
736	Peterson, Jennifer														X	X
	Palm, Melanie														X	X
	Kiripolsky, Monika														X	X
	Goldman, Mitchel														X	X
742	Alexiades-Armenakas, Macrene								X						X	
743	Harth, Yoram							X				X	X		X	
	Vider, Itzhak				X										X	
	Elman, Monica				X										X	
	Kamin, Amy														X	
	Gottfried, Varda						X								X	
	Shemer, Avner														X	
744	Kapoor, Rinky														X	X
	Shome, Debraj														X	X
	Jain, Vandana														X	X
745	Pagni, Gino Luca														X	X
	Lazzari, Tiziana														X	X
746	Suh, Dong-Hye														X	
	Park, Ji-Young														X	
	Chang, Ka-yeun														X	
	Son, Ho-chan														X	
	Lee, Sang-Jun														X	
	Song, Kye-yong														X	
747	Collawn, Sherry										X				X	
748	Russe-Wilflingseder, Katharina		X												X	X
	Russe, Elisabeth														X	X
749	Freedman, Bruce														X	
753	Passeron, Thierry														X	X
	Chiaverini, Christine														X	X
	Rogopoulos, Andre														X	X
	Lacour, Jean-Philippe														X	X
754	Gold, Michael									X					X	X
	Burvin, Ram		X	X											X	X