AMERICAN SOCIETY FOR LASER MEDICINE AND SURGERY

Basic Science & Translational Research— *Diagnostics, Imaging, Dentistry*

USEFULNESS OF IMAGE-BASED MEASURES *VS* CLINICAL INDICES IN ASSESSING PERIODONTITIS

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Background: Mapping periodontal health using clinical indices is laborious, time-consuming and poorly tolerated. The objective is to compare imaging-based *vs* clinical outcomes measures for quantifying periodontal health.

Study Design/Materials and Method: Six subjects with 161 teeth were enrolled within 4–6 weeks of routine oral prophylaxis (UCI #2002-2805). Primary inclusion criterion was the presence of 6 or more periodontal pockets each with a probing depth of >4 mm. Periodontal pocket depth (PPD) was measured using a Florida probe with an automated probing force of 15 grams. PPD was measured again at 3 and 6 months. At each visit, standardized Optical Coherence Tomography (OCT) imaging was performed at the same locations. Patients brushed twice daily with a dental gel (Livionex, Inc., Los Gatos, CA) over the 6 month study period and continued with their usual adjunct measures.

Results: Mean number of teeth per subject was 26.83. On average, clinical probing lasted 22 minutes (+ 4) per subject whereas imaging took 12 (+ 2) minutes. Mean PPD at baseline was 3.3 mm (s.d. 1.176). At six months, mean PPD declined to 3.0 mm (sd 0.959). The 3 month PPD measurement was 3.2 mm (sd 1.103). On Day 0 350 PPD's measured 4 mm or more. After three months, mean PPD decline was 0.5 mm (sd 0.852). At six months, mean PPD reduction was 1.0 mm (sd 0.958). PPD changes were statistically significant at both time points (t-test − t value = 10.54, df = 349, $P < 0.00001$; t value = 19.43, df = 349, $P < 0.000001$ respectively). Using OCT-based measurements, the same trends were observed at each timepoint. However, pocket depths could not be measured using OCT in 23% of sites.

Conclusion: OCT imaging is considerably quicker than clinical PPD probing, and provides similar results. However, it was unable to inform on almost a quarter of all imaging sites.

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Basic Science & Translational Research— *Diagnostics, Imaging, Gastroenterology*

SPATIAL VISUALIZATION OF TRACHEA CILIARY ACTIVITY USING REAL TIME PHASE RESOLVED DOPPLER SPECTRALLY ENCODED INTERFEROMETRIC MICROSCOPY

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Background: Synchronized ciliary beating plays a significant role in respiratory health, and can be influenced by a variety of physiological conditions including disease onset, temperature, and drug administration. Due to limitations in current imaging methods, the spatial pattern of *in vivo* ciliary activity has not been characterized. We present the phase resolved Doppler spectrally encoded interferometric microscopic system (PRD-SEIM) to provide a potential tool for the *in vivo* evaluation of the spatial ciliary activity.

Study Design/Materials and Method: We have developed the SEIM system to visualize the enface ciliary beating activity with 1 micron lateral resolution. Additionally, the PRD method is integrated into the system to detect the micron scale ciliary motion with nanometer displacement sensitivity, ensuring clear visualization of the full ciliary beating cycle. Furthermore, a graphic processing unit accelerated imaging software has been implemented to register and display ciliary motion in real time at up to 200 frame per second. The detection and scanning signals have been synchronized within the customized software to ensure identical imaging conditions across frames. To validate the feasibility of the PRD-SEIM technique, experiments on *ex vivo* rabbit trachea samples have been performed at different temperatures and also with lidocaine and albuterol administration.

Results: By increasing the temperature from 27 to 33 degree Celsius, the CBF also increases from 9 to 13 Hz. Lidocaine decreases the CBF from 7.2 to 2.7 Hz, and the spatial CBF map indicates a significant decrease in the area of ciliary activity. On the contrary, a positive correlation is observed between albuterol concentration and CBF, where 0.3% and 0.6% albuterol exposures have increased the CBF from 5.6 to 6.1 and 6.7 Hz respectively. In addition, the area of active cilia has also expanded with albuterol administration.

Conclusion: The PRD-SEIM technique will serve as the stepping stone to *in vivo* studies and the translation of imaging spatial CBF in clinics.

Basic Science & Translational Research— *Diagnostics, Imaging, Gynecology*

FLUID STRESS ESTIMATION FROM OPTICAL OBSERVATIONS IN A 3D MODEL OF OVARIAN CANCER SUBJECTED TO CONTINUOUS FLOW

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Background: The accumulation of fluid in the peritoneal cavity of ovarian cancer patients results in the production of protein and cell rich ascites. As a consequence, ascitic currents are established in the peritoneal cavity because of physiological movement. These currents play an important role in

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disseminating and modulating the biology of cancer cells. Studies have shown that flow-induced shear stress induces a motile and aggressive tumor phenotype in fluidic models of 3D ovarian cancer, highlighting the importance of understanding the fluid-structure interactions between physiological currents and cancer nodules.
Study Design/Materials and Method: We propose to use optical observations of the fluid flow to measure the fluid velocity field in a well-established model system of flow-induced biological modulation of 3D ovarian cancer nodules. In particular, we show the feasibility of using particle image velocimetry (PIV) and confocal microscopy to observe the flow past 3D cancer nodules subjected to laminar flow in a fluidic chip. Optical tracers are used to reveal the flow pattern around cancer nodules, and their trajectories are used to calculate the velocity field by image processing. The velocity field is next used to estimate the fluidic shear stress experienced by cells and 3D ovarian cancer nodules during cell attachment and nodule growth under fluid stress.
Results: Using the shear stress of the chip walls without cells as reference, it was found that cells can experience 2 to 8 times the wall shear stress as they develop into 3D nodules.
Conclusion: It is feasible to use PIV and confocal microscopy to study the fluid-structure interactions between fluid flow and cancer nodules subjected to a continuous laminar flow, in particular, to determine the fluidic forces that may modulate the biology of cancer cells.

Basic Science & Translational Research—*Diagnostics, Imaging, Skin*

AN OPTICAL IMAGING APPROACH TO BIOFILM WOUND INFECTION

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Background: Clinicians are currently unable to assess and map wound biofilm infection presence and status at the bedside, which delays treatment onset and hinders tailored treatment approaches and monitoring
Study Design/Materials and Method: Using single- and multi-species models of acute and chronic wound infection, candidate biomarkers were identified for indicating the presence and status of biofilm wound infection. Next, various non-invasive optical probes were evaluated for their ability to inform on these biomarkers, and a decision was made to use fluorescence characteristics. Specific high-risk wound infection organisms were cultured, mapped, and fluorescence changes related to acute *vs* transitional *vs* chronic status determined. Finally, a first prototype of a snap-on smartphone probe was constructed, and its ability to identify and characterize biofilm wound infection was tested.
Results: (1) Infection presence, status and acute-to-chronic conversion were mapped in *ex vivo* biofilm infection models using autofluorescence (2) a simple low-cost probe prototype that excites, images and analyzes fluorescence was constructed and tested. The probe is small, light and very inexpensive, primarily uses the smartphone optics with an additional compact snap-on probe.
Conclusion: These early studies examined the concept of combining simple smartphone technology with fluorescence-based imaging to detect and inform on wound infection biofilm. We anticipate developing and incorporating machine learning artificial intelligence techniques into this system to provide direct triage and clinical decision-making guidance in the future. This material is based upon work supported by the Air Force Office of Scientific Research under award number FA9550-17-1-0193. Any opinions, finding, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the United States Air Force.

CORRELATION OF *IN VIVO* IMAGING AND HISTOLOGIC PHOTOTHERMAL DAMAGE TO FOLLICULAR STRUCTURES USING GOLD MICROPARTICLES AND LASER PULSES

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Background: Acne treatment using gold microparticles and laser generate selective photothermal damage to the follicle and sebaceous gland has been reported to be clinically effective. Histologic evaluation of punch biopsies has been the primary tool used to assess the anatomic location of microparticle delivery and resulting photothermal damage. There is a need to develop non-invasive imaging methods to assess microparticle delivery. Previously, reflectance confocal microscopy (RCM) and optical coherence tomography (OCT) enabled visualization of particles within the follicles. The aim of this pilot study was to use ultrasound-assisted delivery of microparticles and perform imaging and histological assessment to evaluate correlation between visualized particles and photothermal damage.
Study Design/Materials and Method: Three subjects were enrolled in an IRB approved study in which delivery of microparticles was performed on bilateral preauricular skin with ultrasound assistance followed by 800 nm laser pulses. Baseline and post-laser imaging was done with RCM and vertical cross-sectional OCT. Biopsies were obtained after laser pulses and evaluated.
Results: In both RCM and OCT images, gold microparticles were visualized as hyperreflective elements within follicles. In RCM images, a high fraction of follicles (23/27) show bright hyperreflective elements after particles application. In OCT images, microparticles were noted as hyperreflective structures within follicles up to 333–1,228 microns depth-range. In each of the OCT images, 60–80% of follicular structures showed presence of particles. Particles were not noted outside the follicles. Histology showed selective photothermal damage limited to follicular structures and often encompassing sebaceous glands consistent with presence of microparticles seen by imaging.
Conclusion: Both RCM and OCT demonstrated consistent follicular delivery of gold microparticles to the target anatomy. Biopsy samples showed significant and consistent photothermal damage to the follicles. The particles visualized in OCT images are predictive of photothermal damage, thus minimizing need for biopsies when confirming new delivery techniques or formulations.

IMPROVED FOLLICULAR DELIVERY OF MICROPARTICLES FOLLOWING TOPICAL PRETREATMENT VISUALIZED BY OPTICAL IMAGING

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Background: Follicles of acne patients are often blocked by cellular debris, bacteria, and sebum. Novel acne treatments using light absorbing gold microparticles (GMPs) and laser pulses rely on effective follicular delivery. The main objective of this study was to evaluate, by means of optical coherence tomography (OCT) and reflectance confocal microscopy (RCM), if and to what extent a topical pre-treatment regimen can achieve deeper deposition of GMPs in hair follicles.
Study Design/Materials and Method: Fifteen acne patients were enrolled in the study. At baseline, RCM and OCT imaging were performed before and after GMP application, and after diode laser exposure. Patients were instructed to apply daily topical 0.3% adapalene and 2.5% benzoyl peroxide (BPO). After 6 weeks, RCM and OCT follow-up scans before and after GMP application and after laser exposure were performed. Penetration depth of GMPs in hair follicles were measured in OCT images and morphological characteristics of content and borders of follicles evaluated in RCM images at baseline and after 6 weeks of pre-treatment using FIJI.
Results: OCT results showed statistically significant increase in mean depth of observed GMPs in follicles from 270 μm before pre-treatment to 302μm after 6 weeks pre-treatment ($P < 0.05$). In RCM images, the fraction of follicles with bright hyperkeratotic border decreased from 40.0% to 7.7% while the percentage of follicles considered empty, i.e., devoid of sebum, keratin, and cellular debris, increased from 51.3% to 80.1% after 6 weeks of pre-treatment. Similarly, higher number of follicles were filled with GMPs.
Conclusion: RCM demonstrated morphological changes in follicles within 6 weeks of daily topical pre-treatment. OCT demonstrated an increase in depth to which the GMPs were observed, suggesting that pre-treatment with adapalene and BPO may provide enhanced follicular delivery of GMPs.

IMPROVED NADH FLUORESCENCE LIFETIME ANALYSIS: A LABEL-FREE BIOENERGETIC MARKER FOR ASSESSMENT OF WOUNDS

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Background: The metabolic analysis of heterogeneous cell cultures and complex tissues carries many analytical difficulties using current evaluation methods due to procedural limitations and lack of visual information. Therefore, the objective of this study was to use autofluorescence of nicotinamide adenine dinucleotide (NADH) and fluorescence lifetime imaging microscopy (FLIM) to provide a highly sensitive label-free biomarker for quantitative assessment of metabolic activity with subcellular resolution.
Study Design/Materials and Method: Two-photon FLIM experiments were carried out on mixed adipocyte and fibroblast cell cultures as well as full thickness skin equivalents using a 60x water objective (NA 1.2) at 755 nm wavelength. Imaging results of heterogeneous cell cultures were compared and correlated to the oxygen consumption rate measured by an extracellular flux analyzer. Wounds in metabolically active skin equivalents created by fractional laser irradiation and mechanical punch biopsies were imaged daily for 5 days and were metabolically analyzed on a cellular level.
Results: A new and improved optical biomarker named mitochondrial-cytoplasmic-ratio (MCR) that accurately reflects shifts in mitochondrial and cytoplasmic NADH distribution was defined. The MCR correlates well with the flux analyzer and has an increased dynamic range to metabolic changes as compared to traditional optical assessments. The observation of differences in metabolic activity due to cell type and mechanical wounding demonstrates that label-free and non-destructive evaluation of mixed cell cultures and wounds is possible on a single cell level.
Conclusion: The use of this optical imaging method, combined with a new analytical algorithm, can follow metabolic and morphological changes in complex cell cultures and tissue constructs in ways not feasible with traditional analysis techniques. Therefore, the MCR biomarker helps to evaluate tissue and wound development and could enable early interventions and treatments.

IN VIVO MULTIPHOTON MICROSCOPY OF SCABIES

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Background: Scabies is a contagious skin parasitosis caused by the mite Sarcoptes scabiei variety hominis. The small size of adult scabies mites and only 10–12 mites on infested human at a given time cause a low sensitivity of the routine microscopic diagnosis using skin scraping. Multiphoton microscopy (MPM) is a laser scanning microscopy technique that uses label-free contrast based on optical signals generated through nonlinear light-matter interactions. Recently this technology has been applied in various cutaneous conditions. Here we exploit the ability of MPM to provide a non-invasive diagnosis of scabies infestation.
Study Design/Materials and Method: A 60-year-old white male presented with an itchy rash on his hand and groin region. Scabies was suspected based on the patient's history and delta sign on clinical examination. The right fourth finger was imaged *in vivo* using MPM-based clinical tomograph (JenLab GmbH, Jena, Germany) using 100 fs of NIR light (790 nm) to generate two-photon excited fluorescence (TPEF) signals from chitin, the predominant component of the exoskeleton of the scabies mite.
Results: The scabies mite appeared in the superficial epidermis as an oval body with short legs in MPM images. The sub-micron resolution of the technique allowed the visualization of spikes on the top of the mite's body and of its short legs, as well as mite eggs.
Conclusion: We found that MPM is capable of imaging the scabies mite and its eggs *in vivo*. *In vivo*, label-free high-resolution visualization of the mite is helpful to support a correct diagnosis of the condition, especially since clear diagnosis of scabies can be difficult as it can often mimic other skin conditions. This visualization relies on fluorescent property of chitin, which is a new addition to previously reported contrast mechanisms based on collagen fibers, NADH, FAD, keratin, melanin, and elastin fibers.

IN VIVO OPTICAL IMAGING OF SCALP EPIDERMIS AND HAIR FOLLICLES AS DIAGNOSTIC AND PROGNOSTIC INDICES OF ALOPECIA: A PILOT STUDY

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Background: Scarring alopecia devastates patients' self-esteem, leading to anxiety or depression of as much as 50% of those afflicted. Management of scarring alopecia, such as lichen planopilaris, is difficult due to progressive inflammation and lack of effective treatments. Non-invasive, real-time assessment of living tissue is quickly becoming invaluable for bolstering histologic and dermatoscopic diagnostic and prognostic measures of dermatologic conditions. Objective non-invasive monitoring with optical coherence tomography (OCT) of alopecia has significant potential for improving clinical practice in this area. The aim of this study was to evaluate the utility of OCT in distinguishing scalp inflammation between scarring and non-scarring alopecia patients.
Study Design/Materials and Method: Twenty patients ranging from 26 to 65 years of age with clinically diagnosed alopecia of varying subtypes were imaged. Two different scalp regions were imaged and analyzed using ImageJ software to discern the thickness of the epidermis and hair follicle density at baseline.
Results: Twenty subjects were imaged once in two locations on their scalp. At baseline the difference in average skin thickness for scarring versus non-scarring alopecia was found to be significant ($P < 0.05$), whereas the differences in average hair follicle density and diameter were not significant ($P > 0.05$).
Conclusion: This study shows that OCT holds the potential to aid in classification of various alopecia subtypes. These findings promise utility in monitoring key prognostic facets of alopecia, such as epidermal thickness, without needing to distinguish microstructures such as active and inactive follicles on histology. Non-invasive monitoring with OCT of alopecia over time may lead to improved treatment regimens and potentially earlier diagnosis of these unpredictable, challenging, and devastating conditions.

SPECTRALLY CORRECTED OPTICAL POLARIZATION IMAGING FOR *IN VIVO* EVALUATION OF SKIN CANCER MARGINS

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Background: Nonmelanoma skin cancer (NMSC) is the most common malignancy in the United States. Most NMSCs are removed by surgery. However, visual assessment of tumor margins by surgeons is often misleading, due to limited contrast between cancerous and normal skin. The aim of this study was to examine optical polarization imaging (OPI) as a tool for preoperative delineation of NMSC margins.
Study Design/Materials and Method: This pilot clinical study was conducted at Massachusetts General Hospital. Forty-eight subjects with biopsy-proven NMSC, scheduled for Mohs surgery, were enrolled under an IRB approved protocol. Before excising the cancer, the study surgeon outlined the clinical boundary of the lesion using blue marker. Wide-field cross-polarized optical reflectance images of the skin were acquired at 440 nm and 640 nm to visualize collagen disruption and the surgeon's markings, respectively. To exclude the impact of uneven pigmentation and vascularization we used spectrally dependent properties of melanin and hemoglobin. The surgeon was blinded to the imaging results. To validate OPI, margin assessment by the surgeon and imaging were evaluated against the gold standard of histopathology.
Results: In total, fifty-three lesions were imaged *in vivo* using the OPI system, including 43 basal cell carcinoma (BCC) and 10 squamous cell carcinoma (SCC). In all 13 cases requiring greater than one Mohs stage, the spectrally encoded images accurately visualized tumor extending beyond the surgeon's markings. For cases negative following the first Mohs stage, margin assessments from the system correlated with histopathology in 39 out of 40 cases.
Conclusion: The results of our study indicate that the OPI can be performed in real time, is well tolerated by the patients, and may provide a valuable non-invasive tool for guiding skin cancer surgery.

Basic Science & Translational Research – *Diagnostics, Imaging, Skin Surgery*

EVALUATION OF FUNGALLY INFECTED NAIL TISSUE USING UV-FLUORESCENCE

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Background: Onychomycosis is the most common nail disorder. Diagnosis is based on agar culture and direct microscopy using external agents to visualize fungal tissue in nail samples. A recently developed UV-camera has shown potential to detect biological processes such as wound healing. This study aimed at assessing the potential of this new device as a screening device for fungal infections.
Study Design/Materials and Method: Clippings of 21 nails with microscopically confirmed onychomycosis and 5 healthy control samples were collected. Fungal culture confirmed onychomycosis in 13 of the 21 nails with signs of fungal infection, the majority being dermatophytes ($n = 8$). Using a UV-camera (295 nm flash, 300 nm sensitive camera with a resolution of 640×480 nm and a 340 nm filter (26 nm bandwidth)), images of all 26 samples were acquired on a bright background. Mean fluorescence intensities were quantified using FIJI and statistically evaluated in SPSS.
Results: UV-images clearly depicted all 26 nail clippings. Increase in fluorescent signal was visible in samples with microscopically confirmed diagnosis of fungal nail infection. After background correction, statistically significant differences in fluorescence intensities were found between healthy nail clippings and 1) nails with microscopic signs of fungal infection ($P = 0.001$), 2) nails with positive fungal culture ($P = 0.04$), and 3) nails with dermatophyte infection ($P = 0.002$).
Conclusion: UV-cameras can potentially differentiate between healthy and fungal nail samples, showing promise as a screening or even diagnostic device for onychomycosis.

Basic Science & Translational Research – *Diagnostics, Light Sensors, Miscellaneous*

IMPLANTABLE OPTICAL MUSCLE OXYGENATION SENSOR

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Background: Measurement of muscle oxygenation in humans can be used to learn critical information about hypoxia during surgery, muscle performance during sports and exercises, severity of septic shock and in other similar situations. In the present work we have developed a minimally invasive optical sensor based on the diffusion model of light transport. Near-infrared reflectance spectroscopy is used here for measurement of muscle oxygenation.
Study Design/Materials and Method: The sensor uses two multiwavelength LEDs as light sources and a silicon photomultiplier as the detector. NIR light from both the LEDs is transmitted to the muscle and collected at the detector. The wavelengths of the LEDs were determined from the absorption spectra of oxy-myoglobin and deoxy-myoglobin. We determine the attenuation in the intensity, and thus the absorption, of the NIR light at two wavelengths and use the ratio to calculate the muscle oxygenation. The sensor is autonomous, requires no calibration and has low energy usage. This sensor is encased in a biocompatible elastomer that is not electrically conductive and makes the sensor suitable for implantation. The elastomers were thoroughly tested before being used as encasings for the sensor. Among the evaluated parameters were cell viability, inflammatory response, biodegradability, temperature stability, electric conduction, mechanical properties and oxygen levels in *ex-* and *in vivo* models.
Results: A calibration-free optical oxygen sensor was designed. Sensor was tested both *in vivo* and *ex vivo* and the oxygen concentration variations were detected. Two elastomer formulations were biologically tested for cell viability. After 21 days, cells proliferated without considerable cell death. The two elastomer formulations were physically tested. Both formulations maintained stability for up to one month at vacuum/drying, room, and physiological conditions. Neither gel formulation was conductive.
Conclusion: An implantable biocompatible optical sensor has been developed for minimally invasive muscle oxygenation measurements.

Basic Science & Translational Research – *Diagnostics, Light Sensors, Skin*

CHEMILUMINESCENCE DETECTION SYSTEM FOR REVEALING THE PRESENCE OF NEUTROPHILS IN SKIN MICROSAMPLES

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Background: Many cutaneous diseases are defined by the presence of neutrophils in the skin, such as bacterial infections, vasculitis, neutrophil dermatoses, and others. Neutrophils are a type of innate immune cell and are often the first to respond to infection and inflammation. In addition to clinical signs and symptoms, identifying the presence of neutrophils in the skin is a critical part of making an accurate diagnosis. Currently, neutrophil identification in the skin requires a skin biopsy and histopathology, which are costly and slow. In order to improve clinical care and reduce costs, a point-of-care, rapid method for identifying neutrophils in the skin is needed.
Study Design/Materials and Method: The method consists in collecting full-thickness skin microbiopsies from the area of interest and placing them into a small portable sample compartment which is light isolated. Next, horseradish peroxidase (HRP), phorbol 12-myristate 13 acetate (PMA) and luminol are infused to activate neutrophils and initiate chemiluminescence. A photon counting detector integrated to the sample compartment is used to measure the light emission due to the activation of neutrophils present in the skin samples.
Results: In preliminary experiments, the system was tested with pig skin and different concentrations of neutrophil cells. Decreasing the concentration of neutrophils resulted in lower number of photon emissions, as expected.
Conclusion: We conclude that the proposed system and method have the potential to provide a point-of-care, rapid way for identifying neutrophils in the skin.

Basic Science & Translational Research – *Diagnostics, Light Sensors, Skin, Cryolipolysis*

USE OF DIFFUSE OPTICAL SPECTROSCOPIC IMAGING TO CHARACTERIZE METABOLIC CHANGES IN SUBCUTANEOUS ADIPOSE TISSUE AFTER CRYOLIPOLYSIS

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Background: Cryolipolysis is a non-invasive, body contouring technique. Currently there are no reliable, quantitative techniques to characterize adipose tissue post-treatment. Diffuse optical spectroscopic imaging (DOSI) is a novel, non-invasive imaging technology visualizing adipose tissue metabolic activity in healthy and pathologic states. We present the first cases using DOSI to visualize and characterize metabolic changes in adipose tissue pre- and post-cryolipolysis.
Study Design/Materials and Method: Female volunteers were treated with lower abdominal cryolipolysis (-11°C, 35 minutes) followed by massage. The treatment areas were mapped in a 2×2 cm grid pattern for DOSI measurements, with data collected pre- and post-treatment up to 90 days. Raw data was transformed into three-dimensional surface images (i.e. heat maps), corresponding to treated areas, using a linear mixed effects model.
Results: Pre-treatment optical signals are consistent with healthy adipose tissue. Immediately post-treatment, acute metabolic changes, such as increased deoxyhemoglobin and water content, suggest injury and subsequent inflammation. During tissue recovery, the metabolic profile begins to return to normal, but never reaches baseline suggesting a fundamental change in tissue architecture and functionality after cryolipolysis.
Conclusion: DOSI is evolving as a tool to non-invasively characterize metabolic changes in adipose tissue and can successfully characterize changes post-cryolipolysis. This ability to monitor tissue response may help identify patients at risk for paradoxical adipose hyperplasia. Other uses of DOSI include optimizing clinical parameters, determining optimal post-procedure mechanical manipulation, and utility of adjuvant techniques to maximize cryolipolysis outcomes. Future directions include using DOSI to determine efficacy of heat, mechanical, ultrasound and radiofrequency modalities of lipolysis.

Basic Science & Translational Research – *Diagnostics, Light Sensors, Vascular*

FLOW SENSING IN-DEPTH OF A TISSUE *VIA*

ANALYSIS OF THE SPATIAL STATISTICS OF THE BACK SCATTERED LASER ILLUMINATION

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Background: Common methods to measure tissue microfluidic flow include usage of laser-based Doppler velocimetry or analysis of speckle patterns dynamics. Here, we show ability of sensing flow characteristics appearing deep inside the inspected tissue and detecting its dynamics.

Study Design/Materials and Method: We model the laser speckle decorrelation distribution, obtained from secondary speckle patterns that are generated in diffused laser light, being back-scattered from the inspected sample. We show that the statistical model depends on the flow velocity, for stationary (fixed) velocity as well as for the transient case (dynamic change of velocities). This analysis of the temporal dynamics of the speckle patterns is related to the motion of particles as well as to the internal flow properties. Random Brownian motion is expressed as pure exponential decaying decorrelation statistics and an organized particles movement, related to flow inside the tissue, deviates from this description.

Results: We show *in vitro* experimental validation of the proposed approach by illuminating a bare tube with mixture of intralipid and agarose flowing, through a plastic tube, in different velocities being dynamically changed. The obtained graph shows fit of the laser speckle autocorrelation, to linear combination of several decaying exponents while the exponential decay constants and coefficients highly depend on the flow velocity and dynamics (stationary or transient flow). Information about the in-depth dynamics of the scatterers was extracted by analyzing the dynamics of the speckle patterns at circles with varying radius measured from the incident position of the illuminating laser point-source.

Conclusion: We present a novel optical method for in-depth flow estimation based on analysis of the dynamic statistics of speckle patterns while detecting not only stationary flow velocity but also its transient behavior. The proposed method was tested on phantoms simulating a tissue with a blood vessel. Flow location was correctly revealed throw the sounding medium.

Basic Science & Translational Research – *Therapeutic, Light Therapy, Dentistry*

THE LINK BETWEEN PERIODONTITIS AND PREGNANCY: THE ROLE OF PHOTODYNAMIC THERAPY

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Background: Periodontitis (P) is one of the most common infectious diseases that affects the periodontium and gradually destroys periodontal tissues. The local inflammatory response of P causes systemic effects due many inflammatory mediators to be released in the blood. Alterations during the gestation occasioned by P as well as its repercussions in the offspring have been studied, and the link between P and pregnancy is inconclusive. PDT is characterized by the association of a light source with a photosensitizing agent in order to cause cell necrosis and microbial death. Thus, our objective was to evaluate the effect of P during pregnancy on the development of allergic lung inflammation in the offspring and the effects of photodynamic therapy.

Study Design/Materials and Method: Ten days before pregnancy, periodontitis was induced by ligature technique, and subsequently the rats were caged overnight with a male. Pregnancy was confirmed by vaginal smear. The treatment with PDT was performed 15 days after the induction the ligatures. Pregnant rats non-manipulated were used as control. After 30 days of birth, the offspring was submitted to allergic lung inflammation by ovalbumin administration. The inflammatory parameters were evaluated 24 hours later. The photosensitizer methylene blue (0.005%, CHIMIOLUX, DMC, São Paulo, Brazil) was administered at the two sites (vestibular and lingual). After three minutes, the periodontal pockets were irradiated with a red laser (MM OPTICS; Wavelength 660 ± 10 nm; Radiant power 100 mW; Exposure duration 90s; spot size 0.02827 cm^2; Radiant energy 9 J; Irradiance 3.5 W/cm^2; Radiant exposure 318 J/cm^2; Total radiant energy 18 J).

Results: We showed that pregnant rats with periodontitis had an increased influx of leukocytes in the blood as well as elevated levels of IL-6 in the gingival homogenates and PDT reversed these responses. No differences were observed among groups of pregnant rats in relation to weight gained during gestation. We also observed important impact of PDT in the offspring parameters. Our data showed low birth weight in the offspring from periodontitis mothers as well as increased development of lung inflammation and PDT was capable to rescue partially low birth weight, besides reduced lung inflammation.

Conclusion: Our data showed the impact of periodontitis in the offspring and the important effects of PDT. Thus, our data showed the important role of oral health during gestation as well as PDT is an effective therapy.

Basic Science & TranslationalResearch – *Therapeutic, Miscellaneous*

NON-INVASIVE INDUCTION OF MUSCLE FIBER HYPERTROPHY AND HYPERPLASIA: EFFECTS OF HIGH-INTENSITY FOCUSED ELECTROMAGNETIC (HIFEM) FIELD EVALUATED IN AN *IN VIVO* PORCINE MODEL

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Background: Multiple recent studies evaluated the efficacy of High-Intensity Focused Electromagnetic (HIFEM) technology for the induction of changes in muscle and adipose tissues. These same studies also reported an increase in muscle hypertrophy, but it had not yet been investigated on a histological level. Our study evaluates *in vivo* structural changes in striated porcine muscle tissue histology following HIFEM treatments.

Study Design/Materials and Method: Four 30-minute HIFEM treatments were applied on biceps femoris muscle of three Yorkshire pigs under general anesthesia; a fourth pig served as a control subject and remained untreated. Muscle biopsies of the treated and control subjects were taken at baseline and two weeks after the last treatment. A certified histopathologist evaluated the collected tissue slices for any structural changes.

Results: The two-week follow-up biopsies of the treated muscle showed hypertrophic changes in the cross-sectional samples, with the muscle mass density increasing by 23.23% ($18714.9 \pm 5467.8\ \mu m^2$) compared to the non-hypertrophic baseline tissue. This observation was coupled with increased

muscle fiber density (hyperplasia) as the average change in the number of fibers in the area of 136533.3μm^2 was +6.9%. In addition, the average fiber size was increased by 16.18% ($461.4 \pm 371.7\ \mu m^2$) post two-weeks follow-up. Control subject samples did not show any histopathological changes. After the treatments, the appearance of endothelial cells with the onset of new capillary bed formation was observed.
Conclusion: Histopathology confirmed significant structural muscle changes through a combination of fiber hypertrophy and hyperplasia. Control biopsies appear to confirm that these changes are directly associated with the application of HIFEM technology and were not induced by changes in subjects' physical activity patterns. The data also suggests that HIFEM could be used for the non-invasive induction of muscle growth; this correlates with findings of other recent HIFEM research.

Basic Science & Translational Research – *Therapeutic, Phototherapy, Gastroenterology*

ABLATIVE FRACTIONAL LASER EXPOSURE AS AN ADJUVANT FOR IMMUNOTHERAPY OF COLON CANCER IN A MICE MODEL

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Background: Immune checkpoint inhibitors are novel and promising treatments for a variety of advanced cancers. One of the challenges of such treatment is that although occasionally complete remissions could be obtained, the average response rate is limited. We explored in a mouse model the utility of ablative Fractional Photothermolysis (aFP) as an adjuvant therapy to augment the response rate of checkpoint blockade immunotherapy.
Study Design/Materials and Method: Six-week-old female BALB/c mice were intradermally inoculated with a murine colon carcinoma cell line (CT26WT) bilaterally. At day seven, when tumors reached a diameter of approximately 5 mm, one of the tumor sites was irradiated with a fractional CO_2 laser (100 mJ pulse energy, 5% pattern density, 300 Hz pulse frequency). Anti-PD-1 antibodies were administered intraperitoneally at a dose of 200 μg per mouse on days 7, 9, 11, 13, and 15 after tumor cell inoculation. Then we compared 4 groups: control, anti-PD1 antibody only, aFP treatment only and anti-PD-1 antibody in combination with aFP treatment.
Results: Inoculated tumors grew significantly slower in the aFP + anti-PD-1 group and complete remission was observed in 33% of mice for tumors on both sides (aFP-treated and untreated side). All tumors of the remaining three groups grew continuously until the size threshold for euthanasia. Flow cytometric analysis of the aFP treated mice exhibited an increase of infiltrating dendritic cell as innate immunity in the laser-treated side and infiltrating CD3+, CD4+, and CD8+ T cells as adaptive immunity in the contralateral, not laser-treated side.
Conclusion: We have demonstrated that ablative fractional photothermolysis is able to augment the systemic antitumor adaptive immunity induced by anti-PD-1 checkpoint blockade immunotherapy. This study demonstrated the promising role of adjuvant FP treatments in combination with immunotherapy for optimal cancer therapy. Further studies on this topic are warranted.

Basic Science & Translational Research – *Therapeutic, Phototherapy, Photobiomodulation, Skin*

PHOTOBIOMODULATION AT MULTIPLE WAVELENGTHS DIFFERENTLY MODULATES OXIDATIVE STRESS *IN VITRO* AND *IN VIVO*

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Background: Photobiomodulation (PBM) is emerging as an effective strategy for the management of multiple inflammatory conditions, including oral mucositis (OM) in cancer patients. Reactive oxygen species (ROS) are massively generated during the early phases of OM and play a major role in the pathogenesis of inflammation in general. Here we report the results of a clinical and experimental study, aimed at evaluating the effect of laser light at different wavelengths on oxidative stress *in vivo* and *in vitro*.
Study Design/Materials and Method: The study was conducted according to the declaration of Helsinki and was approved by the local ethical committee. A diode laser device was employed. 10 patients affected by OM meeting inclusion/exclusion criteria were enrolled and underwent 4 daily PBM sessions (λ 970 nm, 6 J/cm^2) when clinical parameters were recorded and saliva samples were obtained for total oxidant status (TOS) measurement. In parallel, oxidative stress following 5-fluorouracil or H_2O_2 and different PBM protocols applied individually or in combination (λ 660 nm, 3 J/cm^2; λ 800 nm, 6 J/cm^2; λ 970 nm, 6 J/cm^2) was evaluated *in vitro* in neutrophils and keratinocytes. In addition, we used a roGFP2-Orp1 genetically-encoded sensor to monitor in real-time oxidative status changes in living keratinocytes in response to oxidative stress and different PBM protocols.
Results: While 970 nm PBM was effective in treating OM, salivary TOS levels significantly decreased after each PBM session ($P < 0.01$) but increased again after 24 hours. This transient antioxidant effect was confirmed *in vitro* in both cell types. In contrast, 660 nm increased ROS production. The most marked reduction in ROS levels, particularly evident in real-time imaging, was detected in cells exposed to the 800 nm laser light individually or to the combination of the three wavelengths.
Conclusion: Our study showed how the various wavelengths differentially modulate ROS production and prompts the validation of a multi-wavelength protocol in the clinical settings.

Basic Science & Translational Research – *Therapeutic, Phototherapy, Skin Surgery*

DOSIMETRY DETERMINATION PROCESS FOR THE TREATMENT OF SEBACEOUS GLANDS

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Background: We describe a process for determining an optimized dosimetry for targeting sebaceous glands using a 1726 nm laser with real time temperature monitoring that appropriately balances the treatment between safety and efficacy. The therapeutic window for the thermal destruction of sebaceous glands using a 1726 nm laser is very narrow – the size of the window is roughly +/– 10% of optimal fluence. To further complicate the treatment scenario, we have found that the therapeutic window is different from patient to patient.
Study Design/Materials and Method: We will describe a patent-pending dosimetry determination process that uses a series of low fluence laser pulses to characterize the thermal response of the tissue to fluence. This method was employed in an IRB approved safety trial of 10 patients. The thermal

characterization allows us to predict the tissue's response at higher fluences; this prediction in turn allows us to choose an optimized fluence level for safe and efficacious treatment of sebaceous glands. The dosimetry determination process relies on real-time temperature monitoring of the epidermal surface that has been correlated to sebaceous gland destruction. Following the low fluence characterization pulses, a graph is presented to the dermatologist showing the correlation between fluences and tissue temperatures, allowing the dermatologist to choose a fluence that appropriately balances the treatment between safety and efficacy.
Results: Numerous histologies demonstrate that the fluence chosen as a result of this dosimetry determination process consistently results in epidermal and dermal sparing while achieving partial to complete sebaceous gland damage.
Conclusion: The dosimetry determination process has been demonstrated on a variety of patients. The process allows the dermatologist to choose higher, more efficacious, therapeutic fluences with a decreased risk of epidermal or dermal damage. Since there can be different cutaneous responses from patient to patient this process permits us to individualize treatments rather than use a standardized protocol which might not be well suited to some patients. Using this validated process our aim is to selectively safely damage sebaceous glands with a goal of curing acne.

EFFECT OF FRACTIONAL LASER THERAPY ON REDUCING FIBROSIS IN PATIENTS WITH CHRONIC RADIATION DERMATITIS

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Background: Radiation injury to the skin is a major source of dysfunction, disfigurement and complications for thousands of patients who have undergone adjunctive treatment for internal cancers. Chronic radiation injury can result in permanent changes to the skin, including fibrosis, telangiectasias and skin atrophy. This can negatively impact patients' quality of life, due to pain, discomfort, limited mobility and reduced cosmesis. There are currently limited treatment options for radiation dermatitis and no gold standard of care. As fractional laser treatment (FLT) has been shown to treat fibrosis associated with hypertrophic scars and morphea, leading to tissue repair, we hypothesize that FLT can normalize the fibrotic process and induce normal scar remodeling in patients with chronic radiation dermatitis.
Study Design/Materials and Method: A prospective study of patients with significant radiation induced fibrosis. Each study site is treated with a CO_2 fractionated laser and has an internal control which does not receive any intervention. Evaluations include a subjective rating using the SF-36 Health Survey, clinical photographs and objective measurements: scar thickness measured by ultrasound, scar compliance measured by Derma Torque Meter and erythema and pigmentation measured by a DermaSpectrometer. These evaluations occur at an eligibility visit, after 3 laser treatments and 3–12 months after the last treatment.
Results: Preliminary data shows that elasticity improves in the 12 months following 3 laser treatments, indicating a reduction in fibrosis. Clinical photographs show that telangiectasias also improves with laser therapy. To date, 9 subjects have been recruited for this study, and two subjects have completed all study visits.
Conclusion: Initial analysis indicates that FLT can improve cosmesis and decrease functional limitations associated with chronic radiation dermatitis. More research is needed to understand the mechanisms of chronic radiation injury and devise appropriate interventions to treat radiation injury.

EFFECTS OF FRACTIONATED CO_2 LASER ON HUMAN DISCARD TISSUE: OBJECTIVE MEASUREMENT OF ELASTICITY AFTER VARYING TREATMENT DENSITY

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Background: Based upon ongoing protocols and anecdotal experience, fractionated CO_2 laser has been observed to improve aesthetics, function and associated symptoms of burn scars. We hypothesize that fractionated CO_2 laser therapy of varying densities of discarded human surgical tissue will improve in elasticity when measured with a custom-built tensometer and seek to define the density of treatment at which elasticity is optimized.
Study Design/Materials and Method: Our prospective research protocol utilized a CO_2 Fractional Laser (Lumenis) at the San Antonio Military Health System to measure elastic deformation of human surgical discard tissue after treatment with an energy of 50 mJ and varying densities of 5%, 10%, 15%, 20%, 25%, and 30%. Each density was utilized across 5 separate discard specimens and averaged. Initial results have shown the greatest improvement in elasticity with the 30% density but additional specimens are being collected and processed. Our results are preliminary, but appear very promising early data sets. We intend to present the final outcomes at the Annual ASLMS Meeting.
Results: Initial results have shown the greatest improvement in elasticity with the 30% density but additional specimens are being collected and processed. Our results are preliminary, but appear very promising early data sets. We intend to present the final outcomes at the Annual ASLMS Meeting.
Conclusion: Increasing density results in increasing elasticity in discarded human tissue when treated with a fractional CO_2 laser with a fixed energy of 50 mJ.

FOCUSED 1,940 nm THULIUM LASER RADIATION TO CREATE ABLATIVE FRACTIONAL SKIN LESIONS

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Background: 10,600 nm CO_2 laser and 2,940 nm Er:YAG laser radiation are the classical lasers used for creation of ablative fractional lesions in skin. One of the challenges of such laser wavelengths is that they are not well-suited for fiber delivery. Also due to such long wavelengths, it is challenging to obtain small spot sizes. In this experiment, we investigate the feasibility of using focused 1,940 nm Thulium (Tm) laser radiation to create ablative fractional skin lesions.
Study Design/Materials and Method: A customized Tm-fiber laser (IPG Photonic, Oxford, MA) at a wavelength of 1,940 nm with a maximum output power of 120 W was used in the experiment. *Ex vivo*, full thickness human skin samples were irradiated at various preset power levels of 1, 2, 5, 10, 12, 20, 60, 80, and 100W. Spot sizes were preadjusted with different focusing optics to 50, 100, 200, and 400μm. Energy output level was varied between 5–400 mJ.
Results: At high power and energy levels in combination with the use of highly focusing optics, Tm-fiber laser created ablative lesions with a high depth to width ratio of approximately 3:1

mimicking ablative fractional skin lesions produced by the CO_2 laser. The coagulation zone was approximately twice as compared to the CO_2 laser.
Conclusion: The focused non-ablative Tm-fiber laser has a potential to create ablative fractional skin lesions when operated at high power and energy settings.

HIGH-POWER 532 nm LASERS FOR THE TREATMENT OF VASCULAR LESIONS

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Background: Of the light-based modalities used to treat vascular lesions, the long-pulse 532 nm laser (also known as the KTP laser) is arguably considered the gold standard by the aesthetic community. KTP crystals have relatively low damage thresholds in the presence of infrared and green light, thereby, limiting peak power available for larger treatment spot sizes within therapeutic ranges. Recently, we have engineered a new, more efficient long-pulse 532 nm laser that uses a novel crystal for frequency doubling that has a damage threshold far in excess of KTP. This study aims to demonstrate the extended clinical treatment parameters available for vascular lesions.
Study Design/Materials and Method: A flash lamp pumped laser with a novel crystal was designed to characterize and test the performance and limitations of a new laser intended for treating vascular lesions. The crystal shot life performance limits and reliability were characterized by the decay of output power over the iteration of over 500,000 laser pulses operating at the 2 Hz frequency. Shot life tests were performed at 125 and 200% of the maximum power requirement for intended usage. The fluence scaling potential of the crystal was determined by measuring the maximum fluence achieved with 8-16 mm beam spot sizes (controlling for pulse width) and 1-4 ms pulse widths (controlling for spot size). The performance of the laser was compared to former KTP based designs.
Results: There were no signs of crystal damage following over >450,000 shot stress tests. Decay in output power during testing was due to degradation of the laser/pump cavity rather than the crystal demonstrate the reliability of the crystal design. The laser was capable of reliably generating peak powers (up to 1.3 kW) necessary for therapeutic fluences enabling a 12-16 mm treatment spot size without increasing the pulse duration beyond the thermal relaxation times of target blood vessels.
Conclusion: The new 532 nm laser allows larger spot sizes and faster treatment speeds for the efficacious treatment of vascular lesion by extending the ability of the laser to treat deeper chromophores.

NEEDLELESS INJECTOR POWERED BY Er:YAG LASER

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Background: Due to the fear of needle, needle-free injection devices powered by air/gas have been developed and used as a transdermal drug delivery system. But, they were not widely used because of pain and slow speed ($20 \sim 40$ shots/min). Thus the needs for painless and speedy non-needle injection devices has been increased.
Study Design/Materials and Method: We have developed and tested needleless injector powered by laser. The system was designed to produce a microjet generated by an expansion of the vapor bubbles, which is induced by the focused Er:YAG laser beam.
Results: We could generate microjet shots in every pulse of a laser, thus the frequency is greatly high up to 2400 shots/min. On the gelatin pad experiment, it shows constant control of depth and interval with the amount of up to 0.001 ml. The penetration of fluid microjet through pig and mouse skin is proved by ink and insulin. Needleless injection with botulinum toxin microjets, which is generated by this system shows similar efficacy with needle injections. No anesthesia was needed and it was painless.
Conclusion: Needleless injector powered by Er:YAG laser is a promising technique for transdermal drug delivery.

THREE SKIN TYPES FOR LASER-ASSISTED DRUG DELIVERY IN FRANZ DIFFUSION CELL MODEL – A COMPARATIVE STUDY

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Background: Pig skin is often used to substitute human skin in models for topical drug uptake. We aimed to evaluate two pig skin types compared to human skin for *in vitro* laser-assisted drug delivery (LADD) in Franz diffusion cells (FC).
Study Design/Materials and Method: Human abdominal skin was compared to abdominal skin from normal pigs (Danish Yorkshire/Landrace) and from a mutated pig phenotype characterized by few hair follicles and absence of musculi arrectores pili until puberty (hairless pigs). Skin was exposed to ablative fractional laser (AFL), using a 10,600 nm CO_2 laser at 5, 20 and 80 mJ/microbeam and 5% density. Skin thickness ($n = 24$) and dimensions of microscopic ablation zones (MAZ, $n = 120$) were measured as well as drug uptake of 5-fluorouracil and bleomycin (molecular weight 130 and 1416 Da, respectively) in FC and distribution of endogenous lipid biomarkers visualized by mass spectrometry imaging.
Results: Epidermis from pig and hairless pig was significantly thinner than human epidermis (63μm and 87μm *vs* 146μm, $p = 0.000$). At 80 mJ/microbeam, MAZs were significantly deeper and wider in pig and hairless pig skin compared to human skin (1378μm and 1160μm *vs* 676μm, $p = 0.000$ and 206μm and 231μm *vs* 160μm, $p = 0.000$–0.002, respectively). Data comparing biodistribution of 5-fluorouracil and bleomycin in superficial, mid and deep dermis from FC for each skin type will be presented. Likewise, the skin types will be further characterized though distribution of lipid skin biomarkers.
Conclusion: In both pig skin types, epidermis was thinner and MAZs were deeper and wider at high fluence compared to human skin. Together with biodistribution of 5-fluorouracil and bleomycin in FC, this may indicate the better skin type for *in vitro* LADD studies.

Basic Science & Translational Research – *Therapeutic, Radiofrequency Therapy, Gastroenterology*

DEVELOPMENT OF A NOVEL CATHETER-BASED TECHNIQUE FOR ENDOLUMINAL RADIOFREQUENCY SEALING OF PANCREATIC DUCT

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Background: Endoluminal sealing of pancreatic duct by hardening glue or with sutures has been proposed to manage a pancreatic stump after pancreaticoduodenectomy. Our objective was to develop a catheter-based alternative for endoluminal radiofrequency (RF) sealing of pancreatic duct.
Study Design/Materials and Method: We devised a novel RF ablation technique based on impedance-guided catheter pullback. First, bench tests based on *ex vivo* models were performed to improve and tune up the technique before *in vivo* study. Endoluminal RF sealing of a pancreatic duct was conducted on 8 pigs. The 3Fr catheter with two, 3 and 4 mm long electrodes was introduced ≈10 cm inside the duct through the pancreatic papilla (no pancreaticoduodenectomy was conducted). After 30-days postoperatory follow-up, sealing effectiveness was assessed with permeability test (saline injection through the pancreatic papilla) and histological analysis.
Results: The impedance-guided bipolar RF technique was always feasible, delivering a power ≈4 W on an initial impedance of $308 \pm 61\ \Omega$. The progress of electrical impedance throughout ablation showed a more or less similar pattern in all animals. This progress suggested how to efficiently modulate pullback speed to avoid tissue sticking and achieve a continuous lesion. During the follow-up, animals showed significant reduction in weight increase ($P < 0.05$), and alterations in stool consistency. No animal experienced postoperatory complications, except signs of exocrine atrophy. At the necropsy, it was no longer possible to reintroduce the catheter endoluminally, which suggested a sealing of the duct. Permeability test failed in all cases due to the impracticality of injecting saline, which confirmed that the sealing was achieved. As expected, histological analysis revealed a homogeneous exocrine atrophy along the entire ablated segment in all animals.
Conclusion: The findings suggest that catheter-based RF bipolar ablation could be effective and safe for endoluminal sealing of pancreatic duct, and hence suitable for management of the pancreatic stump.

Basic Science & Translational Research – *Therapeutic, Radiofrequency Therapy, Ophthalmology*

ELECTROCHEMICAL THERAPY FOR CORNEAL REFRACTIVE CORRECTION

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Background: Ocular refractive errors occur in over 30% of the general population, and over 800,000 refractive laser corneal procedures are performed annually. We present an electrochemical therapeutic (ECT) technique that exploits the *in situ* generation of redox reactions to modify tissue matrix structure and subsequently the curvature of the cornea. Electromechanical corneal reshaping (EMCR) is an ultra low-cost modality compared to traditional laser-based techniques.
Study Design/Materials and Method: A two needle electrode system for generating electrochemical potentials and spatially selective pH gradients *via* water electrolysis was used. Globes with anterior corneal radii ranging from 7-8 mm were harvested from New Zealand White rabbits freshly after euthanasia. During EMCR, a rigid contact lens placed on the cornea serves as a mold to guide final shape change. An optical coherence tomography system tracks in real time the curvature and refractive changes while software performs segmentation and shape change analysis. The dynamics of shape change with respect to voltage (3–6 V) and time (0–5 min) were tracked in *ex vivo* rabbit globes, and histological analysis using H&E and second harmonic generation (SHG) imaging were performed.
Results: A linear change in corneal curvature radius (8.22 to 7.30 mm radius) and refractive properties (6 diopter change) was observed over 5 minutes of ECT treatment. Following treatment, collagen structural changes were observed with SHG imaging at the ECT sites. Our results suggest the feasibility of EMCR for refractive correction and serve as a stepping stone to the clinical use of this technology.
Conclusion: ECT induced corneal reshaping *via* hydrolysis and collagen re-alignment, suggesting its potential use in refractive correction and a low cost alternative to photorefractive procedures.

Basic Science & Translational Research – *Therapeutic, Radiofrequency Therapy, Skin Surgery*

CHANGES IN MELANIN, MELANOCYTE, MELANOMA CELL AFTER RADIOFREQUENCY IRRADIATION

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Background: Most doctors believe that melanin is not damaged after irradiation of radiofrequency (RF) energy to melanocyte and melanoma cell. However, the character of melanin definitively has semiconductivity and unique electrical property, absorption of broad spectrum light or laser, and other chemical properties. Clinically, we had experienced improvement of melasma, PIH after minimal Invasive Non-Insulated Alternative current Bipolar RF Irradiation (INIABRI) and thus proposed four theories on the causes of melasma improvement and PIH after INIABRI: (1) direct melanin damage theory (2) modulation of vascular component in the dermis (3) accelerated recovery of damaged basement membrane (4) improving dermal environment including inducing collagen production. Of the above four theories, (2)-(4) have been proved by various articles and biopsies, but (1) has yet to be fully understood by investigation.
Study Design/Materials and Method: We investigated change of melanin amount after specific damaged irradiation time and cell specific damaged irradiation time *via in vivo* test.
Results: We found specific irradiation time to damage both melanoma cell and melanocyte. We also found melanin specific irradiation damaged time without cell death after INABRI. We found that above specific irradiation damaged time is not dependent of energy level of RF in specific energy amount
Conclusion: We believe that melanin is directly damaged after INIABRI with specific irradiation time, and so we would report about this investigation results in this conference.

HISTOLOGICAL FINDING OF HUMAN ADIPOCYTE NECROSIS INDUCED BY ELECTROCHEMICAL LIPOLYSIS

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Background: Oxidation-reduction reactions can be initiated in adipose tissue *via* the insertion of passivated needle electrodes into a tumescent surgical field followed by the application of an electrical potential. This electrochemical lipolysis (ECL) induces cellular injury in adipocytes and triglyceride hydrolysis through the spatially localized generation of hydroxide and hydrogen ions. We investigate ECL use in composite human adipose tissue.
Study Design/Materials and Method: Panniculus tissue specimens were obtained following abdominoplasty, and tumesced with normal saline. Two platinum needle electrodes were inserted into each sample through a custom 3D-printed acrylic jig. Voltage was applied at a dosimetry of three to six volts exposed over five minutes. Specimens were hemisectioned through both electrode insertion sites and stained with pH sensitive dye. Computer software was used to calculate the spatial area of electrolytic acid base injury as a function of dosimetry. Samples were evaluated utilizing conventional histology and light microscopy.
Results: Spatial pH distribution mapping revealed that localized electrolytic acid base injury following ECT therapy varied appropriately with dosimetry. Histology and light microscopy showed localized injury with pale, vacuolated adipocyte nuclei, loss of chromatin pattern and nuclear detail, and ruptured adipocyte plasma membranes. Adjacent vessels showed similar histological features of cellular injury.
Conclusion: ECL caused cellular injury in human adipocytes and nearby vessels. With future development, ECL may offer a low-cost, minimally-invasive method of destroying adipocytes for medical or cosmetic reasons.

MICRONEEDLE FRACTIONAL RADIOFREQUENCY-INDUCED MICROPORES EVALUATED BY *IN VIVO* REFLECTANCE CONFOCAL MICROSCOPY, OPTICAL COHERENCE TOMOGRAPHY AND HISTOLOGY

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Background: Microneedle fractional radiofrequency (MNRF) is a minimally-invasive technique that delivers radiofrequency (RF) energy into the skin *via* microneedles. Reflectance confocal microscopy (RCM) and optical coherence tomography (OCT) enable characterisation of device-tissue interactions in *in vivo* skin. The aim of this study is to describe MNRF-induced micropores using RCM and OCT imaging.
Study Design/Materials and Method: Five healthy participants were treated with a 7×7 array of 1500μm microneedles on two adjacent areas of the right hip. One area received MNRF using high RF energy while the other underwent MNRF at low RF-energy. Micropore morphology was evaluated qualitatively and quantitatively with RCM and OCT. To relate imaging with histology, one participant underwent punch biopsy in both areas.
Results: RCM visualised shape, content and thermal induced coagulation zone (CZ) of MNRF micropores. At high RF-energy, micropores showed concentric shape, contained hyperreflective granules and coagulated tissue from epidermis to dermo-epidermal junction (diameter 63–85 μm). Micropores at low RF-energy, presented with a stellate shape, no content and CZs that were visible only in epidermis (CZ thickness 9μm, IQR 8–21 μm). Evaluating OCT, high RF-energy showed deeper (150μm), more easily identifiable micropores compared to low RF-energy micropores (70 μm). Histology showed tissue coagulation to a depth of 1500μm at high RF-energy, while at low RF-energy, disruption was only visible in epidermis.
Conclusion: MNRF micropores show distinct characteristics in both RCM and OCT, depending on RF-energy. These *in vivo*-imaging modalities are complementary and allow combined, qualitative and quantitative evaluation.

OPTIMIZING TISSUE INTERACTION WITH HELIUM DRIVEN PLASMA PLUS RADIOFREQUENCY USING A PORCINE MODEL

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Background: A study of a helium plasma radiofrequency energy device for the coagulation of subdermal tissue was conducted in a live porcine model. The purpose of the study was to determine the impact of multiple treatment variables on internal and external tissue temperatures with the intent of establishing a range of optimal device settings.
Study Design/Materials and Method: Various combinations of device power settings (40%, 60%, and 80%), helium flow rates (1 LPM, 2 LPM, and 4 LPM), and number of passes with the device (3 and 6) were evaluated in a live porcine model (female domestic cross pig). To mimic clinical conditions, a simulated liposuction procedure, including infiltration with Klein solution, was performed prior to treatment with the helium plasma device. Following the simulated liposuction procedure, the helium plasma device was used to treat 18 separate areas. Visualization windows were created to allow for capture of temperature using a high-resolution Forward Looking Infrared (FLIR) camera (FLIR A615). Internal and external tissue temperatures were measured during tissue treatment.
Results: Device power settings ranging from 60% to 80% provided optimal internal temperatures for soft tissue coagulation and collagen contraction. There was no significant trend between helium flow rate and temperatures. The maximum change in external tissue temperature after 6 passes was less than 4°C, meaning that skin temperature would not go beyond 41°C assuming a starting temperature of 37°C (body temperature).
Conclusion: Based on the results of this study, device power settings ranging from 60% to 80% power and a helium flow rate setting of 2 LPM was determined to be appropriate due to clinical performance and ease of gas management at these settings.

DEVICE INDUCED NEOCOLLAGENOSIS; PROFIBROTIC RESPONSE OR TRUE NEOCOLLAGENOSIS?

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Background: Many light and radiofrequency-based rejuvenation devices have claimed to increase the collagen production in skin dermal tissue, each devices cause different thermal damage and therefore different histopathological result. Yet there hasn't been enough scientific evidence to prove whether the result is just profibrotic response or not. The

objective is to find the optimal skin rejuvenation device that shows true neocollagenesis.
Study Design/Materials and Method: We evaluated dermal collagen thickness and gene expression of pro-collagen type 1, pro-collagen type 3, MMP-3 and TGF beta resulted from difference energy based devices in rat model *in vivo*. The wound healing response was evaluated histologically and by RT-PCR on immediate, 1 week, 2 weeks, 4 weeks, 8 weeks and 12 weeks after initial procedure.
Results: At the 12th week observation, the most relevant changes of dermal thickness were found in specimens after treatment with Electrosurgical unit, Fractional CO_2 and Q-switched 1064 nm respectively. Pro-collagen 1 and 3 also found highest in Electrosurgical unit, Fractional CO_2 and Microneedle RF respectively. Dramatic change of MMP and TGF-β is noticeable at the early observation which indicates the wound healing process, and went back to normal level at 12th week. Ratio of pro-collagen 1/3, which is notably important for skin rejuvenation is found lowest after treatment with Q-switched Nd:YAG 1064 nm and Fractional CO_2 respectively.
Conclusion: All devices resulted in higher expression of pro-collagen and dermal thickness yet they all have their drawbacks in certain points. Electrosurgical unit resulted in most significant change but due to the irreversible thermal damage and extreme high pro-collagen result, it is considered as a profibrotic response and not relevant for minimal ablative rejuvenation treatment. Fractional CO_2 and Q-switched Nd:YAG 1064 nm are applicable to face skin rejuvenation treatment as they resulted in thickening of dermal tissue as well as low pro-collagen 1/3 ratio which is similar to neo-collagenesis purpose.

Basic Science & Translational Research – *Therapeutic, Thermal, Skin, Cryolipolisis*

ASSESSMENT OF SUBCUTANEOUS FAT INJURY, DEPTH OF INJURY, AND TEMPERATURE THRESHOLD AFTER CRYOLIPOLYSIS

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Background: Cryolipolysis triggers a natural inflammatory process in which macrophages are recruited, surround and digest dead fat cells. During this process, injured adipocytes must lack metabolic/endocrine activity. Our hypothesis is that macrophage presence and metabolic/endocrine dysfunction are features that may be used to assess injury and extent in adipose tissue with suitable molecular markers. Additionally, extent of injury and its relation to an *in vivo* temperature threshold is not well known. This relationship can be investigated by thermal modeling.
Study Design/Materials and Method: Seven patients with healthy tissue (avg. age/BMI = 41.2/27.67) planned for abdominoplasty were enrolled for cryolipolysis treatments with a small cup applicator at −11°C for 35 or 45 mins. Tissue samples were harvested at 3 days, 1, 3 and/or 12 weeks after treatment. RNA-Sequencing was used to examine differential gene expression of endocrine/metabolic and macrophage mRNA genes and to identify appropriate markers.
Immunohistochemistry by Caspase-3, CD68 and Perilipin-1 were performed. Transient bioheat transfer modeling was done to calculate temperatures within tissue.
Results: Three-days post-treatment, Caspase-3 positive adipocytes were detected. One-to-three weeks post-treatment, differential expressed endocrine/metabolic genes presented substantial downregulation. In contrast, macrophage CD genes were markedly upregulated. Gene expression analysis highlighted Perilipin-1 and CD68 as suitable markers. Perilipin-1 +/− cells were quantified to obtain a relative count of dysfunctional to functional (untreated) adipocytes. CD68 positive staining was used to measure maximal extent of injury into the treated fat layer with average depth of 10.46 mm ($P < 0.035$). The modeling temperature threshold at this maximal depth was 4.9°C.
Conclusion: Perilipin-1 and CD68 are distinctive molecular markers after cryolipolysis. Perilipin-1 can be used to rate dysfunctional adipocytes. CD68 positive staining was used to measure maximal depth of injury in treated fat. Depth of injury from histological measurements can be correlated to a temperature threshold using thermal analysis of *in vivo* treatment conditions.

EFFECTS OF IBUPROFEN ON SELECTIVE CRYOLIPOLYSIS IN A MOUSE MODEL

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Background: We generated a mouse model of localized cold-induced fat loss that might facilitate the optimization of cold exposure parameters and the assessment of adjuvants that could modify clinical performance. As ibuprofen has anti-inflammatory effects and selective cryolipolysis induces a cold panniculitis, administration of ibuprofen is typically avoided in cryolipolysis treatments due to hypothetically impaired treatment efficacy.
Study Design/Materials and Method: C57BL/6J mice were used for localized cold exposures. A custom-built prototype exposed an area of 1.5 cm^2 to cold. Only the right side of the mouse inguinal area was cold-treated and glycerol was used as an antifreeze reagent. We had 4 groups of mice: Group A (mock) was treated at 20°C for 10 minutes, Group B was treated at −10°C for 10 minutes, Group C was treated as Group B with ibuprofen at ∼100 mg/Kg beginning 72 hours before cold exposure, and Group D was treated as Group B with ibuprofen at ∼100 mg/Kg beginning 2 hours after cold exposure. The ibuprofen treatment of groups C and D continued for 1 month after cooling treatment. Subcutaneous fat thickness was quantified at 1 month with optical coherence tomography (OCT). Volumetric OCT data was collected, and the subcutaneous fat layer of several B-scans were manually segmented. To assess the same area, micro-tattoos were physical landmarks.
Results: We observed at 1 month post-treatment a significant reduction of ∼24% of fat layer in all cold treated groups (with or without concurrent Ibuprofen application; $P = 0.0067$ (B), $P = 0.04$ (C) and $P = 0.0061$(D)) as compared to mock controls (A). No significant differences of fat loss were detected related to Ibuprofen (no Ibuprofen, Ibuprofen after, or Ibuprofen before and after cryolipolysis).
Conclusion: The results indicate that selective cryolipolysis-induced fat loss might not be significantly altered by Ibuprofen either before or after cold exposure. Validation of these results are warranted in a clinical study.

Basic Science & Translational Research – *Therapeutic, Thermal, Surgery*

EXTENDING BLOCK LENGTH TO REDUCE TEMPERATURES DURING INFRARED NEURAL INHIBITION

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Background: Infrared neural inhibition (INI) is a spatially precise way to apply neural heat block. Modeling studies suggest that the temperature required for INI can be reduced if a greater length of axon is heated. Here we validate this experimentally by comparing temperature distributions at INI threshold when using one or two adjacent optical fibers. A laser scanning system was subsequently built to apply a more uniform thermal profile with extended block length.
Study Design/Materials and Method: Electrophysiological assessment of radiant exposures at INI thresholds was performed in *ex vivo* Aplysia californica pleural-abdominal nerves ($n = 6$). Radiant thresholds at 1875 nm required to block compound action potential propagation were determined using one and two adjacent optical fibers (400μm cores). Temperature distributions (Tpeak and FWHM along the nerve) at these thresholds were assessed using a fine-wire thermocouple (12.7μm diameter, ~1 ms response time) and magnetic resonance thermometry (9.4T scanner, spatial resolution 0.218 mm). A scanning-beam system was then built (1.1 mm spot diameter, 7 mm max scan distance, 175 Hz max sweep frequency) to apply precise laser heating over a variable length to further investigate the effect of block length.
Results: INI using two adjacent fibers instead of one showed a $23.5 \pm 1.2\%$ (mean ± S.E.M.) reduction in peak temperature rise ($P = 0.00032$) and an increase in FWHM of heating ($P = 0.000024$) from 0.57 ± 0.02 mm to 0.95 ± 0.02 mm. Using laser scanning, a more uniform heating profile was generated over a longer length (FWHM = 5.1 mm), pushing the block lengths that can be tested.
Conclusion: Results show that extending the block length reduces the temperature rise required for nerve block. Reducing temperatures during INI can lower the probability of damage, providing a greater duration of application. With laser scanning, the limits of this effect can be tested, and customized temperature distributions can be optimized for INI in laboratory and clinical use.

Clinical Applications – Cutaneous – *Acne*

A HISTOLOGICAL EVALUATION OF SEBACEOUS GLAND DAMAGE WITH A 1726 nm LASER

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Background: A device that selectively damages sebaceous glands has been thought to be the path to cure acne. A number of researchers have proposed introducing exogenous chromophores into the sebaceous gland to achieve selectivity however a treatment that uses native chromophores would be preferable. Sakamoto has demonstrated that 1726 nm light has a 2:1 preferential absorption of sebum over water. We have worked with a 1726 nm Raman fiber laser with cold air-cooling and real time thermal monitoring to target and damage sebaceous glands.
Study Design/Materials and Method: A 1726 nm laser with a specially designed hand piece with highly controlled air-cooling and real time thermal imaging was used to treat the skin over the neck, back and face of 10 patients in an IRB approved safety trial. We developed a multiple pulse strategy to slowly and preferentially heat sebaceous glands while sparing the epidermis and the surrounding dermis. 3.5 mm punch biopsies were taken 24–72 hours after treatments and evaluated with hematoxylin and eosin staining.
Results: Clinically, small papules were noted in the treatment areas immediately, 24 hours and 72 hours after treatment. Histologically at 24 and 72 hours, destruction of sebaceous glands was noted in the dermis characterized by loss of the definition of the sebocytes, and eosinophilic changes of the basal cell layer of these glands. The collagen surrounding the gland appeared to be preserved with occasional small clots observed in the adjacent blood vessels. The epidermis was preserved and undamaged in all specimens.
Conclusion: We have demonstrated a treatment of acne that takes advantage of native chromophores in the sebaceous glands. Using 1726 nm laser radiation and highly controlled air cooling histological evaluation has demonstrated selective damage to the sebaceous glands. This required a multiple pulse strategy to slowly but preferentially heat these glands over the surrounding dermis. The real time thermal imaging with use of air-cooling was a guide to successful treatments and could also be used to actively monitor and possibly control future treatments.

FIRST CLINICAL USE OF NON-THERMAL NANO-PULSE STIMULATION PROCEDURE TO ELIMINATE SEBACEOUS HYPERPLASIA LESIONS

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Background: The Nano-Pulse Stimulation (NPS) procedure utilizes non-thermal, localized delivery of a timed series of low energy, nanosecond electrical pulses that can trigger regulated cell death. Histology of skin treated with NPS has demonstrated selective non-thermal effects on deep cellular structures, including sebaceous glands, with no apparent damage to the adjacent acellular dermis. This study assesses the clinical reduction of sebaceous hyperplasia lesions observed from this selective destruction of sebaceous glands.
Study Design/Materials and Method: 19 adult subjects with 2–5 SH lesions within study criteria size of less than 2.5 mm in diameter were enrolled. After local anesthesia injection, 1–4 SH lesions were treated in a single session with one SH lesion randomized as an untreated control. At 30 days post-treatment, all treated lesions were evaluated, with lesions rated as partially cleared or not cleared considered eligible for a second NPS treatment, with the final efficacy rating 60 days after the last treatment.
Results: 100% of the lesions from the first eight subjects (31 lesions) met study criteria for efficacy at the 60-day final visit. The 30-day interim efficacy results from the next group of 10 subjects (37 lesions) was 93%. The 3 treated lesions rated as partially clear received a second treatment at the 30-day visit. At the time of publication, no adverse events have been reported. Of 8 patients completing the 60-day visit, the most frequently reported residual skin conditions were hyperpigmentation and small indentations in the skin area, corresponding with the presumed elimination of the original, enlarged sebaceous gland. There were no reports of hypopigmentation. One subject dropped out prior to treatment.
Conclusion: 100% of treated lesions met the study criteria for efficacy for the eight subjects for whom 60-day results were

available. These results, combined with histology of NPS-treated sebaceous glands showing total gland elimination, suggests that rapid and complete lesion clearing is due to the selective effect of NPS in deep dermal cellular structures.

GOLD MICROPARTICLES AND LASER FOR THE TREATMENT OF INFLAMMATORY ACNE VULGARIS: A NEW PARADIGM

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Background: Selective photothermolysis of sebaceous follicles using topically delivered gold microparticles and laser for the treatment of acne vulgaris was previously reported (1). In prior studies of microparticles monotherapy, inflammatory acne lesion burden was reduced by 40–50% at 3 months. Access to the sebaceous follicles is fundamental to the efficacy of gold microparticles. A treatment paradigm using topical retinoid and benzoyl peroxide (BPO) to clear follicular debris and reduce bacterial load prior to the application of gold microparticles and laser is currently being evaluated.
Study Design/Materials and Method: To date, 64 patients with mild to moderate acne vulgaris have been enrolled at 7 European centers. All patients applied topical 0.1% adapalene/2.5% BPO daily for 2–4 weeks, then had three microparticles + laser procedures over a 2-week period. Inflammatory lesion counts (ILC) and Investigator Global Assessment (IGA) are being evaluated at baseline, 2, 3, and 6 months. Concomitant medications are allowed at the discretion of the investigator after the 2-month evaluation. Safety and tolerability are also being assessed.
Results: Interim mean ILC reduction was 66% (n = 58) at 3 months and 79% (n = 38) at 6 months. At 6 months, 63% of patients were clear/almost clear by IGA, and most subjects had used no additional acne medication (61%) or a topical medication only (29%). Mild, transient erythema and edema was reported post-procedure. No serious or unexpected adverse effects were observed. Results through the 6-month evaluation will be reported.
Conclusion: Consensus recommendations for acne treatment emphasize combining therapies to address the multi-faceted pathogenesis. Selective photothermolysis using gold microparticles and laser targets the overproduction of sebum by the sebaceous glands. A short course of retinoid and BPO clears the sebaceous follicles providing improved access for topically delivered gold microparticles. This treatment paradigm delivers meaningful reductions in acne burden and is well tolerated.

Clinical Applications – Cutaneous – *Complications*

COMPLICATIONS FROM LASER TATTOO REMOVAL: HOUSTON, WE HAVE A PROBLEM

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Background: Data presented at the American Society for Laser Medicine and Surgery meeting in 2018 showed that claims related to laser skin surgery are on the rise and, a substantial quantity of injuries are from procedures performed by non-physician providers. Laser tattoo removal is a popular procedure offered by both physician and non-physician facilities. Our practice sought to identify the types, burden and frequency of complications specifically from laser tattoo removal.
Study Design/Materials and Method: The study was conducted at a single dermatologic surgery practice in Houston, Texas. Patients interviewed for the study were those seeking corrective laser tattoo removal after complications from or lack of efficacy of prior treatment elsewhere.
Results: Fifteen Fitzpatrick Skin Type II–V patients with either black or multicolor tattoos were included in the analysis. Patients had an average of 6.67 laser tattoo removal procedures prior to seeking corrective treatment. 73.3% (11/15) reported treatment by a non-physician provider. 73.3% (11/15) had at least one procedure-related complication; the most common complications being dyspigmentation (n = 7) and scarring (n = 5). Of those with complications, 63.6% (7/11) were treated by a non-physician provider. All patients (n = 15) were unsatisfied with the degree of tattoo fading after prior treatments. Nine patients were also interviewed regarding comfort during their prior procedures. 100% (n = 9) reported excessive pain. 66.7% never received any topical anesthesia. No patients received injectable anesthetics. Eight patients were interviewed again after undergoing laser tattoo removal at our practice. All 8 patients underwent treatment with picosecond laser, perfluorodecalin patch and injectable anesthesia. Three patients also received topical anesthesia. 100% (n = 8) reported minimal to no pain during the procedure and an optimal experience.
Conclusion: A substantial quantity of patients seeking corrective laser tattoo removal were previously treated by a non-physician provider. And, non-physician providers were accountable for a higher percentage of the complications seen. The same standard-of-care should be held for all providers (physician and non-physician) performing laser tattoo removal. Limitations include the small sample size and single site design.

POOR WOUND HEALING OF LASER-ASSISTED TUMESCENT LIPOSUCTION ADIT SITES DUE TO POSTOPERATIVE ISOTRETINOIN USE

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Background: Isotretinoin initiated in the perioperative period may significantly impair healing of cannula entry site from to laser-assisted tumescent liposuction.
Study Design/Materials and Method: A 35-year-old Hispanic female underwent laser-assisted tumescent liposuction completely under local anesthesia of her upper abdomen, waist, flanks, bra-back, and inner thighs. She had previously had her upper and lower abdomen and waist liposuctioned with an uneventful postoperative course. 3 weeks prior to repeat liposuction, the patient had been started on isotretinoin (40 mg po BID) for facial acne, which she stopped 3 days before liposuction and resumed 3 days post procedure. Approximately 1100 mL of subcutaneous fat was removed through 15 incisions created by a 1.5 mm punch instrument. Incisions were closed with 4–0 polypropylene sutures, as was standard. At 2-week follow-up, the patient demonstrated multiple atypical open incisions with perilesional erythema and central yellowish fibrinous exudate. Despite a periprocedural course of doxycycline 100 mg po BID x10 days and a negative bacterial wound culture at follow-up, she was started on topical mupirocin BID combined with hydrocolloid dressings. Marked poor wound healing was still noted at 5 weeks post procedure, at which point isotretinoin was stopped.
Results: Dramatic improvement in wound contraction and reepithelialization was noted within 1 week of stopping

isotretinoin. Lesions were fully healed after 1 month, at which point isotretinoin was restarted at 80 mg BID without further complications.
Conclusion: Postoperative isotretinoin use may significantly delay wound healing of cannula entry sites from laser-assisted tumescent liposuction. Isotretinoin should be avoided at least until all entry sites are completely closed.

Clinical Applications – Cutaneous – *Complications and Legal Issues*

GOOGLE AND DERMATOLOGY: WHAT DO WE SEARCH AND WHO CONTROLS THE NARRATIVE?

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Background: Many patients utilize online information to decide what cosmetic and laser procedures they wish to have and from where. The objective of our study was to determine the most popular searches within cosmetic and laser dermatology and use this information to investigate what sources are providing this information.
Study Design/Materials and Method: We cross-measured keyword analytics [Zalea] with the most used Instagram hashtags to obtain the following top 10 online keywords: body contouring, botox, fillers, coolsculpting, laser hair removal, tattoo removal, skin tightening, skin rejuvenation, cosmetic surgery, and liposuction. We then used an advanced google search with a *verbatim* filter and setting the location to United States to obtain the top 25 search results for each of the above keywords. Sources were categorized as professional societies, peer-reviewed journals, non-peer-reviewed online health information, news/media, device/cosmeceutical companies, clinical practices, academic centers, or medical spas.
Results: Top search results for each keyword came from the following: "body contouring" (professional societies, clinical practices, 20% each), "botox" (news/media, 36%), "fillers" (online health information, 28%), "coolsculpting" (clinical practices, 40%), "laser hair removal" (news/media, 32%), "tattoo removal" (medical spas, 28%), "skin tightening" (news/media, 24%), " skin rejuvenation" (medical spas, 28%), "cosmetic surgery" (clinical practices, 52%), and "liposuction" (online health information, 36%). Overall, the most results came from clinical practices (22.8%), online health information sites (19.2%), medical spas (16.4%), and news/media (15.2%). Only 8% came from professional societies, 6.4% from academic centers, and 4.8% from peer-reviewed medical journals. Within clinical practices, 47% were board certified plastic surgeons, 21% board certified dermatologists, and 32% from other specialties or without board certification.
Conclusion: Our study demonstrates the relative paucity of online information regarding cosmetic and laser dermatology from professional societies and academic, peer-reviewed sources. We call for an increased presence of these entities online to help patients navigate the wealth of information and make safe and healthy decisions. Limitations of this study include use of one online forum. Although we excluded all overt advertisements, we could not control for all search engine optimization. Further studies may evaluate other sites (Yelp, Facebook, Instagram) in conjunction with surveys to determine which are the most popular ways to find information.

THE PERCEPTION OF PROCEDURAL VASCULAR LASER PAIN AND DISCREPANCIES AMONGST PATIENTS, PHYSICIANS, AND INDUSTRY

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Background: The inherent subjectivity of pain perception makes pre-procedural pain counseling especially challenging. Setting the wrong pain expectations will negatively impact the patient's experience and affect their physiologic and emotional state. Best practices for sourcing pain related information about a given procedure, however, remains understudied. This retrospective study explores the accuracy of industry materials for describing procedural pain in a clinical trial when compared to subject reported pain scores from the same clinical trial.
Study Design/Materials and Method: Median and mode pain scores were collected from the data of a past clinical trial investigating a dual wavelength laser used for 4 different types of treatments. Industry provided materials were reviewed to ascertain language regarding procedural pain. The principal investigator was interviewed about setting pain expectations during the trial. Subject-reported pain scores and verbal pain descriptors were transferred to validated pain scales, the Numerical Rating Scale and the Verbal Rating Scale, for comparison.
Results: A total of 85 procedural pain scores were collected from 22 subject charts. The average procedural pain scores for 3 of 4 treatment types reported by subjects were translated to entirely different verbal and numerical categories of pain than that described by industry materials.
Conclusion: Industry materials failed to capture the range of procedural pain scores reported by subjects for 3 of 4 treatment types in a clinical trial setting. When counseling patients on procedural pain, physicians should take extra care to not mislead patients and cause undue physiological or emotional stress.

Clinical Applications – Cutaneous – *Fat/Body Contouring*

A NOVEL HANDSFREE APPLICATION OF NON-INVASIVE MONOPOLAR 2 MHz RADIOFREQUENCY TREATMENT FOR REDUCTION SUBCUTANEOUS FAT

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Background: Radiofrequency (RF) technology has been extensively used to address the reduction of wrinkle, cellulite and hyperhidrosis. Non-invasive RF technology has demonstrated a unique advantage of selectively heating relatively large volumes of subcutaneous adipose tissue inducing lipolysis. Our objective was to evaluate a novel monopolar 2 MHz RF device that is able to increase the temperature in the fat without excessively increasing the temperature in the dermis. Ultrasound imaging was used to determine the amount of fat layer thickness reduction after a 15 minute treatment.
Study Design/Materials and Method: This single-center pilot study enrolled fifteen patients, ages 26–52 years with BMI ≥ 18 and ≤ 31. Patients received up to two treatments in

the abdominal and flank region with the monopolar 2 MHz RF device. A temperature-controlled handpiece maintained the skin surface temperature between 43.5°C and 44.5°C for a 15 minute treatment duration. Study inclusion required patients to maintain weight within 5% of the baseline measurement. Patient weight, digital photos, waist circumference, and ultrasound images of the intended treated area were collected at baseline visits and at the 12-week follow-up time points to evaluate treatment efficacy and safety. Primary clinical efficacy of digital photos was determined by two independent blinded evaluators to rate improvement on a quartile scale. Patients completed a patient satisfaction questionnaire regarding their treatments.
Results: Patients tolerated the treatment well with little or no discomfort during the procedure nor prolonged discomfort following the treatment. On all patients who maintained their BMI within 5% of baseline, ultrasound data demonstrated an average $24.3 \pm 2.9\%$ reduction in subcutaneous fat of abdomen and flank. Photographs showed significant to very significant improvement results based on the GAIS scale.
Conclusion: Optimized radiofrequency platforms, such as this 2 MHz monopolar radiofrequency device can precisely target adipose tissue resulting in lipolysis and subsequent reduction fat.

ASSESSING THE SAFETY AND EFFICACY OF DIODE LASER FOR THE TREATMENT OF NON-INVASIVE BODY CONTOURING

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Background: Non-invasive fat reduction and body contouring with cryolipolysis is gaining popularity, but pain and numbness can be an issue. 1060 nm diode laser has been FDA approved for the treatment of fat reduction. The objective of this study aims to evaluate the safety and efficacy of 1060 nm diode laser machine for the treatment of subcutaneous abdominal fat reduction.
Study Design/Materials and Method: This was single-center, open label, retrospective cohort study, using diode laser (parameters: fluence range 0.9–1.4 J/cm^2, 25 minutes for 1 cycle) for non-invasive body contouring. Treatment schedule was 3 treatments, 6 weeks apart, and patients were reviewed at baseline, 6- and 12-week follow-up. Primary endpoint was to evaluate the efficacy of abdominal fat reduction using diode laser by ultrasound measurement of fat thickness at abdomen, right and left flank, at baseline, 6- and 12-week follow-up. Secondary endpoint was assessment of safety of diode laser by documentation of adverse events reported by patients.
Results: A total of 9 patients (1 male, and 8 females) were recruited into the study. A total of 25 treatments were completed. Ultrasound of fat thickness at abdomen was 2.89 cm (0.89–3.36 cm) at baseline, 2.33 cm (1.08–3.31 cm) at 6-weeks, and 2.49 cm (2.05–3.21 cm) at 12-weeks. 5 patients had reduction in abdominal thickness at 6-week follow-up ($P = 0.40$) and 6 patients had reduction at 12-week although this was not clinically significant ($P = 0.67$). Ultrasound of fat thickness at right, and left flank at baseline, 6- and 12-weeks were not clinically significant. 1 patient opted not to continue with treatment after the first session and she developed 6 lumps after initial treatment, this resolved after 5 months without intervention. Painless lumps with bruising was observed in a total of 3 treatments (12.0%), and this resolved spontaneously from 2 weeks to 5 months. 1 patients developed blister at treatment site (4%), topical fucidin ointment was applied twice daily and this resolved after 2 weeks.
Conclusion: Although a reduction of fat thickness based on ultrasound measurement was observed in some patients, this was not statistically significant. Further studies with diode laser in the treatment of non-invasive fat reduction is needed. Long-term side effects of diode laser were not observed, but lumps and bruising developed in some patients. Larger scale studies are needed to observe safety and side effects of this treatment.

CHANGES IN 3D ULTRASOUND MEASUREMENTS IN FAT FOLLOWING TREATMENT WITH A 1060 nm NON-INVASIVE DIODE LASER WITH A PETITE MASK (10.49 cm^2) FOR FAT REDUCTION AND LAX TISSUE IN THE SUBMENTAL AREA

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Background: Non-invasive fat reduction is an efficacious option for body contouring in the flanks, abdomen, thighs, back, and submental area. In this study we examine the results of using a non-invasive 1060 nm diode laser with a petite mask (10.49 cm^2) for fat reduction and for the treatment of lax tissue in the submental area.
Study Design/Materials and Method: 61 subjects enrolled at 3 study centers and received up to two treatments with a 1060 nm laser on the submental area with a petite mask. Adverse events were assessed at all subject visits in addition to phone calls as necessary. Ultrasound images and high resolution 2D photography were taken before treatment and 12-weeks post-final treatment. Ultrasound images were used to measure the fat layer thickness at both timepoints. Photos were analyzed to measure the improvement in the lax tissue of the submental area. Subjects were also asked if the treatment made their chin look more toned.
Results: Of the 61 subjects treated, 58 returned for the 12-week post-final treatment follow-up. All subjects had a reduction in fat thickness ranging from a 0.16 mm to 4.26 mm with a statistically significant (paired t-test, $P < 0.001$) average reduction of 1.62 mm (± 1.02). Post-treatment photos were correctly identified 91% of the time across all subjects. 86% of subject's photos showed an improvement (>20mm^2 improvement) from both the right and left lateral view. 86% of subject's also agreed that the treatment had made their chin look more toned.
Conclusion: The use of a non-invasive 1060 nm diode laser with a petite mask is an effective and safe method for fat reduction and improving the appearance of lax tissue in the submental area.

EFFICACY OF A 1060 nm NON-INVASIVE DIODE LASER FOR THE SUBMENTAL AREA ASSESSED BY 3D PHOTOGRAPHY WITH 6-MONTH FOLLOW-UP

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Background: Previous studies have evaluated and shown that 2D photography is an effective method to evaluate changes in

the submental area following fat reduction treatments. This study was designed to utilize and evaluate the use of a 3D photography system to assess the changes in a subject's submental area up to 6 months after receiving treatment with the 1060 nm laser system.
Study Design/Materials and Method: 18 female subjects with BMIs ranging from 27 to 43 were enrolled and received 2 treatments with the 1060 nm laser system targeting their submental fat. 8 subjects returned for a 3-month follow-up visit after their second treatment to take 3D imaging, while the remaining 10 continued follow-up visits up to 6 months post-treatment with 3D imaging collected monthly. Subject satisfaction was also collected at the follow-up visits.
Results: All subjects were satisfied with their results up to 6-months post-treatment. 3D photography analyzed after treatment showed progressive improvement over the 6 months. At 6 months post 2 treatments showed a compression in the treatment area ranging from 0.63% − 7.48% ($P < 0.001$). A circular area of interest (AOI) with diameter 50 mm was centered in the treatment area with a goal surface area of 20 cm^2. Images were matched and the AOI circle was projected onto the follow-up image showed an average decrease of 0.77 cm^2 ($P = 0.006$) at 6 months. Physician review of photographs showed marked improvement for a majority of subjects.
Conclusion: The use of a 1060 nm non-invasive diode laser for fat reduction of the submental area is shown to be effective up to 6 months post-treatment as measured by subject satisfaction and 3D imaging.

EVALUATING THE USE OF CRYOLIPOLYSIS OF SUBMENTAL FAT IN ASIAN PATIENTS

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Background: Submental fat can pose a significant aesthetic concern for some patients. Cryolipolysis is a non-invasive procedure that has been FDA approved for the treatment of submental fat. The objective is to assess the effect of cryolipolysis in the treatment of submental fat in Asian patients.
Study Design/Materials and Method: 6 patients (all female) with a mean age of 46.5 (range 30–63 years) of Asian descent were recruited into the study. All received 1 session of cryolipolysis, with treatment parameters of cooling temperature: −11°C and 45 minutes of treatment time. Assessments were done based by photography at baseline, 6- and 12-weeks post-treatment.
Results: Physician assessment was done based on comparing submental convexity at baseline, and 6- and 12-weeks post-treatment on a 5-point score; −1 = worse, 0 = no change, 1 = slight improvement, 2 = much improved, 3 = drastically improved. At 12-week post cryolipolysis treatment, 1 (16.7%) patient had much improvement, 3 (50%) patients had slight improvement, 1 had no change, and 1 had worsening of submental fat volume. Overall, 4 (66.7%) of patients had some improvement in reduction of submental fat after treatment with cryolipolysis. There were no reported numbness or side-effects from treatment at 12-week follow-up.
Conclusion: Cryolipolysis treatment appears to be safe and effective for the treatment of submental fat in our study group.

LONG-TERM FOLLOW-UP ON PATIENTS WITH HIFEM-INDUCED ABDOMINAL TISSUE CHANGES: MRI AND CT ASSISTED QUANTIFICATION OF MUSCLE GROWTH AND FAT REDUCTION

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Background: Various researchers recently investigated the immediate efficacy of High-Intensity Focused Electromagnetic technology (HIFEM) for abdominal shaping. Due to HIFEM's relative novelty, additional follow-up data is critical for proper assessment of long-term efficacy. This study evaluated HIFEM patients 9–13 months post-treatment.
Study Design/Materials and Method: Twenty-one patients (16 females, 5 males), previously treated with HIFEM and evaluated with either MRI or CT scans were recalled for further evaluation. Patients underwent an additional CT or MRI scan on average 332.6 ± 88.5 days after their last procedure, with no further treatments administered. Data were compared to the original pre-treatment and post-treatment measurements. Sub-umbilical and epi-umbilical scans were evaluated for abdominal muscle thickness, subcutaneous fat changes, and diastasis recti. Patients were also screened for adverse events related to earlier treatments.
Results: The 38 patients in the original studies showed an 18.9% (3.85 ± 2.2 mm) fat reduction and 15.6% (1.6 ± 0.8 mm) muscle thickening 1–2 months after treatment. In the original follow-up at 1–2 months, recalled patients had on average 17.46% (3.67 ± 2.2 mm) reduction in abdominal subcutaneous fat thickness, and 17.66% (1.79 ± 0.73 mm) increase in muscle thickness, with 10.76% (1.82 ± 1.46 mm) reduction in diastasis (all $P < 0.05$). Nine to thirteen months post-treatment, we observed 14.63% (2.97 ± 2.11 mm) fat reduction, 19.05% (1.89 ± 0.88 mm) muscle thickening, and diastasis reduction of 10.46% (1.96 ± 1.71 mm) compared to the baseline (all $P < 0.05$). Weight did not change significantly ($P > 0.05$). No adverse events were reported.
Conclusion: Patients preserved and maintained the majority of the original muscle growth, fat reduction, and reduction in diastasis on average 333 days post-treatment. Data suggests that HIFEM-induced fat reduction is maintained longer-term than initially expected. Muscle growth demonstrated additional improvement. Continuing treatments might be beneficial and necessary over the course of 4–6 to 12 months afterward as a preventative measure to minimize muscle deconditioning. Further studies evaluating different follow-up therapy will help optimize treatment timing for the long-term.

MULTICENTER PIVOTAL STUDY OF THE SAFETY AND EFFECTIVENESS OF A TISSUE STABILIZED-GUIDED SUBCISION PROCEDURE FOR THE TREATMENT OF CELLULITE – 5 YEAR UPDATE

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Background: Tissue release (subcision) for cellulite has been practiced for decades with limited success. A novel procedure has been developed which stretches and stabilizes tissue while providing integrated anesthesia delivery and precise depth control of minimally-invasive tissue release. The pivotal study supported the FDA-clearance of this novel tissue stabilized-guided subcision (TS-GS) system as an effective and safe treatment for the long term improvement in the appearance of cellulite in the buttocks and thighs with no diminishment of

benefit for up to 3 years. The purpose of this study update was to determine the safety and efficacy of TS-GS for maintained improvement in the appearance of cellulite of the buttocks and thighs out to 5 years.
Study Design/Materials and Method: A pivotal prospective multi-centered safety and effectiveness study enrolled 55 subjects. Subjects underwent a single treatment, and were followed at regular intervals out to 5 years. Safety was assessed and effectiveness was evaluated by blinded, independent physician evaluators using randomized (before and after) professional photographs and a novel, validated 6 point (0–5) cellulite severity scale.
Results: Treatments were well tolerated with minor expected side effects that resolved quickly. Improvement was rapid and pronounced. 37 subjects completed 5 year follow-ups. Five year average reduction in cellulite severity was 1.8 points ($P < 0.0001$) and masked evaluator improvement was 92.8%. At 5 years, evaluators rated 100% of subjects as having noticeable improvement and 78.4% of subjects were either satisfied or very satisfied.
Conclusion: Tissue release at precise depths leads to significant, lasting improvement in cellulite. The results of this study demonstrates that a single treatment with a novel TS-GS release system improved the appearance of cellulite on the thighs and buttocks through 5 years of follow-up with minimal adverse effects.

RETROSPECTIVE EVALUATION OF NEEDLE BASED BIPOLAR RADIOFREQUENCY *VS* 1440 nm FIBER BASED LASER WITH 3 AND 12 MONTHS FOLLOW-UP

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Background: The objective of this retrospective analysis was to evaluate and compare results on skin tightening and fat reduction on face and neck after one single treatment of a needle based radiofrequency device compared to a fiber-based laser device.
Study Design/Materials and Method: Retrospectively 20 female patients with mild to moderate skin laxity and submental fat deposit cervico-mental angle scale (CAS) grade 2 and 3 were selected. Each group consisted of 10 patients age 42–68 years. All patients received one single treatment in topical and tumescent anesthesia. Group 1: age Ø 52.14 fractional radiofrequency (FRF) with real-time temperature feedback mechanism delivered through five 32g-needle electrode pairs in an angle of 25° for the reticular dermis or seven 32g-needle electrode pairs in an angle of 75° for deeper layers and fat at 67°C and 3-4sec. Group 2: age Ø 56.33 1440 nm laser energy (LAST) was emitted with an 800μm side-firing-fiber and a temperature-sensing cannula through three small incisions for shallow heating of collagen fibers within the dermis and for the deeper layers and fat. Fat was removed through vacuum aspiration using a 2 mm cannula. Documentation and evaluation was done before, at 3 and 12 months after treatment. Photo documentation was evaluated by doctor and independent observer using the global aesthetic improvement scale GAIS. Patients rated skin tightening and firmness as overall satisfaction.
Results: In both groups patients tolerated treatment well with a downtime of 4–5 days. There was no statistically difference in patients' satisfaction at 3 and 12 months. Physician and blinded investigator rated equal improvement after 3 and 12 months.
Conclusion: Results on skin tightening are well comparable. LAST had more effect in fat reduction due to vacuum aspiration. FRF has the advantage of being less invasive, of allowing treating the perioral area and improvement of skin texture and thickness showed to be better due to the mechanical effect of the microneedling.

SUBCUTANEOUS ADIPOSE HYPERTHERMIC RESPONSE TO SELECTIVE HEATING FOLLOWING TREATMENT WITH A NON-INVASIVE MONOPOLAR RADIOFREQUENCY TREATMENT AT THE 2 MHz FREQUENCY

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Background: Radiofrequency (RF) devices provide a non-invasive, safe and effective means of body contouring, without the risks associated with surgery. Previous studies have established the safety and efficacy of the 1 MHz RF device for adipolysis to include histology from treated patients. At present, there are no histological studies examining the effectiveness of the 2 MHz frequency for adipolysis. This study evaluates the long term treatment outcomes of the cutaneous and subcutaneous adipose tissue after treatment with the monopolar 2 MHz RF device for fat removal.
Study Design/Materials and Method: Eleven subjects, ages 24–60 years with BMI ≥ 20 and ≤ 30, scheduled for an abdominoplasty were enrolled into a single-center, prospective, open-labeled study. All subjects received a single RF abdominal treatment and assigned to one of six sub-groups. Sub-group assignment determined when biopsies from RF treated and contralateral control areas were harvested for histological processing: immediate, 10, 20, 30, 60, or 90 days post-treatment. All incisional skin biopsies were processed for review by two board certified dermatopathologists.
Results: Control histology showed normal subcutaneous adipose tissue. In contrast, histology from RF treated areas showed adipocyte necrosis and/or inflammatory cell response to the subcutaneous fat. Apoptosis was observed immediately and out to 60 days following treatment for six subject with peak adipocyte death and fat necrosis occurring 30-days post-treatment. Acute inflammation was present immediately and out to 20 days following treatment. Sixty days following treatment, fat necrosis is still present although confined to small, focal areas with less than 20% of the subcutaneous affected. At the final 90 days time point, there was minimal inflammation. The epidermal and dermal tissues were unaffected by RF treatment.
Conclusion: A single 2 MHz RF treatment leads to fat necrosis within the subcutaneous tissue while the dermal and epidermal layers remain unaffected by treatment.

TEMPERATURE INVERSION CURVES OF THE ADIPOSE TISSUE RESPONSE TO A BODY CONTOURING TREATMENT WITH A 2 MHz RADIOFREQUENCY DEVICE

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Background: Radiofrequency (RF) technology has been used extensively to treat unwanted fat bulges with little or no downtime. Non-invasive monopolar RF has the advantage of selectively heating relatively large volumes of subcutaneous

adipose tissue. In this study, we evaluated a novel 2 MHz RF device with a unique applicator architecture to heat adipose tissue in various anatomical areas. The spatial distribution of heat on the skin surface in relation to the corresponding temperature rise in adipose tissue was characterized to define ideal treatment temperatures for adipolysis while controlling for pain. The primary goal was to measure the temperature profile in the skin and the fat over a 15 minute application. Models and previous studies have shown a more homogenous and fat selective heating profile at 2 MHz *vs* 1 MHz.
Study Design/Materials and Method: Four patients received a body contouring treatment with a monopolar 2 MHz RF device to the abdomen and arms. RF was delivered to the body using temperature-controlled handpieces (40 cm^2) which continuously reported skin surface temperatures in real time. Treatment temperatures were maintained at the skin surface between 43.5°- 44°C for the abdomen and 42°- 42.5°C for the arms over a 15 minute period. The tip location was identified *via* ultrasound over the abdomen (three patients) and posterior arm (one patient). The temperatures were measured over a 15 minute time period. Skin surface temperatures were verified using an infrared camera before, during, and after treatment. Subcutaneous fat temperatures were collected using fluoroptic probes at a depth of 7–8 and 13-15 mm for the arm and abdomen, respectively. Probe depth insertion was measured using ultrasound images prior to and after treatment. Patient comfort levels were collected during treatment.
Results: Infrared images indicated therapeutic heating of the skin matched skin temperature readouts from the device (via thermistors built into the monopolar heating surface). Measured subcutaneous thermal profiles resulted in a thermal inversion curve in which therapeutic peak fat temperatures >45°C were approximately 3 – 4°C warmer than the skin surface. Pain was variable but usually mild to moderate over the initial 5 minutes, than diminishing in the last 10 minutes. A steady state temperature was achieved after the first 5 minutes into the 15 minute application. Side effects included erythema lasting 20 minutes after the procedure.
Conclusion: The novel monopolar RF device creates a temperature inversion curve which selectively heats the subcutaneous fat resulting in a therapeutic hyperthermia required for adipolysis while maintaining a reduce temperature on the skin surface. The 2 MHz treatment creates a more homogeneous thermal profile resulting in a more comfortable treatment.

THE EFFECT OF REPEAT CRYOLIPOLYSIS TREATMENTS ON THE FLANKS

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Background: Studies have demonstrated that cryolipolysis can safely and effectively reduce subcutaneous fat layer thickness. This study was conducted to examine the safety and efficacy of receiving repeat treatments at 12-week intervals.
Study Design/Materials and Method: A total of 5 sites treated 44 flanks using a contoured cup vacuum applicator. Each flank received 2 treatments at 12 weeks apart with currently recommended parameters. The final follow-up was completed at 12 weeks post-second treatment. Efficacy was evaluated by ultrasound measurement of fat layer thickness and assessment of pre- and post-treatment photographs using a seven-point Global Aesthetic Improvement Scale (GAIS). Subject satisfaction questionnaires were collected at 12 weeks after each treatment.
Results: No serious adverse events were reported. All reported side effects were expected and resolved spontaneously within days post procedure. In few rare cases, mild numbness lasted for up to 3 months post-procedure. Ultrasound measurements were available for all 44 treated flanks, demonstrating a mean fat layer reduction of 3.5 ± 1.9 mm after first treatment and 5.1 ± 2.6 mm reduction after second treatment. Grading of the pre- and post-treatment photographs using the GAIS showed a mean score of 1.0 ± 0.7 and 1.4 ± 0.7 after first and second treatment, respectively. 86.4% of subjects showed at least 1-point improvement (obvious improvement) after first treatment, which further improved to 90.9% after second treatment. Of these subjects, 15.9% of subjects scored at least 2-point improvement (marked improvement) after first treatment and 43.2% after second treatment. The overall satisfaction reported by the subjects was 72.7% and 86.4% at 12 weeks after first and second treatment, respectively.
Conclusion: Receiving repeat cryolipolysis treatments on the flank was safe and effective. While majority of subjects (86.4%) showed reduction after first treatment, a second treatment delivered 12 weeks later further reduced subcutaneous fat layer thickness by 46%, as measured by ultrasound. Subject self-reported satisfaction rate further supports this finding.

Clinical Applications – Cutaneous – *Hair*

STIMULATING HAIR FOLLICLES IN ALOPECIA PATIENTS WITH FRACTIONAL PHOTOTHERMOLYSIS

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Background: Fractional photothermolysis for the treatment of hair loss (alopecia) is controversial due to current reports of varying efficacy. Laser treatment creates areas of microthermal injury with resultant wound healing, angiogenesis, increased cytokine/growth factor delivery, as well as stimulation of the dermal papillae causing accelerated telogen to anagen change in the hair cycle and transforming vellus to terminal hairs. In the literature, lasers including the 1064 nm neodymium-doped yttrium-aluminum-garnet, 1550 nm erbium glass, 1927 nm thulium and 10,600 nm ablative fractional carbon dioxide have been tested with an average 20% to 60% increase in hair density after multiple treatment sessions. The objective of this study is to demonstrate the use of fractional photothermolysis to stimulate scalp hair growth in a group of patients with varying alopecia diagnoses.
Study Design/Materials and Method: The scalps of patients with non-scarring and scarring alopecias were treated with six sessions of fractional photothermolysis using 1550 nm. Hair regrowth was measured using physician and patient-reported qualitative scales, as well as quantitatively using optical coherence tomography (OCT). In an effort to promote transformation of vellus to terminal hairs, a subset of patients were treated with adjuvant topical minoxidil 5% or topical finasteride 1% daily.
Results: During treatment, patients demonstrated a significant increase in hair density as measured by OCT. Qualitatively, both physicians and patients reported hair growth as "improved" to "very improved". The addition of topical minoxidil

or finasteride resulted in non-significant increases in hair density compared to laser therapy alone. Hair density decreased after fractional photothermolysis was discontinued.
Conclusion: Fractional photothermolysis using 1550 nm can stimulate scalp hair follicles. Current literature supports the use of low-energy, high-density laser treatment protocols to induce hair growth. It appears fractional laser therapy is effective in treating both non-scarring and scarring types of alopecia, however further studies are required.

Clinical Applications – Cutaneous – *Hyperhidrosis*

BOTULINUM TOXIN *VS* MICROWAVE TREATMENT FOR HYPERHIDROSIS

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Background: The aim of this work is to summarize our pilot experience with two methods for the treatment of hyperhidrosis and excessive sweating (subjectively perceived). It is a dermatosurgical microwave treatment (MWT) that aims to be the permanent solution of the problem and treatment with botulinum toxin (BTX), which is effective for about 48 weeks.
Study Design/Materials and Method: 32 patients previously treated with BTX (dilution 200 U/ml, 100–200 U of BTX per axilla, 10 U per point) treated with MWT (Miradry, 2–3 Tx 1 Mo apart). Subjective and objective evaluation of results.
Results: 24 from 32 will prefer BTX next time (75%), 6 from 7 will prefer BTX in the case of hyperhidrosis; up to 10 Mo paresthesia (1 case) in MWT group with 3 cases up to 2 Mo; skin texture changes and superinfection (1 case) in MWT group. No side-effect for BTX group. Only 22 from 32 patient had very significant or full permanent therapeutical effect after MWT.
Conclusion: Higher satisfaction and no side-effects with BTX treatment event if it is not permanent. Need of repetitive treatment with MWT but even after some treatment we have some non-responders or partial responders.

MICROWAVE THERMOLYSIS FOR THE TREATMENT OF RESIDUAL LIMB HYPERHIDROSIS: A PERMANENT SOLUTION FOR A COMMON PROBLEM IN THE AMPUTEE POPULATION

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Background: Amputation stump dermatoses have a high prevalence and impact amputee quality of life and use of medical resources. Over 50% of individuals with limb loss report frequent skin problems on the residual limb (51% Vietnam veterans and 58% of OIF/OEF veterans). In addition to dermatologic conditions attributable to or exacerbated by hyperhidrosis, there are significant functional concerns caused by hyperhidrosis of the residual limb. Hyperhidrosis can lead to impaired fit of the prosthetic limb despite numerous attempts with different sockets and liners. Injuries can result as the patient's limb loses suction with the prosthetic resulting in falls and further injuries, and in extreme cases the potential for prosthetic abandonment. There is currently no permanent solution to residual limb hyperhidrosis.
Study Design/Materials and Method: Our prospective research protocol has enrolled 8 of 20 subjects with residual limb hyperhidrosis with at least one treatment of microwave thermolysis utilizing the non-invasive microwave technology (Sientra) at the San Antonio Military Health System with the remainder to be treated by the ASLMS Annual Meeting. Patients underwent two complete treatments of the residual limb under local tumescent anesthesia spaced three months apart. Validated subjective endpoints were measured before and after treatment to include the dermatology life quality index (DLQI), hyperhidrosis disease severity scale (HDSS), and the severity of prosthesis severity scale (SPSS). Objective measurements included gravimetric analysis of sweat production and transepidermal water loss (TEWL) as measured by a validated device (Delfin Technologies) for the quantification of hyperhidrosis in the axillae, palms, and soles and is a non-invasive device. Measurements were performed at rest, after 15 minutes of cardiovascular exercise with a minimal heart rate of 65% of goal for age group, and three months after treatment completion. To be included in the study, the residual limb had to be stable for 3 months and above and below the knee amputations were enrolled.
Results: Our results are preliminary, but appear very promising clinically and in early data sets. We intend to present objective and subjective findings at the Annual ASLMS meeting for the first time. To date, a trial of this size, at this site and with the included subjective and objective measurements has not been presented in the literature and we believe this study will have significant impact upon how residual limb hyperhidrosis is managed in the traumatic and non-traumatic amputee populations.
Conclusion: Microwave thermolysis permanently improves residual limb hyperhidrosis, minimizing the functional and symptomatic impairments caused by excessive sweating at the residual limb-prosthetic interface and improving patient quality of life.

Clinical Applications – Cutaneous – *Laser-Assisted Delivery*

RE-PIGMENTATION OF HYPOPIGMENTATION: RANDOMIZED, BLINDED HEAD TO HEAD STUDY FRACTIONAL LASER *VS* LASER-ASSISTED DELIVERY OF BIMATOPROST *VS* NOVEL EPIDERMAL MELANOCYTE HARVESTING SYSTEM

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Background: Hypopigmentation is a common cutaneous manifestation that frequently poses a therapeutic challenge for dermatologists. Current treatments have varying efficacies and rarely provide patients with long-term results. However, new treatments are emerging, and head-to-head studies comparing these treatments are warranted.
Study Design/Materials and Method: In this prospective, randomized, IRB-Approved, double-blinded study, 40 subjects with moderate to severe hypopigmentation were randomized into one of four treatment arms; non-ablative fractional laser, fractional ablative laser, fractional ablative laser with laser-assisted delivered bimatoprost, and an epidermal harvesting system.
Results: All patients in this study showed improvement regardless of the treatment modality. The average improvement score was calculated on a 0 to 4 scale, and Group 3 (fractional ablative laser & bimatoprost) was found to have a significantly higher rank than any other treatments, with 76% of the

patients exhibiting at least a grade 3 (over 50%) improvement over the treatment course. Group 1 (non-ablative fractional) also had a significantly higher average score compared to group 2 (fractional ablative laser).
Conclusion: New and emerging therapies have shown promise to help re-pigmentation of cutaneous hypopigmentation. In this head-to-head trial, it was shown that laser-assisted delivery of bimatoprost had a statistically significant improvement over the other three modalities.

TOPICAL ABLATIVE FRACTIONAL LASER-ASSISTED DELIVERY OF CISPLATIN + 5-FU FOR BASAL CELL CARCINOMA: AN EXPLORATIVE, OPEN LABEL CLINICAL TRIAL

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Background: The chemotherapeutic agents, cisplatin and 5-fluorouracil (5-FU), exhibit synergistic activity against epithelial tumors, but as a topical treatment for basal cell carcinoma (BCC), the combination is limited by insufficient dermal penetration. In an explorative clinical trial, we investigate tumor response, local skin reactions (LSRs), safety, as well as cutaneous and systemic drug biodistribution following topical laser-assisted cisplatin + 5-FU treatment of BCCs.
Study Design/Materials and Method: Patients with histologically-verified, low risk superficial or nodular BCCs on the face/scalp (< 20 mm), trunk or extremities (< 50 mm), were included in the study. Imaging-guided tumor demarcation was performed using optical coherence tomography, reflectance confocal microscopy and high-intensity focused ultrasound. Treatment areas, consisting of tumors + 5 mm margin, underwent irradiation with an ablative fractional laser (AFL) at 40 mJ/mb, 5% density, 300 Hz. Following 60 min topical exposure to cisplatin solution (1 mg/ml), 5-FU cream (50 mg/ml) was applied to treatment areas and left under occlusion over 7 days. Clinical LSRs were evaluated 1-, 5- and 14 days as well as 1- and 3-months post AFL. Tumor response was assessed clinically and by imaging at 1- and 3-months follow-up, supported by histological clearance at 3 months. In a subset of patients, cisplatin and 5-FU detection in treated tumors and plasma was performed 24 hrs post-treatment, using imaging-based and quantitative mass spectrometry, respectively.
Results: Nine patients have currently undergone treatment with AFL-assisted cisplatin + 5-FU. Interim results reveal moderate LSRs on days 1–5, consisting of erythema, edema and epidermal erosion, most pronounced corresponding to BCC lesions. No side effects have been observed. Preliminary *in vivo* biodistribution results further demonstrate AFL-assisted cisplatin uptake extending to deep skin layers. Based on drug quantification in plasma samples, no systemic 5-FU uptake was shown despite 24 hour AFL-assisted topical exposure.
Conclusion: Topical AFL-assisted cisplatin + 5-FU has potential as a tolerable, non-surgical treatment option for BCC. Study results will be presented in their entirety at the 2019 ASLMS Conference.

Clinical Applications – Cutaneous – *Novel Uses Of Lasers For Medical Conditions*

PHOTODYNAMIC THERAPY IN COMBINATION WITH TOPICAL IMIQUIMOD AND CRYOSURGERY FOR EXTRAMAMMARY PAGET'S DISEASE

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Background: Extramammary Paget's disease (EMPD) is a rare low-grade cutaneous malignancy affecting apocrine gland-bearing areas most commonly on the perineal skin. Standard treatment is surgical excision often with skin grafting but local failures and recurrences are frequent. Photodynamic therapy (PDT) may represent a useful treatment option for extensive, non-invasive EMPD, alone or as part of multimodal therapy. The objective of this study was to determine if PDT in combination with imiquimod and/or cryosurgery could induce remission of EMPD.
Study Design/Materials and Method: Two elderly male patients (69 years old, 83 years old) presented to our clinic with a chronic (>6 months) rash in the groin. Punch biopsies of affected areas were performed with pathology revealing a diagnosis of EMPD. Treatment options and expectations were discussed including observation, Mohs micrographic surgery followed by skin grafting, radiation therapy, or a combination of imiquimod and PDT. In light of significant multifocal tumor burden, our patients opted to proceed with the combination of imiquimod (three-to-five times/weekly) and PDT (once/monthly), followed by cryosurgery to any residual lesions. Our PDT regimen consisted of applying 5-aminolevulinic acid (ALA) to affected areas. After a brief incubation period, we used a Wood's lamp to illuminate pathologic areas prior to treatment with red light PDT. Incubation and treatment duration were initially adjusted for both clinical efficacy (peeling, fluorescence under Wood's lamp) and safety (pain, swelling, blistering erythema). Surveillance biopsies, guided by black light fluorescence, were additionally undertaken at selected intervals to gauge treatment response.
Results: Our 69 year old patient received a total of 6 monthly PDT treatments followed by quarterly PDT treatments. Treatment resulted in significant improvement in the appearance of the lesion, and subsequent surveillance biopsies revealed no evidence of residual disease. This patient has had no clinical signs of disease for >6 years. Our 83 year old patient underwent 12 sessions of PDT over a period of 20 months. After 9 PDT sessions, 3 surveillance biopsies were performed, of which one area (right inguinal crease) in the groin was positive for EMPD. After the patient's most recent 12^{th} PDT session, cryosurgery was then started to potentiate destruction to these residual lesions. Throughout both of our patients' treatment courses, they have continued to remain asymptomatic from disease and there have been no clinical signs, including lymphadenopathy, warranting further management.
Conclusion: The utility of topical photodynamic therapy (PDT) in the treatment of EMPD has been reported. Combination of PDT with imiquimod and/or cryosurgery may offer a therapeutic alternative to conventional surgery for the treatment of large or recurrent multifocal perineal EMPD or in elderly people who wish to avoid surgery. These non-invasive techniques can induce a complete or near-complete response in patients and may be used to treat many lesions in a single session while preserving cosmetic and/or functional anatomy.

SUCCESSFUL TREATMENT OF MULTINUCLEATE CELL ANGIOHISTIOCYTOMA WITH FRACTIONATED ABLATIVE CO_2 LASER: CASE SERIES OF 2 PATIENTS

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Background: Multinucleate cell angiohistiocytoma (MCA) is a rare and benign vascular proliferation often refractory to treatment. The etiology of this condition is unknown, and it is clinically characterized by well-circumscribed red-brown dome-shaped papules and papules often presenting on the hands, wrists, and legs. In the literature, approximately 76 cases of MCA have been reported. This abstract presents 2 patients with MCA successfully treated with several sessions of ablative fractionated CO_2 laser.

Study Design/Materials and Method: A case series of 2 patients with MCA treated with CO_2 laser is presented in this abstract. A MedLine and Google Scholar search using the key word "multinucleate cell angiohistiocytoma" was completed and summarized for the literature review.

Results: A 59-year-old dentist presented with MCA on the dorsal hands. He had unsuccessfully been treated with intralesional and topical triamcinolone, cryotherapy, and 595 nm pulsed dye laser. After 4 sessions of fractionated ablative CO_2 (Lumenis, 25% density, 30J/cm^2, 300 Hz) followed by triamcinolone 40 mg/cc rubbed into the treated areas, the MCA lesions demonstrated significant flattening and improvement in color. A 42-year former dental hygienist presented with biopsy proven MCA on the anterior thighs, after failing treatment with intralesional triamcinolone, cryotherapy, and 755 nm long-pulsed alexandrite laser. She sustained noticeable improvement after 3 sessions of fractionated ablative CO_2 laser (Lumenis, 25% density, 20 J/cm^2, 300 Hz) followed by triamcinolone 40 mg/cc rubbed into the treated areas. A review of the literature revealed approximately 60 relevant articles (76 cases), of which 3 cases were treated with laser therapy with argon, intense pulsed light, and pulsed dye laser.

Conclusion: This is the largest case series of successfully treatment of MCA with fractionated ablative CO_2 laser. Of interest, both patients were involved in the dentistry profession. This report offers additional treatment options for MCA.

Clinical Applications – Cutaneous – *Picosecond Laser*

FRACTIONAL PICOSECOND LASERS FOR REJUVENATION AND ACNE SCAR REDUCTION

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Background: Picosecond fractional lasers are able to create small wounds presumably by laser induced optical breakdown. We studied the use of a PS fractional laser in the treatment of mottled pigment, texture, wrinkles, and acne scars. This study was designed to evaluate the efficacy of this laser (Lumenis, Israel) for facial skin rejuvenation.

Study Design/Materials and Method: This study included up to 8 visits at the clinic: initial screening/consultation, 3 treatment (Tx) visits at monthly intervals, and 3 follow-up (FU) visits at 1, 3 and 6 months after the last treatment visit. Subject satisfaction was measured at all time points. A total of 17 healthy subjects at a single site, aged 18–70 years old with at least two facial sub-areas with visible wrinkles with or without pigmentation and/or acne scars, were enrolled at the time of abstract submission. The laser is an 800 ps fractional system with nominal 120 μm microspot size, and with a 10×10 mm macrospot diameter. About 100 beamlets are directed to the skin per single pulse. The laser was swept over the skin at 10 Hz for a total of 4–6 passes per region. Photographs were taken with both polarized and unpolarized flash digital SLR camera at all time points. No anesthesia was applied. Patients had the option of requesting refrigerated air if pain was excessive. In the first 3 patients, test spots were applied in the postauricular region.

Results: During treatment the mean pain score was 1.5 and 3.5 on a 1–10 VAS, respectively, for 1064 nm and 532 nm, respectively. The 1064 nm portion was carried out first and immediately thereafter the 532 nm portion of the treatment was carried out. A plasma was observed about (1–2 cm) above the skin surface during the 1064 nm application, whereas no obvious plasma was observed during the 532 nm treatment. The focal point of the 1064 nm diffracted beam was just proximal to the tip of the spacer (at skin surface) at the end of the hand piece, thus the slightly expanded microbeam reduced the plasma at the surface. By avoiding plasma at the surface, gross petechiae were avoided. Immediately after the 1064 nm treatment, trace erythema was observed, and after the 532 nm treatment, 2/4 erythema was recorded. Very small white dots were observed on the skin after the 532 nm laser, but only seen with magnification. Patients reported average downtime (time for erythema to resolve) of 0–1.5 days. Most patients returned immediately to work and social activities. Preliminary data showed mild improvement in wrinkles and acne scars and moderate improvement in overall pigment dyschromia. Biopsy data is pending.

Conclusion: A picosecond 1064/532 nm fractional laser achieves reduction in fine lines, acne scars, and pigment with little pain and downtime after a series of treatments.

PICOSECOND TREATMENT OF FACIAL PHOTOAGING USING A NOVEL HOLOGRAPHIC AXICON

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Background: There are many options to treat photoaging. We present the results of a split face study, comparing a holographic beam-splitting optic on one half of the face to a novel holographic axicon beam-splitting optic on the other half. The axicon beam-splitting optic reshapes the full beam into 101 focused beamlets with a low fluence ring around the focused beamlet.

Study Design/Materials and Method: 7 subjects (6 female and 1 male) with Fitzpatrick skin II–III were treated (randomized split-face) at a wavelength of 532 nm with the pure beam-splitting and the novel axicon optic. A total of 4 treatments spaced 4–10 weeks apart were administered, with effective treatment energies ranging from 0.4- 0.7 mJ/μBeam in the focused microbeam and corresponding ring fluence of 0.1–0.4 J/cm^2 in the low fluence background for the axicon handpiece and treatment fluence range of 0.4- 0.8 mJ/μBeam for the pure beam-splitting handpiece. Three reviewers performed blinded assessment of digital, cross-polarized photographs taken at baseline and 12-week follow-up following the last treatment. Assessment was done using a 11-point clearance scale varying from 0–100 in steps of 10.

Results: Blinded observers correctly identified the axicon treated side in 19 out of 21 image sets (90.5%). The reviewers rated the axicon side as having an average improvement of 58.1% versus an improvement of 33.8% for the pure beam-

splitter ($P < 0.0005$; 2-sided paired t-test). Side effects were limited to mild to moderate edema, mild to moderate erythema, and mild petechiae which resolved within 2–4 days after treatment. One subject reported a recurrence of melasma. Pain scores were moderate with an average pain score of 5.4 ± 2.1 (mean + SD) on a 11-point scale varying from 0–10.
Conclusion: This study demonstrates improved treatments of photodamaged facial skin when using a novel holographic axicon optic.

Clinical Applications – Cutaneous – *Pigment*

A RANDOMIZED CONTROLLED TRIAL OF PICOSECOND ALEXANDRITE LASER WITH A DIFFRACTIVE LENS ARRAY COMPARED TO TRIPLE COMBINATION CREAM FOR MELASMA IN ASIANS

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Background: The Triple Combination Cream (fluocinolone acetonide 0.01%, hydroquinone 4%, tretinoin 0.05%) had been proven as a standard treatment but with less patients' compliance and more adverse effects. The purpose of this study is to compare the efficacy and safety between picosecond alexandrite laser with a diffractive lens array in different treatment sessions and triple combination cream for melasma patients.
Study Design/Materials and Method: This was a randomized, controlled, investigator-blinded study. Twenty-nine patients with Fitzpatrick skin type IV were recruited and randomly assigned for Group A1 (three sessions) or Group A2 (five sessions) of picosecond alexandrite laser at 4-weeks interval or Group B triple combination cream once daily treatment. Melasma Area and Severity Index (MASI) score and VISIA imaging system analysis was utilized for assessment at baseline, 12 and 20 weeks.
Results: Ten (A1), Ten (A2) and Six (B) subjects completed the study. MASI were significantly improved in all groups at 12 and 20 weeks. The improvement rate of MASI among three groups showed no significant difference. VISIA imaging system analysis presented improvements in spots, wrinkles, texture, pores, UV spots, brown spots and porphyrins in two groups received laser treatments. Significant percentile ranking improvements of spots ($P < 0.05$) and porphyria ($P < 0.05$) were noted at 12 week after three sessions of laser treatment. Significant greater log value of percentile ranking improvement rate in vascularization at 20 week was observed in Group A2, comparing to Group A1.
Conclusion: The results show that picosecond alexandrite laser with a diffractive lens array can achieve comparable efficacy for treating melasma in Asian compared to triple combination cream. The changes in vascularization observed in laser-treated groups suggests that picosecond alexandrite laser did effectively target the vascular component of melasma. Furthermore, the improvement in overall skin texture, especially in spots and porphyrins were also observed with VISIA imaging analysis in laser-treated groups.

COMBINATION, SEQUENTIAL TREATMENT USING FRACTIONATED 1550 nm, FRACTIONATED 1927 nm AND PICOSECOND 532 nm LASERS IMPROVES MODERATELY SEVERE PHOTODAMAGE IN A SINGLE TREATMENT SESSION

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Background: There is great interest in achieving dramatic improvements in photodamage with minimal anesthesia requirements, minimal downtime and few treatment visits. We report our experience treating photodamage using a one session combination treatment procedure with sequential application of a fractionated 1550 nm, fractionated 1927 nm and picosecond 532 nm laser.
Study Design/Materials and Method: Fifteen subjects with skin phototypes I–III and moderately severe photodamage underwent a single session combination laser treatment with follow-up visits at 1 month and long term follow-up visits ranging from 3 to 18 months. Topical anesthetic was applied for one hour prior to treatment (lidocaine 23%/tetracaine 7% for the face and lidocaine 7%/tetracaine 7% for the chest). A fractionated 1550 nm laser (Solta Medical, Pleasanton, CA) was applied first, with pulse energies of 40–50 mJ and 6–8% skin surface coverage. A fractionated 1927 nm laser (Solta Medical, Pleasanton, CA) was applied second, with pulse energies of 10–15 mJ and 20% skin surface coverage. A 350 ps 532 nm laser (Candela Corp, Wayland, MA) was then applied to the discrete pigmented lesions (lentigines and macular seborrheic keratoses). Cold air cooling was used during laser treatment. Subjects applied a moisturizer 2–3 times per day for a period of 4–5 days. Standardized 35 mm digital photographs were obtained before treatment and at the follow-up visits. Blinded photographic analysis was performed using a quartile grading system, and physician and subject ratings were recorded using a Global Aesthetic Improvement Scale (GAIS).
Results: Subjects rated their discomfort during laser treatment as mild to moderate. All subjects experienced mild erythema and edema lasting 2–4 days, followed by 2–3 days of light exfoliation. There were no instances of crusting, vesiculation, hyperpigmentation, hypopigmentation or scarring. One hundred percent (15/15) of subjects achieved greater than 50% improvement and 80% (12/15) of subjects achieved 76–100% improvement in their photodamage after a single treatment session. All subjects were rated as much improved or very much improved by subjects and physicians. Improvement was evident at the 18-month follow-up visit.
Conclusion: One session of sequential, combination treatment using a fractionated 1550 nm, fractionated 1927 nm and picosecond 532 nm laser produced dramatic improvements in photodamage, including pigmented lesions, skin texture and fine wrinkling. This one session combination treatment is a low risk, minimal down time procedure that produces consistent results and high patient satisfaction.

LASER-ASSISTED DRUG DELIVERY OF TOPICAL TRANEXAMIC ACID USING A 1927 nm NON-ABLATIVE FRACTIONAL THULIUM LASER FOR THE TREATMENT OF MELASMA

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Background: Melasma is a common disorder characterized by hyperpigmented patches on sun exposed facial sites. Although several treatment options exist, the optimal treatment of this condition remains a challenge. The purpose of this study was to evaluate the safety and efficacy of a novel 1927 nm non-ablative thulium laser followed by topical tranexamic acid for the treatment of melasma.
Study Design/Materials and Method: A total of 10 female subjects were treated with a novel 1927 nm non-ablative fractional thulium laser (Lutronic, Billerica, MA) with 5 treatments administered 3 to 4 weeks apart at an average of 8 mJ per microbeam and 6 passes per treatment. Subjects received topical anesthesia with EMLA cream applied for one hour before treatment. Tranexamic acid 1.2% was applied topically immediately post-treatment and twice daily for 7 days after each treatment. Outcome measures included percentage reductions in Melasma Area and Severity Index (MASI) and in the Melasma Quality of Life scale (MELASQOL) at one month follow-up. Clinician and Subject Global Aesthetic Improvement Scales (CGAIS, SGAIS) and patient satisfaction were also assessed. Further outcome data will be obtained at 3 month and 6 month follow-up.
Results: The 10 subjects enrolled had a mean age of 44 years and had Fitzpatrick Skin Types II (20%), III (40%), and IV (40%). The procedure was well tolerated with low pain scores and no serious adverse events. At one-month follow-up, MASI reductions were noted in all subjects and MELASQOL improvements were noted in 83% of subjects who completed follow-up. The mean percentage reduction in MASI was 48% and the mean MELASQOL improvement was 25%. Physician assessment noted improvement in 66% of subjects. Subject satisfaction was moderate to high with 83% indicating satisfaction or mild satisfaction and 83% self-reporting moderate improvement in their melasma. Half the subjects reported improvement in skin texture, tone and quality.
Conclusion: These results indicate that laser-assisted drug delivery of topical tranexamic acid with a novel 1927 nm non-ablative fractional thulium laser is safe and moderately effective for the treatment of melasma with near term follow-up.

MULTI-CENTER STUDY OF A NOVEL, INTELLIGENT DEVICE DELIVERING CONTROLLED, EPIDERMAL FREEZING FOR THE TREATMENT OF BENIGN PIGMENTED LESIONS

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Background: Current energy-based modalities to treat dyschromia are often associated with pain and epidermal adverse effects. This study evaluated a novel device which administers controlled, localized freezing to the epidermis for treatment of benign pigmented lesions.
Study Design/Materials and Method: A prospective, non-randomized, multi-center study was conducted to evaluate the safety and effectiveness of a novel treatment for benign pigmented lesions. Enrollment included healthy subjects having clinically benign appearing lesions on any anatomic location. An FDA-cleared system utilizing a distinct range of temperatures, administered controlled, localized freezing to the epidermis. Subjects reported pain scores during treatment, and visual improvement at the 1, 2, 3, 6, 9, and 12-month follow-up. Investigator grading of pigmentation and overall global aesthetic improvement was recorded at all follow-ups. Standardized photographs were captured at all time points.
Results: Three consecutive study phases evaluated feasibility, dosage, and parameter optimization. 321 subjects with skin types I–V and diagnosed with lentigines, seborrheic keratosis, melasma, poikiloderma, or various other hyperpigmentation disorders were treated. Treatment consisted of a range of 165–223 kJ/m^2 of extracted heat. In all phases, treatment was well-tolerated with a 2.87 average pain score on the 0–10 VAS scale, and no device-related adverse events were reported. Transient skin changes post-treatment included mild erythema and lesion darkening. Clinical outcomes improved with each study phase; concluding with a high rate of procedural success and aesthetic improvement at two months post.
Conclusion: Treatment of benign pigmented lesions typically use various energy-based devices, yet pose the risk of post-inflammatory hyperpigmentation, and are associated with both considerable procedural pain and social downtime. This novel, intelligent device delivering controlled, localized epidermal freezing provides improvement of benign pigmented lesions, with minimal procedural discomfort and no downtime. Additionally, this novel modality offers promise for application to other skin indications.

THE EFFICACY IN TREATMENT OF FACIAL MELASMA WITH THULIUM 1927 nm FRACTIONAL LASER-ASSISTED TOPICAL TRANEXAMIC ACID DELIVERY: A SPLIT-FACE, DOUBLE-BLIND, RANDOMIZED CONTROLLED PILOT STUDY

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Background: In the treatment of melasma, inconsistent results, treatment failure, and adverse events remain to be key problems. This study explores the efficacy of laser-assisted delivery of topical tranexamic acid (TXA) as a treatment option for melasma.
Study Design/Materials and Method: Thirty-three healthy adults were enrolled to this split-face, double-blind, randomized controlled pilot study. Each subject was treated with thulium 1927 nm fractional laser with two passes on the whole face and four passes on melasma patches, once a week for four sessions. Immediately post laser, participants were assigned by block randomization to apply tranexamic acid occlusion on one side of the face and nightly for 5 weeks and the other side with normal saline solution occlusion and nightly for 5 weeks. Results at baseline, one, four, and 12 weeks post-treatment were evaluated with mMASI scoring system, melanin index using a skin colorimeter, and average melanin using reflectance mapping. Parameters were compared using paired-samples t-test.
Results: Majority of participants (93.9%, $n = 31$) were female and two (6.1%) were male, with a mean age of $47.3 + 10.1$. Most participants (90.9%) were Fitzpatrick skin type IV. While significant decrease in mMASI scores from baseline were noted in both groups only after third treatment, statistically significant improvement was already noted in the group with laser-assisted TXA delivery after second treatment ($P = 0.028$). There was also a significant difference between mMASI scores between the two groups 3 months after the fourth treatment ($P = 0.023$) and in decrease in average melanin from baseline at

3 months after the fourth treatment ($P = 0.024$). Results with more number of subjects and longer-term of follow-up at 6 months will also be presented.
Conclusion: This study shows that thulium 1927 nm fractional laser-assisted topical TXA delivery decreases the duration of melasma treatment compared to laser alone.

TREATMENT OF MELASMA USING A COMBINED TREATMENT APPROACH OF A LOW-FLUENCE QUALITY-SWITCHED (QS) Nd:YAG LASER; MECHANICAL EXFOLIATION, TOPICAL HYDROQUINONE, AND PHOTOPROTECTION: A PROSPECTIVE, BLIND, RANDOMIZED, SPLIT-FACE, PLACEBO-CONTROLLED TRIAL

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Background: Safety and efficacy of lasers in melasma treatment remain controversial. Numerous studies have supported combination treatment using laser and topical therapy for better long-term results, yet our current knowledge is limited to mostly retrospective, observational, or inadequately controlled studies. We sought to prospectively compare the efficacy of combination therapy using low-fluence quality-switched (QS) Nd:YAG laser, mechanical exfoliation (ME), 4% hydroquinone, and broad-spectrum SPF 50 sunscreen (HQ + SPF) for treatment of melasma, compared to the same combination therapy using placebo laser treatments.
Study Design/Materials and Method: Prospective, randomized, split-face study was performed at a single center from October 2017-August 2018. Patients were randomized and blinded to receive "treatment" (laser + ME+ HQ+ SPF) versus "control" (placebo laser + ME+ HQ + SPF) on either right or left side of the face at 0, 4 and 8 weeks, with follow-up at 1, 3, and 6 months after last laser treatment. Treatment efficacy was assessed using melanin index (MI) scores, and the modified Melasma Area and Severity Index (mMASI) scores by three, independent, blinded-evaluators.
Results: Eleven of fifteen patients completed the study. At 3-month follow-up the reduction of MI was similar in both the treatment and control sides ($50.7 + 41.4$) *vs* ($48.7 + 37.1$) ($P = 0.78$). Similarly, there was no significant difference in mMASI scores between the two sides ($1.3 + 1.1$) *vs* ($1.4 + 0.9$) ($P = 0.29$). More than 60% of all patients reported marked to excellent (50–100%) improvement in both the treatment and control side (73% *vs* 64% of patients respectively). Overall, >70% of patients were somewhat to extremely satisfied at the 3-month follow-up visit, however satisfaction report favored the treatment side (91% *vs* 73% of patients respectively). There were no adverse events during the 9-month study period.
Conclusion: Combination of three monthly treatments using low-fluence QS Nd:YAG laser, mechanical exfoliation, 4% HQ twice daily, and broad-spectrum SPF 50 sunscreen resulted in similar reduction of both mMASI and melanin index scores compared to same combination therapy using a placebo laser treatment.

Clinical Applications – Cutaneous – *Rejuvenation*

A HIGH INTENSITY ULTRASOUND TECHNOLOGY FOR TREATMENT OF FACIAL AND SUBMENTAL FINE LINES AND WRINKLES

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Background: Several energy-based technologies exist as treatment options for facial and submental wrinkles. Ablative lasers are effective but require downtime, non-ablative lasers and radiofrequency treatments have variable efficacy and require several treatments, and high intensity focused ultrasound traditionally has high pain scores. We describe a novel high intensity (non-focused) ultrasound-based device designed to target the mid-dermis. The goal of this prospective clinical study was to assess the efficacy, safety and tolerability of this device for this application.
Study Design/Materials and Method: A total of 28 subjects with mild to moderate facial and submental wrinkles were treated with a single treatment using a high intensity ultrasound-based device (Yokneam, Israel) on the face and neck. Topical anesthesia with EMLA and optional IM Toradol were used for pain control. Results were assessed using the Fitzpatrick elastosis score (1 to 9), physician and patient global aesthetic improvement scale, and patient satisfaction.
Results: At 12-week follow-up, 89% of patients showed improvement by physician assessment. Seventy nine percent of patients reduced their elastosis scores: 57% improved by 1 point and 22% improved by 2 points on a scale of 1 to 9. Consistent with the improvement in elastosis scores, 78% of patients reported improvement and 75% were satisfied or very satisfied. Subjects reported moderate pain scores ranging from 5 to 7.4 during treatment. Anticipated treatment responses were limited to mild erythema and edema, and these resolved without intervention at 1-week follow-up.
Conclusion: This study demonstrates the safety and efficacy of a novel high intensity ultrasound-based device. A single treatment with no downtime was associated with some pain but resulted in improvement in facial and submental fine lines and wrinkles with high patient satisfaction.

A RANDOMIZED, SPLIT-FACE CLINICAL TRIAL OF THE PICOSECOND FRACTIONAL 1064/523 nm Nd:YAG LASER *VS* THE 1927 nm NON-ABLATIVE FRACTIONAL LASER FOR THE TREATMENT OF FACIAL PHOTODAMAGE

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Background: The aim of our study was to compare the efficacy and safety of the picosecond fractional 1064/532 nm Nd:YAG laser with the fractional non-ablative 1927 nm thulium fiber laser for the treatment of the visual signs of photoaging of the face.
Study Design/Materials and Method: This was a prospective, evaluator-blinded, split-face clinical trial. Twenty subjects ages 18–85 with at least moderate photoaging were enrolled. Each side of the face was randomly treated with either the picosecond fractional 1064/532 nm Nd:YAG laser or the fractional non-ablative 1927 nm thulium fiber laser, receiving a total of 3 treatments 4 weeks apart. The primary endpoint was the degree of rhytids, laxity, dyschromia, erythema-telangiectasia, keratoses, and texture rated on a 4-point scale and performed by a blinded evaluator at baseline, and 12, 20, and 30 weeks from baseline. The secondary endpoints were the global aesthetic improvement score, investigator satisfaction questionnaire, and a subject satisfaction questionnaire administered at weeks 12, 20, and

30. A detailed analysis of recovery time and adverse events were assessed through a 14-day subject diary administered after each treatment.
Results: For the primary endpoint, both lasers significantly improved the degree of dyschromia, erythema-telangiectasia, keratoses, and texture compared to baseline ($P < 0.01$ for all endpoints). Deep rhytids and skin laxity did not significantly improve with either laser. Additionally, there were no significant differences between the two lasers at any time point. The investigator global aesthetic improvement score and investigator satisfaction score were slightly higher for the side treated with the thulium fiber laser at 1 month following the final treatment session ($P < 0.01$) but by 3-months follow-up there were no longer any significant differences with scores in the "improved" to "much improved" and "satisfied" to "extremely satisfied" categories respectively for each laser. Subject satisfaction was rated as "satisfied" to "extremely satisfied" at the 3-month follow-up visit and did not differ between lasers. Interestingly, significant differences were revealed with the post-treatment diary entries. The fractionated picosecond laser treated side experienced significantly less redness on days 3 and 4, less swelling on day 5, less crusting on days 1 through 9, less peeling on days 3 through 5, and less itching on day 4. Post-operative pain was minimal on both sides and was not significantly different.
Conclusion: This was the first split-face, randomized, evaluator-blinded clinical trial comparing fractionated picosecond laser with traditional non-ablative fractional photothermolysis. The clinical efficacy of the two modalities was shown to be equivalent. However, the fractionated picosecond laser resulted in significantly reduced post-operative recovery time. These data have the potential to dramatically improve patient experience and are immediately applicable in clinical practice.

FRACTIONATED LASER RESURFACING USED TO PREVENT ACTINIC NEOPLASIA, A PROSPECTIVE INTERVENTIONAL STUDY

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Background: Age and UVB exposure are the major risk factors for actinic neoplasia. Our group has previously shown that fibroblast senescence with concomitant lack of IGF-1 (insulin-like growth factor-1) production as we age negatively impacts how epidermal keratinocytes respond to UVR-induced DNA damage, which ultimately leads to the development of NMSC (nonmelanoma skin cancer). Wounding strategies including fractionated laser resurfacing (FLR) therapy decreases numbers of senescent fibroblasts in geriatric dermis, increases the dermal expression of IGF-1, and corrects the inappropriate UVB responses as we have reported in human geriatric skin. Of importance, these beneficial effects of FLR are present up to two years post-treatment. We now present initial results of a prospective interventional study to assess the short- and long-term effects of FLR on actinic neoplasia in geriatric subjects.
Study Design/Materials and Method: Geriatric subjects (age >65 years old) with at least five actinic keratosis (AK) on each dorsal forearm/wrist underwent FLR using YSSG 2900 nm randomized to left or right side based on social security number. The treated sites were allowed to heal and the numbers of AKs were mapped and counted over time and compared to baseline pre-treatment numbers.
Results: 34 subjects were recruited thus far. The numbers of AKs were decreased in the FLR-treated skin at both 3 and 6 months. The mean change in number of AKs at 6 months was −4.70 (95% CI −11.16 − 1.76) on the treated arm and +3.16 (95% CI −3.43- 9.77) on the un-treated arm ($P < 0.05$).
Conclusion: These studies represent the first interventional study to assess the ability of fractionated laser resurfacing treatment to prevent aging-associated actinic neoplasia. Our initial findings demonstrate that FLR is an effective treatment modality for AKs. We anticipate that over time this interventional study will reveal the effectiveness of FLR to prevent actinic neoplasia.

Clinical Applications – Cutaneous – *Scar*

AN ATLAS OF OPTICAL COHERENCE TOMOGRAPHY IMAGES OF SCARS AND THEIR APPLICATION TO THE ASSESSMENT OF SCAR PATHOLOGY AND SEVERITY TO GUIDE LASER TREATMENT PARAMETERS

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Background: The effective treatment of scars in terms of selection of therapies and the choice of treatment parameters depends on the accuracy of the treating clinician's knowledge of the underlying scar pathology, especially the scar thickness. Often this is difficult to judge visually or by palpitation. In recent years Optical Coherence Tomography (OCT) has shown promise as a real-time skin imaging technology capable of revealing and objectively measuring sub-surface skin microstructure, including thickness of epidermis, blood vessel density and depth, and local variations in tissue scattering attributable to collagen changes. Therefore, OCT may be of direct use in the imaging of scars in routine care for the optimization of treatments.
Study Design/Materials and Method: Under IRB approval, 150 scars were imaged using OCT, capturing both the vascular and structural data. Scars imaged included burn, surgical, traumatic, keloid, acne and other scar types of varying severity and age. Scars of hypertrophic, atrophic and normal type were included. All scars were additionally photographed. The OCT images were compared with OCT images of normal skin.
Results: Found that OCT revealed clear morphological differences in the epidermis and dermis between scars and normal tissue, and between scar subtypes. Obvious features in the OCT images relating to scar pathology included changes to the epidermis thickness; skin surface texture; DEJ rugosity; blood vessel density; vessel shape and diameter; vessel direction and vascular network connectivity; dermis scattering intensity and non-uniformity. Each scar subtype showed consistent characteristics distinct from the scar subtypes. The OCT images showed the depth to which these scar features extended, up to 1 mm (the limit of the imaging depth) enabling objective assessment of scar thickness.
Conclusion: The accurate diagnosis and assessment of depth of scars can be challenging. OCT is a powerful new objective tool for the clinician to utilize in the pursuit of effective treatment strategies.

HIGH *VS* LOW DENSITY FRACTIONAL LASER IN HYPERTROPHIC POSTBURN SCARS: A RANDOMIZED CLINICAL TRIAL

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Background: Fractional CO_2, has been shown to be effective in improving pigmentation, pruritus, pain, tightness of post-burn scars, by breaking down the collagen with organized columns of microthermal injury, with the ability to heal in a more organized pattern. There is no *consensus* on the fractional laser parameters used in the treatment of post-burn scars. The investigators adapted variable densities in the treatment of scars, some adopted the higher density, aiming at more ablation and release of the scar tension, while others used lower density to avoid the commonly reported side effects. Our aim of work was to compare effectiveness of different densities of fractional CO_2 laser in the treatment of post-burn scars.
Study Design/Materials and Method: The study included 25 patients of both sex with post-burn scars, with three separate post-burn scars or large scars divided into three parts (A, B, C), that were randomly assigned to treatment with low, medium and high density fractional CO_2 laser. The degree of improvement was assessed clinically through Vancouver scar score and POSAS score and histologically through evaluation of collagen (Masson's Trichrome stain) before and one month after end of therapy.
Results: High density parameter showed significant improvement in VSS and POSAS assessment scores ($P < 0.001$), vascularity, pliability, relief and surface area are significantly improved with high density parameter ($P < 0.001$). Histopathological evaluation revealed a significant improvement in the mean area percent of collagen in the three used parameters, with significant improvement with high density parameter ($P < 0.001$).
Conclusion: The study concluded that fractional CO_2 laser is an effective and safe modality for the treatment of burn scars, and when used in high density gives more improvement of burn scars from clinical and histopathological aspects due to high collagen remodeling.

EFFICACY OF COMBINED INTENSE PULSED LIGHT (IPL) WITH FRACTIONAL CO_2 LASER ABLATION IN THE TREATMENT OF LARGE HYPERTROPHIC SCARS: A PROSPECTIVE, RANDOMIZED CONTROL TRIAL

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Background: Scar rehabilitation is a complex, multi-disciplinary process that incorporates medical, surgical, and occupational/physical therapeutic measures to best restore function and cosmesis. As different lasers are indicated for the management of each of these features, multi-laser therapeutic approaches offer the theoretical benefit of a more comprehensive approach to scar revision.
Study Design/Materials and Method: In this, IRB-approved, prospective, randomized, controlled single-site study, twenty-three (23) healthy adults with large ($< 100\,cm^2$) hypertrophic scars had scars randomized to one of three treatment arms: A) IPL and fractional ablative CO_2 laser (AFL), B) CO_2 AFL alone, and C) control (no laser treatment). Subjects underwent a total of four treatment sessions at 6-8-week intervals, followed by follow-up visits at one, three, and six months following the last treatment session.
Results: Of the 23 subjects completing the study, 100% of subjects showed a significant decrease in the POSAS scale after the series of four treatment sessions. In all categories of the MSS, the control group had zero to mild improvement, the CO_2 AFL laser alone had mild significant improvement and the CO_2 AFL and IPL combination group had an overall higher improvement compared to the other groups.
Conclusion: Treatment with combined IPL and CO_2 AFL demonstrated higher average improvements across the majority of assessed scar domains, as compared to both control and CO_2 laser alone. These findings support the use of a multi-photo-thermolytic approach with combined IPL and CO_2 AFL in the treatment of hypertrophic scars.

NON-ABLATIVE AND NON-FRACTIONAL LASER TREATMENT OF SURGICAL AND LASER INDUCED CUTANEOUS SCARRING

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Background: Scarring which occurs after surgical or laser therapy is even more objectionable than other traumatically induced scars in terms of patient acceptance and tolerance. These iatrogenic undesired changes include hypertrophic scars, erythema and pigmentation. Gentler non-ablative and non-fractional laser therapy offers the patient the potential for excellent results with reduced post therapy undesired changes and adverse effects.
Study Design/Materials and Method: Twenty patients ages 20 to 55 years with Skin Types I–III presented with either post-surgical or post-laser procedural scarring. All had hypertrophic scarring and erythema, and 13 had hyperpigmentation. Thirteen patients had post-surgical scars. The rest had either IPL or laser induced scars. Three patients were treated exclusively by the pulsed dye laser. Three patients by low dose QS YAG, the rest by low dose combination QS and long pulsed YAG. Treatment sessions were administered generally 4 to 6 weeks apart. Two blinded observers graded before and after photos and were not informed as to which photos were before or after.
Results: Using a 1–5 severity score for scarring, with 5 being the most severe, the mean score was 4.1. All photos were correctly chosen as to before and after. A total of 24 separate sites were evaluated by a 0 to 100% improvement (complete resolution) scale. The mean level of improvement was 78%. Seventeen sites (68%) were graded 80% and greater and 6 (24%) at 90% or greater. Both erythema and hyperpigmentation dramatically improved. A minimum of 8 procedures per patient were administered. Aside for immediate post dye laser darkening, the therapies were very well tolerated and only exhibited transient erythema.
Conclusion: Non-ablative and non-fractional laser systems are a desirable choice for post-surgical and post-laser scar therapy. There were excellent scar improvement outcomes. The level of patient tolerance and acceptance may be greater with these systems than with other more aggressive laser approaches.

WHAT IS THE LARGEST SIZE FULL-THICKNESS SKIN INJURY THAT CAN HEAL WITHOUT A SCAR?

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Background: Conventional autologous skin grafting is a life-saving procedure with significant donor site morbidity. We hypothesize that harvesting skin tissue in very small columns would significantly reduce these adverse effects. This concept is based on fractional photothermolysis in which a multitude of small, full-thickness thermal burns are produced by a laser on the skin with rapid healing and no scarring. Our study objective is to demonstrate the safety of skin micro-biopsies and to determine the biopsy size limit at which healing occurs without a scar.
Study Design/Materials and Method: A pilot study was designed to evaluate the healing response after collecting skin micro-biopsies of different sizes from pre-abdominoplasty skin. Seven test sites were performed per subject using biopsy sizes between 200μm to 2 mm in diameter. The Patient and Observer Scar Assessment Scale (POSAS), donor site pain scale, subject satisfaction survey, side effect assessment, clinical photographs, and histology were taken to the evaluate the efficacy and safety of the study procedure.
Results: To date 5 patients have completed the study. Average final POSAS-Investigator scores (scale range 5–50) were 200μm: 5.6, 400μm: 5.2, 500μm: 7.0, 600μm: 6.8, 800μm: 8.2, 1 mm: 9.6, 2 mm: 13.2. Average final POSAS-Subject scores (scale range 6–60) were 200μm: 6.0, 400μm: 6.0, 500μm: 6.6, 600μm: 6.4, 800μm: 7.2, 1 mm: 7.4, 2 mm: 10.0. Maximum donor site pain was 3/10 associated with a 2 mm biopsy site. Side effects included mild or moderate bleeding, oozing, scabbing, redness, swelling, hyper/hypopigmentation, and scarring. No severe side effects were reported. All subjects agreed that micro-biopsies performed at 200-600μm were cosmetically sound, whereas one subject reported an undesirable cosmetic outcome with 800μm, 1 mm, and 2 mm biopsy sizes.
Conclusion: This study demonstrates that a clinically identifiable scar occurs after full-thickness skin wounds greater than 400-500μm in diameter. Overall the study procedure was found to be safe and highly tolerable by the subjects.

Clinical Applications – Cutaneous – *Tattoo*

ACOUSTIC SHOCK WAVE DEVICE IMPROVES CLEARANCE IN PICOSECOND LASER-ASSISTED TATTOO REMOVAL: RESULTS FROM A PILOT STUDY

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Background: Multiple-pass treatments in conventional laser tattoo removal are limited by the development of cavitation bubbles and vacuoles within the epidermis and dermis that result from the rapid heating of tattoo particles. While methods such as the R20 protocol and the PFD patch enhance tattoo removal through epidermal clearance, they have no effect on deep-intradermal pigment associated vacuoles. We tested the efficacy of an acoustic shock wave device as an adjunct treatment to standard laser therapy.
Study Design/Materials and Method: One patient with Fitzpatrick type III skin, two patients with type IV skin, three patients with type V skin, and one patient with type VI skin participated in this study. 6 black and 1 multi-colored (black, green, yellow, and pink) tattoos were treated at 6–8 week intervals using a commercial 1,064 nm picosecond Nd:YAG laser and a perfluorodecalin patch. At each treatment session, tattoos were treated with two passes. After each laser pass, one-half of the target area was treated with an acoustic shock wave device. Photographs were obtained at each visit and the percentage of tattoo pigment clearance at 8 weeks following each treatment session was determined by a blinded assessor.
Results: 86% of treated tattoos showed greater pigment clearance at the area treated with the acoustic shock wave device when compared to the standard treatment. On average, the areas treated with shock waves showed 25% more clearance of pigment from baseline when compared with areas treated with conventional treatment. There were no side effects associated with the use of the device.
Conclusion: Treatment with the acoustic shock wave device improves tattoo clearance, presumably through increasing lymphatic drainage and stimulating metabolic activity, and may have a role as an adjunct to laser-assisted tattoo removal.

EFFICACY OF MULTIPLE-TREATMENT SESSIONS IN INDUCING ENHANCED TATTOO REMOVAL USING A COMBINATION OF MULTIPLE-PASS Q-SWITCHED Nd:YAG LASER TREATMENT AND THE RAPID ACOUSTIC PULSE (RAP) DEVICE

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Background: Effective and efficient tattoo removal remains a clinical challenge. Previously, we demonstrated that by dispersing the epidermal and dermal vacuoles "whitening" generated during the initial laser pass, the Rapid Acoustic Pulse (RAP) accessory device allows for delivery of multiple laser passes in one laser tattoo removal treatment session, and results in statistically significant improvement in tattoo clearance after just one session when compared to laser treatment alone. Here, we sought to evaluate the long-term efficacy of RAP in inducing superior tattoo clearance compared to conventional single-pass laser treatments, when used in up to three multi-pass laser treatment sessions.
Study Design/Materials and Method: The efficacy of the RAP device in combination with Q-switched 1064 nm Nd:YAG (QS) laser was evaluated in a single-center prospective study. A total of 12 black tattoos were treated in up to three treatment sessions at 0, 20, and 28 weeks. For each session, each tattoo was treated in two zones, separated by a control zone, using either multiple passes of QS laser alternating with a RAP device application (Laser + RAP) or a single QS laser treatment (Laser-Only). Percent tattoo fading was assessed for all treatment sites at 3-months and 6-months following the third QS laser treatment session.
Results: At the 3-month follow-up visit, 100% of tattoos ($n = 12$) treated with Laser + RAP had a "complete" response (76–100% fading), compared to only 17% of tattoos treated with Laser-Only ($P < 0.001$). At the 6-month follow-up, average fading ($n = 5$) for Laser + RAP was 98% versus 75% for Laser-Only treatment ($P < 0.05$).
Conclusion: The RAP device, when used as an accessory to the Q-switched 1064 nm laser, resulted in a statistically significant increase in tattoo fading compared to the clinical standard of laser-only treatments. Moreover, its use in as little as three treatment sessions resulted in near-complete removal of tattoos.

Clinical Applications – Cutaneous – *Tightening*

A PILOT STUDY, COMBINING UNIPOLAR RADIOFREQUENCY AND POLYDIOXANONE (PDO) THREADS IN TREATING UPPER LID AND BROW PTOSIS IN ASIAN PATIENTS

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Background: For Asians, upper lid ptosis is a common consequence of ageing. Descending of the upper lid over the entire pupil is commonly gives the patient a tired or sad look often prompting consult. Each year there is an increasing demand for upper blepharoplasty, although considered as a minor operation and often laser-assisted techniques are utilized, surgical complications such as under/over correction, scarring and infection may occur. Because of this problems patients are willing to undergo non-invasive alternatives. Unipolar Radiofrequency uses thermal heating to the dermis creating a reparative response that stimulates fibroblast to synthesize and lay down new collagen. The lack of epidermal involvement has greatly decreased the risk for injury. Polydioxanone PDO threads is fast becoming an accepted adjunct to facial rejuvenation using absorbable threads similar to surgical sutures inserted into the cutis, to continuously stimulate collagen synthesis.

Study Design/Materials and Method: Randomized control trial of 20 patients all female was selected, aged 30–50 years old. All subjects had 1 session of non-ablative unipolar RF eye tip, 225 shots per side, concentrated on the upper lid and brow area at 2.5–3.5 Jcm^2, this was followed by insertion of 6 mono 30 mm PDO threads on the lateral brow area per eye. For evaluation digital photos and measurement of the Margin reflex distance and Margin crease distance before the procedure and 3 months after the procedure was recorded. Gathered data was tallied, interpreted and statistically analyzed. Patient satisfaction was also determined. Side effects and complications were also noted.

Results: A single combined treatment of non-ablative unipolar RF on the upper lid and brow area and PDO thread insertion on the lateral brow showed an average increase in Marginal reflex distance of 2 mm (mean difference) for the right eye and 2.2 mm (mean difference) for the left eye after 3 months. Marginal Crease Distance mean average for the right eye is 3 mm increase and 3.2 mm increase on the left after 3 months. All patients observed significant degrees of skin tightening, brow elevation, texture improvement and wrinkle reduction in the eye area. Statistical data analysis was significant.

Conclusion: This study proved that by combining non-ablative unipolar RF and PDO threads resulted in clinical and statistically significant improvement in upper lid ptosis and brow ptosis based on marginal reflex distance and marginal crease distance. Skin tightening, brow elevation and texture improvement was observed on all subjects.

FRACTIONAL, HIGH DENSITY DELIVERY OF ULTRASOUND PULSES IMPROVES FACIAL AND NECK WRINKLES: RESULTS OF *IN VIVO* PIG SKIN HISTOLOGY AND HUMAN CLINICAL STUDIES

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Background: Controlled thermal heating of dermal connective tissue has been shown to improve skin laxity and wrinkling. We describe the first report of a novel, non-invasive, high intensity ultrasound (U/S) technology generating isolated regions of tissue coagulation in the mid-dermis with no epidermal damage. The results of the numerical simulation and *in vivo* animal model will be described. The clinical effects of this U/S technology on facial and neck wrinkles, evaluated in a prospective, IRB-approved 30 patient clinical study, will be presented.

Study Design/Materials and Method: The technology (Sofwave, Yokneam, Israel) utilizes multiple ultrasonic transducers that simultaneously emit low divergence ultrasonic beams perpendicularly to the skin surface and into the dermis. Skin surface cooling is applied *via* the applicator and real time measurement of skin temperature ensures the prevention of epidermal thermal damage. A numerical simulation of the ultrasonic beam was performed using a proprietary 3D time dependent code to solve the bio-heat equation in order to analyze temporal and spatial temperature distribution in the tissue at different U/S power levels. Treatment parameters were further optimized in an *in vivo* pig model. Thirty patients with mild to moderate facial wrinkles were enrolled. Treatment of the full face and anterior neck was performed after the application of an anesthetic (7% tetracaine/30% lidocaine) cream. Standardized 35 mm digital photography was performed before treatment and at the 1-week and 12-week follow-up visits. The treatment endpoints were a change in the Fitzpatrick Wrinkle Score (FWS) and improvement in a 5 point global aesthetic improvement scale (GAIS).

Results: Histologic examination of pig skin demonstrated well-defined fractionated treatment zones of thermally induced collagen coagulation and denaturation in the mid dermis, with intervening zones of tissue sparing and sparing of the epidermis. All patients tolerated the procedure. Adverse effects were limited to pain during treatment and several hours of erythema and edema. At 12-week follow-up evaluation, 87% of subjects showed improvement or marked improvement in the GAIS. There was a grade 1 FWS improvement in 77% (23/30) and a grade 2 FWS improvement in 10% (3/30) of subjects following a single treatment session.

Conclusion: The first clinical experience with a single treatment session of this novel, non-invasive, U/S technology resulted in no downtime, no unanticipated adverse events and produced demonstrable improvement in wrinkles of the face and neck. Histologic studies showed fractionated mid-dermal coagulation zones with sparing of the epidermis. Stimulation of long-term tissue remodeling and the creation of new collagen, elastin and extracellular matrix is likely the result of the activation of the wound healing cascade and associated generation of inflammatory mediators, as is known to occur with production of discrete thermal wounds in the dermis. Optimization of treatment parameters and refinements in this procedure should further improve outcomes.

INFLUENCES OF AGE, GENDER AND BODY MASS INDEX ON THE DEPTH OF THE SUPERFICIAL FASCIA IN THE FACE, NECK, ARM AND THIGH USING MICROFOCUSED ULTRASOUND WITH VISUALIZATION

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Background: Non-surgical skin tightening procedures are increasing in popularity due to their non-invasiveness as the

energy is transdermally applied to the subcutaneous tissues. The present study was designed to provide precise data on the depth of the superficial fascia – the structure of action – for safer and better targeted treatments of the face, neck, arms and thighs.
Study Design/Materials and Method: 150 Caucasian individuals were investigated with an equal distribution of males and females (each n = 75) and a balanced distribution of age (n = 30 per decade: 20–29, 30–39, 40–49, 50–59 and 60–69 years) and body mass index (BMI) (n = 50 per group: BMI $\leq 24.9\,kg/m^2$, BMI between 25.0 and $29.9\,kg/m^2$ BMI $\geq 30\,kg/m^2$. Ultrasound-based measurements were conducted, measuring the distance between skin surface and the superficial fascia in the buccal, premasseteric region, the lateral neck, posterior arm and the anterior, medial and posterior thigh.
Results: The superficial fascia was consistently and bilaterally identified in all investigated regions. The overall mean distance between the skin surface and the superficial fascia was for the buccal region was 4.82 ± 0.9 mm; range [2.60–6.90], for the premasseteric region 4.25 ± 0.6 mm range [2.60–5.80], for the lateral neck 3.71 ± 0.5 mm range [2.0–5.0], for the posterior arm 4.38 ± 0.9 mm; range [2.60–6.70], for the anterior thigh 7.90 ± 2.3 mm range [3.50–13.20], for the medial thigh 5.74 ± 1.2 mm range [3.10–8.20] and for the posterior thigh 7.77 ± 3.2 mm range [3.60–14.50].
Conclusion: Knowing the precise depth of the superficial fascia for non-surgical, skin-tightening procedures will guide practitioners toward safer and more effective outcomes. Devices using ultrasound guided treatment, i.e., microfocused ultrasound with visualization (MFU-V; Merz North America, Inc.), provides a reliable option for health care professionals.

MAGNETIC ENERGY FOR TREATMENT OF SKIN LAXITY

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Background: Skin tissue laxity tightening is almost a universal request from older patients who wish to improve their appearance. Although there are several therapeutic approaches currently available, the quest for effective, well tolerated and safe approaches persists with no single modality achieving all three goals, in all patients, in a desirable and consistent matter. Magnetic energy can achieve heat formation through current production and vibrational movement. This can be a source of collagen promotion within tissue. As such, a new high energy magnet device was evaluated while treating patients with facial and neck laxity.
Study Design/Materials and Method: A 27 MHz magnetic device with a 3 cm spot size was used to treat 20 patients with facial and upper neck laxity. Skin Types were I – IV. Patients received a series of treatments with a minimum of a 4 week hiatus between treatments. 85% of the patients had paid for their procedures. Two blinded observers evaluated both before and after photographs for overall improvement of skin laxity and texture. The observers were not informed which photographs were before or after.
Results: The observers correctly chose 19 out of 20 patients before and afters. The mean grade level of improvement seen by the observers was 43%. 48% of the patients were graded at 50% or greater improvement. The patients themselves graded their improvement at a mean of 6.5 out of 10. 45% of the patients graded their outcome at 7 or better which was designated as very satisfied. There was a mean of 4.3 treatment sessions. Aside for minor transient erythema and edema, these were no other side effects. The procedures were well tolerated.
Conclusion: High magnetic energy can be delivered in a safe and tolerable manner allowing for skin tightening and skin texture improvement. Both observers and patients designated a moderate to very satisfactory outcome.

STANDARDIZATION FOR NOVEL RADIOFREQUENCY DEVICE EVALUATION

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Background: Radiofrequency (RF) technology is a popular modality for surgery, non-invasive treatments and aesthetic applications. Questions concerning the effect of RF devices on tissue and the safety of tissue heating have become more prevalent with the rise of the technology. This study evaluated the effects of different RF treatment profiles on collagen and elastin fibers.
Study Design/Materials and Method: The RF device was used on the patient's tissue, and one month later the tissue was excised during an abdominoplasty. Thermal couplings, a thermal camera, a forward looking infrared camera (FLIR), Hi frequency ultrasound, ultrasound, optical coherence tomography, and biopsies were all used in this evaluation. Histology samples were taken from both treated and untreated areas. The size of the probe (10 mm – 30 mm), the exposure duration (5–30 minutes), and the device setting were adjusted for four different treatment sites. Sirius Red, Fast Green, Hematoxylin and Eosin, and Verhoeff stains were utilized to observe the effects of the treatment on tissue.
Results: All tests confirmed treated areas showed a general increase in non-collagen proteins, collagen bundles, and elastin fiber as compared to untreated areas. The 30 mm probe with a 5 to 15 minute exposure time and a 41 – 42°C temperature setting showed the most significant results. In histology, moderate to strong staining in the treatment area was observed in the histology for all methods. Elastin fibers showed the most significant staining, with minimal staining being observed in non-treated areas, and strong staining seen in a 30 mm and 5 min treatment setting.
Conclusion: The novel RF device significantly affects tissue, with an increase in collagen and elastin seen across multiple treatment areas. Shorter exposure durations of 5 minutes and lower temperature settings of 41°C showed significant histological changes as compared to control areas.

Clinical Applications – Cutaneous – *Vascular*

EVALUATION OF A NOVEL TOPICAL AGENT IN CONJUNCTION WITH LONG PULSED 532 nm LASER FOR THE TREATMENT OF FACIAL ERYTHEMA ASSOCIATED WITH ERYTHROTELANGIECTATIC ROSACEA

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Background: Vascular laser therapy is the standard of care for reduction of facial erythema associated with

erythrotelangiectatic rosacea. The objective of this blinded, controlled prospective study was to determine whether treatment outcomes can be enhanced when a novel, topically applied product designed to reduce facial erythema is used in conjunction with vascular laser therapy for the reduction of facial erythema.
Study Design/Materials and Method: Thirty subjects with moderate to severe erythrotelangiectatic rosacea were randomly divided into two equal, physician blinded groups of 15. Group 1 received 3 treatments with a long-pulsed 532 nm laser. Group 2 received 2 laser treatments plus concurrent daily use of novel topical products. Laser treatments were performed at 4-week intervals. Subjects were evaluated at baseline, 4, 8 and 12 weeks by physician and subject self-assessment using 5-point (0–4) standardized scales: the Clinician Erythema Assessment (CEA) and Patient Self-Assessment (PSA) as well as a Dermatology Quality of Life Assessment (QOL).
Results: In both treatment groups, reduction in facial erythema as assessed by CEA and PSA showed statistically significant improvement at all measured intervals. Average CEA scores improved from 3.00 to 1.87 for the Laser Only group and from 3.07 to 1.64 for the Laser + Topical group. Laser + Topical outperformed Laser Only treatment at all time intervals. The average improvement in the Laser + Topical group was equal or superior to the Laser Only Group despite fewer laser treatments. Further, in the combination therapy group, improvement was noted from week 8 to 12 despite no additional laser treatment. There were no complications or adverse reactions in either group.
Conclusion: Optimal outcomes in the treatment of facial erythema associated with rosacea may be best achieved with a combination of these novel topical products and vascular laser therapy.

RETROSPECTIVE ANALYSIS OF PULSED DYE LASER PLUS OXYMETAZOLINE 1% CREAM FOR TREATMENT OF FACIAL TELANGIECTASIAS

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Background: Pulsed dye laser (PDL) and oxymetazoline 1% cream are commonly used for treatment of rosacea. Our clinical experience has suggested a synergistic effect when using these two treatments in combination. PDL has been shown to effectively reduce both facial erythema and telangiectasias. Oxymetazoline 1% cream has been shown to effectively reduce facial erythema. Oxymetazoline 1% cream is an alpha adrenergic agonist which reduces erythema *via* temporary vasoconstriction. To our knowledge, the long-term effect of this topical on reduction of telangiectasias has not been extensively studied. The objective of this study was to determine the degree of telangiectasia clearance after combination treatment with PDL and oxymetazoline 1% cream.
Study Design/Materials and Method: This retrospective study was conducted at two dermatologic surgery practices (one in Houston, Texas; one in Charlotte, North Carolina). At each practice, a board-certified dermatologist graded pre- and post-treatment cross-polarized images. Images from a total of 20 patients on combination treatment with PDL and oxymetazoline 1% cream were analyzed. Blinded pre- and post-treatment images were analyzed using the Clinical Erythema Assessment (CEA) Scale (0 = clear and 4 = severe). Unblinded pre- and post-treatment images were compared using the 5-point Telangiectasia Scale to determine the degree of improvement post-treatment compared to baseline. (1 = < 5% clearance and 5 = 75-100% clearance).
Results: Patients completed an average of 3.45 months of daily topical oxymetazoline and 1.8 PDL treatments. At baseline, 90% (18/20) of patents had CEA Grade 2 (mild erythema) or higher. For erythema, 50% (10/20) of patients improved by at least 1 CEA grade after treatment. And, 15% (3/20) achieved 2 grades of improvement post-treatment. For telangiectasias, 75% (15/20) of patients achieved at least a 2-point clearance (5–25%) post-treatment. 50% (10/20) achieved at least a 4-point clearance (50–75%). 20% (4/20) achieved 5-point clearance (75–100%).
Conclusion: Combination treatment with PDL and daily oxymetazoline 1% cream can effectively reduce telangiectasias. Limitations include the retrospective design of the study and lack of a control group.

TREATING CHALLENGING CUTANEOUS CAPILLARY MALFORMATIONS WITH A 595 nm LASER AIDED BY DYNAMIC OPTICAL COHERENCE TOMOGRAPHY

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Background: Adults with port wine stains or cutaneous capillary malformations (CM) are challenging to treat due to the maturity of their lesions. Pulsed dye laser (595 nm) remains the treatment of choice, however, clinical response varies depending on the characteristics of the lesion. We describe treatment of challenging cases of CM with a 595 nm laser where 52 optical coherence tomography (OCT) images allowed non-invasive measurement of vessel characteristics and therefore suggested explanations for patients' clinical response.
Study Design/Materials and Method: Two adult patients with large CMs were treated with multiple settings of a 595 nm pulsed dye laser (Syneron Candela, Wayland, MA). Dynamic OCT images were obtained of multiple areas of the CMs using a OCT scanner (Michelson Diagnostics Ltd., Maidstone, Kent, United Kingdom) both before treatment and at follow-up. Dynamic OCT can detect the motion of red blood cells in the sub-surface skin enabling visualization and measurement of blood vessels as small as 20 microns in diameter and up to 2 mm in depth.
Results: In total, 52 lesional areas in two adult patients with large CMs were imaged at the bedside using dynamic OCT. For the patient who showed clinical blanching of CM from treatment, OCT imaging revealed most vessels were of diameter 70 to 100 microns at depth 0.15mm+, and reduced blood flow post-treatment. However, for the patient who failed to respond, OCT imaging revealed that by contrast, most vessels were of diameter 200 microns or more at a greater depth of 0.3mm+, and had not been coagulated, suggesting that the lack of response was due to inadequate combination of pulse duration and fluence. More assertive settings were therefore indicated.
Conclusion: For challenging CM cases, dynamic OCT may be used as a tool to non-invasively determine lesional vessel diameters and depths at the bedside. This allows more precise matching of pulse duration and fluence to vessel size, enabling real time application of the theory of selective photothermolysis.

TREATMENT RESISTANT PORT WINE STAINS SUCCESSFULLY TREATED WITH SHORT-PULSE Nd:YAG LASER

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Background: Port wine stain vascular malformations are often resistant to treatment with traditional pulsed dye lasers. Many vascular lesions fail to improve substantially long-term despite many pulsed dye laser treatments. Nd:YAG laser lasers have a deeper penetrating wavelength, but a lower absorption coefficient in hemoglobin than pulsed dye laser and have a greater risk of adverse effects. Port wines stains make up an extremely heterogeneous population, so it is difficult to generalize about success and failure of treatments for this condition.
Study Design/Materials and Method: 47 patients treatment resistant or pulse-dye-laser treatment failures were treated using an Nd:YAG laser with a short 0.6 to 2.0 ms pulse, a 2 to 4 mm spot size and 130 to 300+ J/cm^2 in a factional mode, with skin cooling. All patients received a series of treatments spaced at least 4 weeks apart.
Results: All patients, including patients who had failed numerous pulsed dye laser treatments, achieved a 50% or greater response. Occasional minimal scarring was noted in some patients.
Conclusion: With proper pulsing technology, fractional treatments, high energy, short pulse, small spot size Nd:YAG lasers can be used successfully and safety in the treatment of pulsed dye laser treatment failures and also inherently difficult lesions.

VASCULAR-TARGETING PHOTODYNAMIC THERAPY (PDT) IN TREATMENT OF PORT WINE STAIN (PWS) BIRTHMARKS

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Background: Port wine stain (PWS) birthmarks are congenital vascular malformations of the skin that affect 0.3% of newborns. The majority of PWS occur on the face and neck area. PWS lesions can become darker and thicker with time. Pulsed dye laser (PDL)-mediated photothermolysis is the current standard treatment. But only a small portion of PWS lesions in Asian populations can achieve complete blanching after PDL treatment. There is a need to develop effective and safe therapeutic approach to treat PWS. This study investigated the feasibility of a novel vascular-targeting photodynamic therapy (PDT) approach for the management of facial PWS of Chinese patients.
Study Design/Materials and Method: This was a single arm open-label trial. A total of 50 consecutive patients (13 − 43 years old, 16 males and 34 females) with facial PWS were recruited. Amongst them, 24 had red lesion and 26 purple lesion. All patients underwent one session PDT treatment using the combination of a new photosensitizer hematoporphyrin monomethyl ether (HMME, 5 mg/kg) and a green LED panel of 530 nm (20 − 30 min at 80 − 100 mW/cm^2). The efficacy was evaluated 3-month after the treatment.
Results: A total of 70.8% patients in the red group and 53.8% patients in the purple group showed significant color blanching. In term of overall improvement after a single treatment there was no statistical difference between two groups ($x^2 = 1.53$, $p > 0.100$). Pain was the major complain during the light irradiation. Four patients (8%) showed temporary hyperpigmentation and one patient (2%) non-specific thermal lesion without scar formation.
Conclusion: This study demonstrated that the combination of photosensitizer HMME and green LED irradiation could achieve good blanching effect. The efficacy of using LED is similar to that of laser, but using large LED panel as the PWS PDT light source can treat larger PWS lesions.

Clinical Applications – Gynecologic/Women's Health – *Genitourinary Syndrome of Menopause*

EFFECT OF POSTMENOPAUSAL DURATION ON EFFICACY OF FRACTIONAL CO_2 LASER TREATMENT OF VAGINAL TISSUE

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Background: Clinical data to support the safety and efficacy of energy-based laser treatment to vaginal tissue in postmenopausal women is needed. This study assessed the effect of postmenopausal status on treatment outcome following resurfacing and coagulation of vaginal tissue with a fractional CO_2 laser.
Study Design/Materials and Method: Postmenopausal women with atrophic vaginitis on clinical presentation were screened and enrolled in an IRB-approved clinical trial. The Vaginal Health Index (VHI) was used to assess changes in vaginal elasticity, fluid volume, vaginal pH level, epithelial integrity and moisture following treatments.
Results: 20 postmenopausal females (mean age 54 ± 6 years) with vulvovaginal atrophy underwent three monthly CO_2 laser treatments. Subjects were divided into two cohorts: postmenopausal for >3 years (range 3–17) *vs* recently postmenopausal of <3 years. Following the first treatment, there was a significant difference between the two cohorts. The average VHI improvement was 8.0 points among recently postmenopausal women as compared to 4.3 points for longer postmenopausal status of >3 years ($P < 0.05$). Following the third treatment, all patients showed a statistically significant improvement in the VHI score ($P < 0.01$): 3-month mean score of 22.3 (range 19–25) as compared to baseline mean of 11.4 (range 7–18). The effect of postmenopausal status detected following the first treatment was not observed following successive treatments possibly due to the restoration of normal VHI scores (24 or 25) among the recently postmenopausal cohort. Self-reported improvement rate in sexual function was 92%, with mean improvement of 10.0 points over baseline score (18.8 ± 9.1) on the Female Sexual Functional Index. Immediate treatment responses were limited to transient and mild erythema or edema.
Conclusion: In this study, a greater improvement in vaginal health following fractional CO_2 laser treatment was observed in recently postmenopausal subjects, suggesting that earlier intervention may contribute to better outcomes. More study is required to reproduce these findings. Fractional CO_2 laser treatment was associated with improvement of vaginal health and sexual function in postmenopausal women, as previously reported in the literature. Investigation of long-term clinical outcome is underway and may further elucidate the effect of postmenopausal duration on treatment outcome.

ENERGY-BASED DEVICES MARKETED FOR VAGINAL REJUVENATION: AN ANALYSIS OF THE MAUDE DATABASE

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Background: The FDA recently issued a statement expressing concern over energy-based devices marketed to promote vaginal rejuvenation. Current literature lacks sufficient evidence supporting efficacy and safety data to recommend this modality for optimization of sexual function and alleviation of genitourinary syndrome of menopause (GSM)-related symptoms in postmenopausal or postpartum women. This retrospective review aims to characterize the mandatory and voluntary reports concerning energy-based procedures marketed for vaginal rejuvenation.

Study Design/Materials and Method: Retrospective review of the FDA database, Manufacturer and User Facility Device Experience (MAUDE), for events related to energy-based devices for vaginal rejuvenation. The MAUDE database is a publicly available resource kept by the FDA that provides over 5 million records related to medical device safety.

Results: Since November 2015, 10 distinct events describing 11 patients were recorded and reviewed. The most commonly reported adverse event related to the procedure was pain (vagina, bladder, urethral, or unspecified) (n = 6). Follow-up care was required in all patient-related injury cases (n = 8). Four patients reported suffering from chronic altered sensation, pain, and discomfort after treatment with an energy-based device.

Conclusion: A variety of adverse events associated with the use of energy-based devices was reported to the MAUDE database related to its use for vaginal rejuvenation. Although the circumstances surrounding these events were unclear, these reports underscore the FDA's concern over the marketing and use of these devices while clinical trials investigating their efficacy and safety profile have yet to be published.

NON-ABLATIVE, NON-FRACTIONAL Er:YAG LASER MANAGEMENT OF FEMALE SUI, 2 YEARS FOLLOW-UP

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Background: Objective of our study was to evaluate the efficacy and safety of erbium laser treatment for stress urinary incontinence when laser energy is delivered with a full spot instead of a traditional original fractional laser beam.

Study Design/Materials and Method: Patients with a complaint of urinary leakage and with an ICIQ-SF score between 6 to 16 points and without other genitourinary symptoms were included in this trial. All patients received 3 sessions of non-ablative full beam Er:YAG (2940 nm) laser treatment with one month interval. No anesthesia was used. The efficacy was assessed with ICIQ-SF and VAS (0–10) questionnaires about improvement on SUI, at 6, 12 and 24 month follow-up. In all measurement points the adverse effects were also observed.

Results: 35 patients with average age of 49.2 years were included in this study and received 3 monthly sessions of erbium laser treatment with full spot handpiece. At the first follow-up ICIQ-SF showed a decrease from 8.3 to 1.4 points while the subjective assessment on improvement of SUI showed 78.9% of success rate. At 6 months 68.4% of all patients claim to be dry. At 12 months 78.9% and at 24 months 21% of them sustained the improvement. The full spot protocol required more than 50% less time and saved more than 40% of laser pulses in comparison with fractional protocol. There were no adverse effects reported aside of mild discomfort at introitus area during the treatment.

Conclusion: According to our results the full spot non-ablative erbium laser treatment seems to be faster, of the same efficacy as the previous fractional protocol while equally safe. Further studies with larger number of patients and longer follow-up are needed for better assessment of this novel protocol.

OPEN-LABEL, PROSPECTIVE, SINGLE CENTER STUDY OF FRACTIONAL ERBIUM LASER FOR THE TREATMENT OF GENITOURINARY SYNDROME OF MENOPAUSE

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Background: Er:YAG systems offer a nonsurgical approach for coagulation and ablation in cutaneous as well as vaginal tissues. The Er:YAG the laser has been associated with neocollagenesis, collagen remodeling, and most recently has been used for the treatment of vaginal laxity, vaginal atrophy, stress urinary incontinence and strengthening of the pelvic floor. The purpose of this study is to evaluate the efficacy and safety of unique dual pass approach of the Er:YAG laser for the treatment of genitourinary syndrome of menopause (GSM).

Study Design/Materials and Method: A total of 40 postmenopausal women who self-reported symptoms of GSM to include genital, sexual, and uro-gynecological symptoms and who were not on hormonal therapy were enrolled in this open-label, single center study. Patients received two to three Er:YAG laser procedures spaced 4 weeks apart with two follow-up visits at 6 and 12 weeks following their final study treatment. GSM symptoms were evaluated subjectively by a visual analogue scale (VAS) survey at baseline and all follow-up visits. Treatment efficacy were evaluated using questionnaires collected at baseline and all follow-up visits. Subject satisfaction assessments were also collected. Patient discomfort and adverse events were recorded for safety evaluations.

Results: None of the patients reported any pain and 22.5% reported warmth during the procedure. Urological symptoms improved further with each subsequent treatment with 60%, 70%, and 87.5% of patients reported improvement after first, second, and third treatment, respectively. After a single treatment, all patients reported feeling "tighter" as did their partners and 95% reported increase in vaginal moisture after one treatment and 100% after three treatments. Subjects were satisfied with the results, with 82.5% reporting satisfaction after one treatment and 100% after three treatments.

Conclusion: Treatment with an Er:YAG laser provides a safe and effective treatment for GSM symptoms with relatively no pain. All patients had subjective improvement in sexual symptoms associated with tightness and vaginal moisture. Incontinence symptoms were significantly reduced in most patients. Most patient had improvement with uro-gynecological symptoms.

PHOTOBIOMODULATION EFFECTS ON SEXUAL FUNCTION AND URINARY INCONTINENCE

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Background: Female sexual dysfunction is a prevalent problem affecting approximately 40% of women across the world with limited treatment options. Common symptoms include decreased desire, arousal and lubrication as well as pain with intercourse and difficulty achieving orgasm. Urinary incontinence affects at least 30% of women worldwide and

minimally invasive effective treatments are limited. We proposed that a novel, at home-device using photobiomodulation will improve sexual function and urinary incontinence in women with self reported complaints of sexual dysfunction, urologic dysfunction with distress in relation to these issues as measured by validated QOL questionnaires.
Study Design/Materials and Method: Patients self administered a LED device with heat and vibratory components for 10 minute sessions 3–4 times/week at home over 8 weeks. Following the 8 weeks the device was self administered for 10 minute sessions 1–2 times per week for a year. Sexual function and urinary incontinence was assessed at baseline and again at 90 and 180 days using validated questionnaires including the FSFI, FSDS, UDI-6 and IIQ-7 .
Results: 43 women entered the study with results on 30 over 6 months. At 90 days there was significant improvement in sexual function and related distress and in urologic dysfunction and distress related to it as measured by UDI-6 and IIQ-7.
Conclusion: LLLT combined with heat and vibration yields clinically meaningful improvements in bladder symptoms, sexual function, and quality of life in women with self reported sexual and urologic dysfunction.

THE SAFETY AND EFFICACY USING FRACTIONAL MATRIX RADIOFREQUENCY TO TREAT VAGINAL LAXITY

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Background: Vaginal laxity and urinary incontinence are common conditions occurring in over 50% of menopausal parous women. Current therapies are targeted at surgical correction with variable long term efficacy. The objective of this study is to evaluate the one year safety and efficacy of matrix radiofrequency for the treatment of vaginal laxity, urinary incontinence and sexual dysfunction.
Study Design/Materials and Method: A prospective study of 30 volunteer subjects diagnosed with vaginal laxity and meeting the inclusion/exclusion criteria following study NCT03280446. All patients were assigned to a single treatment arm, receiving three treatments one month apart. All patients were asses at baseline, one two and three months before each treatment and at 6 and 12 months following the last treatment. A primary criterion was assessed by Vaginal laxity scale and physical exam. Secondary outcome measures included assessment of sexual dysfunction using the Female Sexual Function Inventory (FSFI) and urinary Incontinence with the UDI, IIQ and QOL. Statistical analysis with nonparametric t-test was performed. Safety was measured during and after treatment with a self-report pain VAS and examination for edema, erythema gradation, burns and report of other events such as vaginal or urinary tract infections.
Results: The Vaginal Laxity was statistically improved after RF vaginal treatment. Urinary incontinence and sexual function were also statistically improved by objective questionnaires using the FSFI, SSQ, UDI, IIQ, and QOL. The side effects were minimal with vaginal discharge and three urinary tract infections, two bacterial vaginosis and two yeast infections.
Conclusion: This is the first clinical trial describing specific parameters for treatment of vaginal laxity, urinary incontinence and sexual dysfunction using a matrix radiofrequency device.

Clinical Applications – Gynecologic/Women's Health – *Histology*

3D VISUALIZATION OF VAGINAL HISTOPATHOLOGY AFTER FRACTIONAL CO_2 LASER TREATMENT USING OPTICAL COHERENCE TOMOGRAPHIC ENDOSCOPY

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Background: Energy-based devices (EBD) have recently been marketed for the treatment of Genitourinary Syndrome of Menopause (GSM) and cosmetic vaginal procedures; however, data on effectiveness and safety is limited due to lack of sensitive *in vivo* imaging tools needed to monitor tissue characteristics following treatment. Optical coherence tomography (OCT) is a non-invasive, point-of-care technology that provides near histological resolution of tissue substructure. We propose an intra-vaginal OCT system to assess the histopathologic changes occur after EBD treatment of GSM.
Study Design/Materials and Method: We report our first intra-vaginal OCT measurement in patients undergoing EBD treatment. Institutional Review Board (IRB) approval was obtained. Phase I of this study includes intra-vaginal OCT scan of 6 patients (4 premenopausal, 2 postmenopausal) in order to characterize various tissue conditions. In Phase II, OCT was acquired before and 8 weeks after treatment. Laser treatment was performed with a commercial fractional CO_2 laser. The vaginal epithelial thickness (VET) was assessed from the OCT images.
Results: Intra-vaginal OCT provided images of tissue substructure 1 mm deep with 6μm resolution. Scanning of the full vagina took less than 40 seconds. Phase I: The changes in VET, stroma densities, vaginal folding density was identified for different patients, which can serve as an indicator of vaginal health. Compared to the premenopausal group, the VET for the postmenopausal patient was significantly thinner (287 ± 65μm pre, 145 ± 29μm post). Phase II. Prior to laser treatment, the VET was measured at 126μm. Eight weeks after treatment it was noted to be 199μm, representing an average increase of 72μm.
Conclusion: This is the first report to quantify the change of VET after CO_2 laser treatment using OCT endoscopy. We demonstrated the capability of OCT to set an objective standard of vaginal wall characteristics and monitor treatment.

HISTOLOGICAL CHANGES IN VAGINAL TISSUE FOLLOWING FRACTIONAL LASER VAGINAL APPLICATION FOR TREATMENT OF ATROPHIC VAGINITIS AND DYSPAREUNIA

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Background: Fractional Laser applied energy treatment has recently been described in various gynecological conditions. The aim of this study is to describe the histological and immunochemical connective tissue changes using a novel superpulse fractional laser with atrophic vaginitis and dyspareunia.
Study Design/Materials and Method: A prospective clinical trial of three volunteers subjects meeting criteria for inclusion/

exclusion of atrophic vaginitis and sexual dysfunction measured by FSFI NTC03271944 were treated at baseline and one month intervals for three total treatments. Vaginal biopsies were obtained at baseline; one-month post-treatment and before the second treatment; and one, three and six month following the third treatment. Quantitative analysis of collagen types I, III, and VII, newly synthesized collagen, tropoelastin and total elastin were quantitatively evaluated.
Results: Histological improvement was observed after superpulsed fractional laser vaginal treatment with statistically significant improvement in collagen types I, III, and VII, newly synthesized collagen, and tropoelastin. Clinical improvement was also observed and presented in another abstract.
Conclusion: This is the first histological study delineating both elastin and various collagen changes following a novel superpulsed laser treatment in vaginal tissue.

HISTOLOGICAL CHANGES IN VAGINAL TISSUE FOLLOWING MATRIX RADIOFREQUENCY TREATMENT FOR VAGINAL LAXITY

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Background: Radiofrequency applied energy treatment has recently been described in various gynecological conditions. The aim of this study is to describe the histological and immunochemical connective tissue changes using a non-ablative matrix radiofrequency with impedance feedback tissue application technique for gynecological conditions.
Study Design/Materials and Method: A prospective clinical trial of three volunteers subjects meeting criteria for inclusion/exclusion of vaginal laxity clinical trial NTC03280446 were treated at baseline and one month intervals for three total treatments. Vaginal biopsies were obtained at baseline; one month post-treatment and before the second treatment; and one, three and six month following the third treatment. Quantitative analysis of collagen types I, III, and VII, newly synthesized collagen, tropoelastin and total elastin were quantitatively evaluated.
Results: Histological improvement was observed after RF vaginal treatment with statistically significant improvement in collagen types I, III, and VII, newly synthesized collagen, and tropoelastin. Clinical improvement was also observed and presented in another abstract.
Conclusion: This is the first histological study delineating both collagen and various elastin changes following RF matrix treatment for vaginal laxity.

HISTOLOGICAL OUTCOMES IN THE TREATMENT OF VULVOVAGINAL ATROPHY USING PHOTOBIOMODULATION TECHNOLOGY

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Background: Photobiomodulation (PBM) has become a popular modality to treat a multitude of medical conditions either as a standalone or an adjunctive therapy given the technologies' ability to stimulate tissue healing, restore cellular function, and relieve pain and inflammation. Early clinical work using PBM for the treatment of vulvovaginal atrophy (VVA)—a medical condition affecting millions of postmenopausal women—suggests that patients can benefit from this therapeutic modality. While research to date has focused on subjective outcomes such as quality of life (QoL) questionnaires, lack of vaginal histological data post PBM treatment raises skepticism about clinical effectiveness.
Study Design/Materials and Method: This two-arm, placebo-controlled pilot study investigated histological and clinical outcomes using PBM technology to treat VVA symptoms in postmenopausal women.The study included 16 postmenopausal women randomly assigned to two arms, eight active and eight placebo-control subjects. The active arm was treated for 10-minutes, two times per week for four weeks (total of eight sessions) using an intravaginal OTC PBM device administered by the investigator, Dr. Adrian Gaspar, in combination with 15 minutes of Kegel exercises under the direction of a physiotherapist. The placebo-control arm received only 15 minutes of Kegel exercises, two times per week for four weeks (total of eight sessions) under the direction of a physiotherapist. Outcomes included vaginal biopsies at three months post-treatment on six of the eight active-arm patients, in addition to vaginal Visual Analogue Scale (VAS) for dyspareunia and dryness at one-month, and the Female Sexual Function Index (FSFI) on all 16 subjects at one month.
Results: Histological results at three months post baseline validate impressive change in vaginal health, including significant thickening of the epithelium at the lamina propria, neocollagenesis, and increased angiogenesis and glycogen. Active-arm patients reported no discomfort with treatment device, and no side effects were reported, or thermal injury observed in the histological cuts examined. Subject assessment of vaginal symptoms and mean VAS and QoL FSFI scores in active arm subjects improved significantly one-month post-treatment and remained positive at three months. In comparison, placebo-control arm showed negligible QoL FSFI score change after one month.
Conclusion: PBM treatment for VVA symptoms in postmenopausal women shows encouraging subjective and objective improvement. The absence of adverse events, coupled with the ease and affordability of treatment, makes for a viable VVA therapy. Given the size of the study, investigation of clinical outcomes in a larger study population is warranted.

Clinical Applications – Gynecologic/Women's Health – *Other*

THE APPLICATION OF DC POINT STIMULATION FOR THE MANAGEMENT OF CESAREAN CHRONIC POST SURGICAL PAIN (CPSP)

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Background: Treatment of hypertrophic scars still remains challenging. Many invasive and non-invasive options are available for surgeons and patients to prevent scar formation, such as corticosteroid injections, silicone sheets, oils, lotions, and creams. However, current evidenced based strategies to manage cesarean post surgical pain can be disappointing to patients and subjective at best. C-sections may be a hidden cause for millions of women suffering from chronic pain, as they have been reported to linked in literature to Chronic Post-Surgical Pain (CPSP), back pain, shoulder pain, and neuropathic pain. The application of DC point stimulation to scars is called Scar Reduction Therapy (SRT). SRT is an innovative breakthrough in scar reduction therapy for systemic homeostasis and post-operative scar pain management. Data will be presented reporting the application of SRT to physical scars had a statistically significant improvement in reducing

Cesarean Chronic Post Surgical Pain (CPSP). This lecture will introduce the concepts of Scar Release Therapy and explore scars integral relationship scars have to to fascia, Heart rate Variability (HRV), CPSP, and their adverse influence on women's health. Presentation will report the scientific findings of SRT applied to n = 47 cesarean patient sample.
Study Design/Materials and Method: This was a cohort study analysis of treatment outcomes pre-, post-, and 48-hour follow-up after DC point stimulation was applied to C-section scars on 47 patients with history of non-specific chronic pain. Evaluations entailed a baseline Visual Analogue Score (VAS) pain scale assessment, which was repeated after an electro-therapy treatment and 48 hours later. All 47 patients received one SRT session applied bi-laterally to C-section scars. Evaluations entailed a baseline Visual Analogue Score (VAS) pain scale assessment, which was repeated after an electro-therapy treatment and 48 hours later. All 47 patients received one MPS Scar Release session.
Results: The VAS response of the 47 patient sample with chronic pain reflected a statistically significant reduction in mean post pain levels of 67.5% [$P = 0.000$], when compared to initial pain levels. When VAS was measured at the 48 hour follow-up, there was a further statistically significant reduction of 45.2% treatment [$P = 0.000$], for a total pain reduction of 82.2% [$P = 0.000$], when compared to initial pain levels.
Conclusion: These significant changes help validate the potential application of DC point stimulation to C-section scars as a viable option to treating women with Cesarean Chronic Post Surgical Pain.

Clinical Applications – Gynecologic/Women's Health – *Vulva*

CARBON DIOXIDE LASER TREATMENT OF EXTRAGENITAL LICHEN SCLEROSUS ET ATROPHICUS IN A PEDIATRIC PATIENT

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Background: Lichen sclerosus et atrophicus is a chronic autoinflammatory disease that most commonly affects the genital skin of adults; however, up to 15% of cases are in children, and extragenital skin is involved in 11% of cases. High potency topical corticosteroids and topical calcineurin inhibitors are the mainstay of treatment. Refractory cases of genital lichen sclerosus in adults have been treated successfully with carbon dioxide laser therapy, however this treatment modality has not been well-studied in either pediatric patients nor extragenital cases.
Study Design/Materials and Method: This case study was performed at the University of Minnesota in Minneapolis, MN.
Results: This is a case of a 9-year-old, otherwise healthy, Caucasian female who presented to the Pediatric Dermatology clinic with a several year history of an expanding, shiny, violaceous to white plaque with follicular plugging on the right mid back, consistent with extragenital lichen sclerosus. She had a history of genital involvement in the past as well, but this had completely resolved at the time of her presentation. For the back lesion, she had been treated with mometasone 0.1% ointment, tacrolimus 0.1% ointment, topical calcipotriene 0.005%, and intralesional triamcinolone injections in the past without any improvement. The patient was initially prescribed clobetasol 0.05% ointment to apply to the lesion daily, but after a 7-week trial proved ineffective, she was referred for laser therapy. The patient then underwent two sessions of carbon dioxide (CO_2) ablative laser therapy, which resulted in significant clinical improvement.
Conclusion: This case highlights the efficacy of carbon dioxide laser therapy for extragenital lichen sclerosus in a pediatric patient. Ablative laser therapy may prove to be a safe and effective treatment option for cases of pediatric extragenital lichen sclerosus that are refractory to topical medications.

LASER TREATMENT OF EPISIOTOMY – RELATED COMPLAINTS

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Background: Episiotomies have often adverse effects like are: infections, increased pain and bleeding, prolonged healing times, scarring, increased discomfort during intercourse. The purpose of this study was to evaluate efficacy and safety of erbium laser treatment for the range of episiotomies-related symptoms.
Study Design/Materials and Method: Patients with episiotomies complaining to: pain while sitting, pain at pressure, painful intercourse, pulling, bumps at perineum and bleeding after intercourse were treated with ablative Er:YAG laser in two steps protocol: full spot (2 mm) cold ablation along the scar with 300 mJ and 0.1 msec pulses, follow by fractional beam (5 mm spot, 800 mJ and 0.6 msec) across the whole episiotomy surface with 2 cm margins. Three sessions were performed with one month intervals. Subjective patients' assessment of improvement was measured with 10 point numerical scale. Treatment discomfort was measured with VAS (0–10). Follow-ups were performed at each visit and at 3 months post laser treatment. Adverse events were registered at every follow-up.
Results: 41 patients with average age 39.1 yrs (24–51) gravidity 2.1 (1–4) and parity 1.9 (1–3) were treated. 30 patients (75%) suffered from more than one of six observed symptoms. After the first session 27 (66%) patients improved, after the second all patients (100%) improved, 24 (58%) of them were free of any complaints and after the third session 34 (83%) were without complaints. Average improvement scores after sessions were 3.5, 8.1 and 9.8. Average procedure pain (without anesthesia) was 6.5/10. All reported adverse effects were mild and transient.
Conclusion: Erbium laser treatment showed efficacy in improvement of episiotomy-related symptoms with no major adverse effects noted. Patients' tolerated the treatment well and their satisfaction was very high.

TOPIC CORTICOSTEROID AND PHOTOBIOMODULATION TREATMENT IMPACT ON VULVAR LICHEN SCLEROSUS: CLINICAL, INFLAMMATORY AND REPARATIVE ANALYSIS

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Background: Vulvar Lichen Sclerosus (VLS) is the most common cause of chronic vulvar disease, with recurrent character resulting in atrophy, deformities of the anogenital region, as well as sexual dysfunction. Autoimmune factors and

oxidative stress have been considered in disease genesis due to presence of antibodies against extracellular matrix protein, in addition to the increase of specific cytokines Th1 and lymphocytic vasculitis. The standard treatment is the use of topical corticosteroid. The objective of this study was to evaluate the inflammatory infiltrate, pruritus, thermography and collagen hyalinization evaluation in patients treated with Photobiomodulation (PBM) and topical corticosteroid (CG).
Study Design/Materials and Method: Controlled and randomized study with 12 women with histological diagnosis VLS, allocated in two groups, PBM and CG, with 6 patients in each. The GC applied clobetasol propionate 0.05% ointment, daily for 4 weeks and after in alternated days for 4 weeks. The PBM group received weekly application of Diode Laser, $\lambda = 660$, $P = 100\,mW$, $SD = 510\,mW/cm^2$, $E = 4\,J$, $DE = 20\,J/cm^2$, $t = 40\,s$ once weekly for 8 weeks. Pre- and post-treatment biopsy was performed for collagen and inflammatory infiltrate study. The pruritus was measured by visual analogue scale before and after treatment in the CG and weekly in the PBM group. Thermography evaluation was performed pre and post-treatment in the studied groups.
Results: CG inflammatory infiltrate decreased post-treatment, however the collagenous hyalinization still remained. PBMG inflammatory infiltrate decrease and collagen matrix remodeling were observed post-treatment. The post-treatment pruritus showed a significant diminution in both groups. The thermography local heat intensity decreases in the post-treatments, however in the PBM group, it was more relevant.
Conclusion: PBM treatment showed to be effective for the inflammatory process and clinical symptom control, in addition improved repair process by collagen stimulus significantly compared to standard treatment. The corticoid does not favor collagen improvement, maintaining vulvar skin thinning. Thus, PBM is a promising VLS treatment.

Clinical Applications – Multi-Specialty – *Body Contouring*

ABDOMINAL FAT REDUCTION USING A HANDS-FREE MONOPOLAR 2 MHz RADIOFREQUENCY MULTI-TRANSDUCER DEVICE

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Background: In a recent 2017 consumer survey by the American Society of Dermatologic Surgery of 7,322 participants, 58% of participants expressed interested in body contouring. Traditionally, fat reduction has been accomplished most successfully with liposuction and cryolipolysis. We evaluated a novel treatment using a monopolar 2 MHz radiofrequency multi-transducer device for subcutaneous fat.
Study Design/Materials and Method: Twelve subjects, 11 female and 1 male, aged 19–59 years with skin types I–IV received a single treatment on the abdomen and bilateral flanks. 11 subjects were followed up at 12 weeks. Standardized photographs along with waist circumferential and ultrasound measurements were taken at baseline and 12 week follow-up. 4 to 6 transducers were secured to the abdomen *via* a novel double-sided adhesive strip and wrapped with a silicone sheet for a hands-free application for 15 minutes. This was repeated for a treatment to bilateral flanks for another 15 minute application. Satisfaction questionnaires were given to each subject at the 12 week follow-up.
Results: Immediate post-treatment side effects included mild to moderate erythema and edema. Subjects reported an average pain score of 3.97 (range = 0-10) during the treatment duration which quickly subsided to no pain when treatment ended. Ultrasound measurements showed combined mean of 23.2% (-3.51 mm) with 23% (-3.81 mm) reduction on the abdomen and 24% (-3.20 mm) reduction on the flanks. A combined mean of -0.98 cm reduction ($P < 0.05$) in circumferential waist measurements was observed. No adverse events reported. 8 subjects were satisfied or extremely satisfied in overall improvement while 9 subjects stated they would be likely or very likely to repeat treatment. 8 subjects were retreated with pending results at an additional 12 week follow-up.
Conclusion: Monopolar 2 MHz radiofrequency with multi-transducers and a hands-free attachment method is a safe and effective treatment for subcutaneous fat on the abdomen and flanks.

SAFETY AND EFFICACY OF 1060 nm NON-INVASIVE DIODE LASER WITH A PETITE MASK (10.49 cm^2) FOR FAT REDUCTION IN PATIENTS WITH BODY MASS INDEX GREATER THAN 30

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Background: Several non-invasive modalities exist to achieve fat reduction. Devices currently available for non-invasive fat reduction have been granted FDA clearance for individuals with body mass index (BMI) of 30 or less. This study was designed to evaluate the safety and efficacy of a 1060 nm diode laser with a petite mask (10.49 cm^2) for non-invasive lipolysis in subjects with BMI greater than 30.
Study Design/Materials and Method: This study is an IRB-approved, prospective, evaluator-blinded, multicenter study evaluating the safety and efficacy of the 1060 nm diode laser for reduction of submental fat in both non-obese (BMI less than 30) and obese (BMI greater than 30) patients. 61 patients received up to two treatments at 6-week intervals with a 1060 nm diode laser. Standardized 2D photography, 3D ultrasound measurements of submental adipose tissue, photographic evaluation, subject satisfaction, and adverse events were all collected throughout the study. Results were categorized into two BMI groups for data analysis: one group with BMI 30 or less, and one group with BMI greater than 30. All data sets were analyzed and compared.
Results: 58 subjects completed the study. There was not a statistically significant difference in adverse event profile, subject satisfaction rates, and blinded photography evaluations ($P > 0.05$). There was a statistically significant difference found in fat layer thickness measurements ($P = 0.04$) but both BMI groups had statistically significant results that met the desired clinical endpoint. 88% of high BMI subjects were satisfied and had 100% correct photography evaluation.
Conclusion: The use of a non-invasive 1060 nm diode laser is safe and effective for BMIs up to 49. BMI does not appear to significantly affect the safety or the efficacy of the treatment.

SAFETY AND EFFICACY OF DUAL 1060 nm NON-INVASIVE DIODE LASERS FOR FAT REDUCTION IN THE FLANKS AND ABDOMEN

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Background: Several non-invasive modalities exist to achieve fat reduction in both the flanks and abdomen. The 1060 nm non-invasive diode laser with four applicator heads has been shown to be safe and effective in both these areas. This study explored the idea that using multiple devices (eight laser heads) simultaneously for the treatment of fat reduction would allow quicker treatment sessions for larger body areas without introducing additional risk to the patient.

Study Design/Materials and Method: This study evaluated the safety and efficacy of using multiple 1060 nm diode lasers simultaneously for fat reduction on the abdomen and flanks. 43 patients were treated either on their flanks, abdomen, or both up to two times. Patients had high resolution 2D photography, adverse event assessment, and weight information collected at all visits. Patients also had satisfaction scores collected at a 12-week post-final treatment follow-up.

Results: Subjects age ranged from 23–54 (37.6 ± 8.8) with BMIs ranging from 19.3–30.9 (26.7 ± 2.5). Subjects with Fitzpatrick Skin Types I through IV were all treated in the study. Average patient weight change during the study was 1.2 pounds (± 5.1). 91% of subjects were satisfied with their results at the 12-week follow-up. The use of multiple devices for simultaneous treatments did not increase patient discomfort or the adverse event profile. The most common adverse event was pain which was reported by 23% of patients and lasted less than 5 days on average. Less than 10% of patients reported instances of hardness, nodule, redness, bruising, or a blister.

Conclusion: The use of multiple applicators with multiple non-invasive 1060 nm diode lasers simultaneously is safe and effective for fat reduction of both the flanks and abdomen.

SAFETY AND USABILITY OF A NOVEL RADIOFREQUENCY DEVICE WITH 30 mm AND 60 mm HANDPIECES FOR THE TREATMENT OF LAX TISSUE

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Background: Radiofrequency (RF) technology is commonly used in surgery, non-invasive treatments and aesthetic applications. Inconsistencies in energy profile, along with issues with patient comfort have traditionally been negative factors associated with this type of technology. This study evaluates both the parameters, safety, and usability of a 30 mm and 60 mm handpiece (HP) intended for the treatment of lax tissue on the abdomen, and legs in larger areas.

Study Design/Materials and Method: 17 subjects enrolled and treated up to 5 times with treatments occurring every one to two weeks. The 30 mm HP was used to treat areas up to 6×6 inches, with the 60 mm HP treating areas that are 8.5×11 inches or larger. Treatment parameters such as energy and NEM pad size differed among the population. Target temperature was set to 39°C and once target temperature was met the treatment continued for 5 additional minutes. Subjects reported treatment pain throughout the entire treatment.

Results: BMIs ranging from 21–38 were treated during the study. Fat thickness, abdominal circumference, weight, and BMI appear to have a positive correlation with increased energy settings. Overall the treatment was well tolerated, with pain scores not exceeding a 4/10 for a majority of subjects. Technology updates prevented arcing in the 60 mm handpiece aiding both patient comfort and safety. Two subjects reported pain exceeding a four which was remedied with an adjustment in treatment technique. Mild instances of erythema and tenderness were reported and resolved within a few hours.

Conclusion: The 30 mm and 60 mm HP for this novel radiofrequency device for tissue heating have shown to be safe for the treatment of lax tissue in larger body areas, with preliminary analysis showing promising subject results.

ULTRASONOGRAPHY EVALUATION OF CHANGES IN SUBCUTANEOUS ABDOMINAL FAT THICKNESS FOLLOWING HIFEM TREATMENTS: RESULTS OF 6-MONTH FOLLOW-UP

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Background: Previous research investigated the efficacy of HIFEM treatments for the reduction in subcutaneous fat 1–2 months post-treatments while the long-term data was not available. The objective of this study was to evaluate changes in the patient's subcutaneous fat thickness 6 months after their initial treatment series.

Study Design/Materials and Method: In previously published study, 22 patients were treated with High-Intensity Focused Electromagnetic technology (HIFEM) for abdominal fat reduction, each study site utilized an ultrasound template to standardize 4 data measurement points within the subcutaneous fat layer, assessing thickness before the treatments and at 1-month follow-up post-treatment series. In the current study, the same patients were recalled on an average 206 ± 9.8 days after their original treatment series, and measurements were taken using the same evaluation methodology. No additional treatments were administered. Baseline and 1-month measurements were compared for evaluation. Weight measurements were documented, and patients were screened for adverse events.

Results: In total 18 patients (mean age 43.8 ± 10.8; BMI 24.8 ± 2.8) were evaluated. Compared to the original baseline measurements, the 6-month data showed a significant ($P < 0.01$) average reduction in fat across the abdomen of 27.4%/7.73 ± 5.68 mm. This represents further decrease in the fat thickness compared to the original 1-month evaluation which averaged 16.3%/4.74 ± 4.02 mm ($P < 0.01$). At 6-months, the most significant reduction was seen sub-umbilically (37.7%/9.66 ± 6.3 mm) and epi-umbilically (30.7%/8.0 ± 4.7 mm), with lateral measurements averaging 20.7%/6.63 ± 7.9 mm reduction. Weight changes at six months compared to one month and the baseline were insignificant (-0.69 lb and -1.76 lb respectively, both $P > 0.05$). No adverse events were reported.

Conclusion: The data shows a continued improvement in the reduction of abdominal fat in the majority of patients at 6-months, without significant weight changes. This suggests that a reduction in fat after HIFEM treatments could continue to improve over several months, similar to what has been observed after controlled cooling/heating procedures. Further evaluation and correlation with MRI and CT scan is required to document our ultrasound findings at 6 months.

Clinical Applications – Multi-Specialty – *Dental*

BEYOND SCREENING: FIRST STEPS IN

TRAINING A COMBINED IMAGING AND MACHINE LEARNING-BASED CAPABILITY FOR MAPPING ORAL CANCER HETEROGENEITY AND MARGINS

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Background: Our inability to map the heterogeneity and margins of oral neoplastic lesions presents a critical barrier to accurate diagnosis, treatment and monitoring. It is a significant obstacle to improving oral cancer management and outcomes, which remain poor. Our long-term goal is to develop a specialist tool that will improve oral and oropharyngeal cancer (OC) outcomes. The object is to improve OC outcomes by combining an innovative imaging approach with artificial intelligence convolutional neural networks and deep learning (AI) to develop an OC management system that will guide biopsy, pre-operative treatment planning, intra-operative margin mapping and post-operative monitoring.

Study Design/Materials and Method: This was our first study to evaluate feasibility. Using 7,600 de-identified intraoral white light, polarized white light, autofluorescence and Optical Coherence Tomography images of oral and oropharyngeal healthy tissues, dysplastic and malignant lesions were co-localized using landmarks and physical marking, and convolutional neural networks were trained to continuously map location-specific cancer risk in 3D across each entire region of interest. Then these maps were compared with the corresponding histology. Both intra-oral imaging and imaging of biopsies was performed.

Results: The 3D lesion maps generated from imaging were compared with similar maps generated from histopathology. Agreement within a margin of 500μm was 82%.

Conclusion: These first results show the considerable potential for using AI approaches to improving OC diagnosis, mapping and management. This research was supported by the National Institutes of Health under grants No. 1R03EB014852, UH2 EB022623, P41EB015890 and UL1 TR0001414, as well as the Beckman Foundation.

EFFECT OF 980 nm DIODE LASER GINGIVECTOMY ON FLUOROSED ENAMEL SURFACE IN ORTHODONTIC PATIENTS

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Background: Gingival hyperplasia is a common adverse reaction due to orthodontic treatment with fixed appliances. Soft tissue diode laser is often used for gingivectomy for management of orthodontic treatment-induced gingival hyperplasia. Orthodontists working in endemic fluorosis regions, frequently experience difficulties in bonding brackets to fluorosed teeth as the thin outermost enamel surface layer of fluorosed teeth is hypermineralized and is resistant to acid etching and therefore, has been found to significantly decrease bond strength of orthodontic brackets. The effect of diode lasers on fluorosed enamel needs to be investigated in cases where orthodontic patients with fluorosis are referred for laser gingivectomy procedure to periodontist. Therefore, this clinical study aimed to evaluate and compare the enamel surface morphological changes following a 980 nm diode laser gingivectomy on fluorosed and non-fluorosed teeth.

Study Design/Materials and Method: Gingivectomy was performed on 50 mildly fluorosed and 50 non-fluorosed teeth indicated for orthodontic extraction, using 980 nm diode laser at 1.2 W power, continuous mode, in 31 orthodontic patients (16 males and 15 females, mean age 17.8 years) having gingival hyperplasia. Subsequently, teeth were extracted, and were examined by scanning electron microscope (SEM) at 50x and 750x magnifications at intersection of cervical and mid-labial region for all crown specimens to assess the ultra-structural changes.

Results: The enamel specimens of both laser-irradiated fluorosed and non-fluorosed teeth exhibited no evidence of laser-induced pitting or cavitation, carbonization of surface and heat induced surface cracking. However, smear layer was observed in enamel specimens of fluorosed teeth.

Conclusion: 980 nm diode laser can induce smear layer formation in fluorosed enamel during gingivectomy in orthodontic patients. Thus, extended enamel conditioning with phosphoric acid might be needed to effectively remove this laser-induced smear layer which may affect the effective bonding of orthodontic brackets and also composite or laminate veneers to the fluorosed enamel surface.

Clinical Applications – Multi-Specialty – *Fractional*

A PROSPECTIVE, SPLIT-FACE, RANDOMIZED STUDY COMPARING A 755 nm PICOSECOND LASER WITH AND WITHOUT DIFFRACTIVE LENS ARRAY (DLA) IN THE TREATMENT OF THE UNWANTED PIGMENT COMPONENT OF MELASMA IN ASIANS

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Background: Treatment of melasma with laser remains a challenge due to limited efficacy in response in addition to high rates of recurrence and side effects. Recently, picosecond lasers have shown favorable results in treatment of benign pigmented lesions with minimal downtime and adverse effects. The present study compared the efficacy and safety treatment of unwanted pigmentation associated with mixed-type melasma using picosecond 755 nm alexandrite laser in a split-face manner, having one side treated with a diffractive lens array (DLA) and the other side with a standard non-diffractive optic. The study only assessed the improvement of pigmentation and did not take into account any other improvement in skin quality that has been clinically proven with the DLA.

Study Design/Materials and Method: Fourteen subjects with skin type IV and V that presented with mixed type melasma were enrolled. All patients did not receive any other energy-based or topical treatment during the period of the study. Each patient was randomly treated with a 755 nm picosecond laser coupled with a DLA on one side of the face and without DLA on the other side. The laser was delivered through an 8 mm spot size with average fluence of 0.38 J/cm^2 (0.36–0.40 J/cm^2) at 2.5 Hz for a total of two passes without pulse overlapping. All subjects received six-monthly treatments. Subjective (clinical evaluation) and objective (Mexameter reading and 3D photography) evaluations on the degree of pigment clearance and adverse effects were obtained at 1-, 3- and 6-month after

the final treatment. Subjective assessment on the degree of pigment clearance was evaluated by two-blinded physicians, based on a five-category grading system of the lesion clearance (1 = 0–24% improvement in pigment; 2 = 25–49%; 3 = 50–74%; 4 = 75–94%, and 5 = 95–100%). Adverse effects including the occurrence of infection, erosion, blister, scar, and hypo- and hyperpigmentation were also recorded.
Results: At the 6-month follow-up, 43% and 29% of no DLA and DLA sites, respectively, were graded as having greater than 50% improvement in the pigment component associate with melasma. There was no significant difference in clinical improvement in pigmentation from the 1-month to the 6-month follow-up on DLA ($P = 0.100$) and no DLA sites ($P = 0.110$). No statistically significant difference in clinical improvement in melasma pigmentation between the two laser techniques at 1- ($P = 0.44$), 3- ($P = 0.58$), and 6-month ($P = 0.65$) follow-up was noted. Objective assessment on melasma clearance using Mexameter and 3D photography corresponded to the clinical evaluation. Mild post-inflammatory hyperpigmentation (PIH) was observed in 28.6% and 14.3% of the subjects on the DLA and no DLA sides, respectively. All PIH was transient and resolved within one month without further sequelae.
Conclusion: A 755 nm picosecond laser is safe and effective for the treatment of the unwanted pigment associated with mixed melasma in Asian skin types IV–V. The 755 nm picosecond laser has shown to prolong improvement of melasma from recurring up to a period of 6 months after the treatment.

ACNE SCARS SINGLE SESSION TREATMENT USING SUBCISION AND FRACTIONAL ABLATIVE 2940 nm Er:YAG LASER

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Background: The main purpose of this study was to evaluate the safety and efficacy of single session acne scars treatment using subcision and fractional Er:YAG laser.
Study Design/Materials and Method: This is a retrospective study in which acne scars patients were treated with subcision and fractional ablative Er:YAG laser in our clinic in the period from May 2015 until February 2018. Two step protocol was used: subcision using Taylor's Liberator subcision instrument and Er:YAG fractional ablation using $2 \times 132\,J/cm^2$ at 250μm microspots and 0.6 msec performed in 6 passes across the whole face. Each patient received single treatment session. Tumescent anesthesia was applied. Before and at every follow-up visit standardized photographs were taken for evaluation of the treatment efficacy. Subjective and objective tools (Satisfaction Questionnaire and Blinded evaluation of pre and post photographs plus GIAS score) were used for efficacy assessment. Adverse effects (AE) were observed every day during the first 5–7 days (until re-epithelization) as well as at every following visit. Follow-ups were done at 3 and 12 months.
Results: 34 patients (8 male and 26 female), mean age 38 (range 23–69) were treated. Four independent reviewers correctly identified Before and After pictures in 82% of cases at 3-12-months follow-up. GIAS assessment resulted in 81% improved patients (28% much or very much improved). 90.5% of patients were satisfied with the results of the treatment (57.1% very satisfied). All patients had expected post-operative AE: re-epithelization and erythema lasting in average 6.0 ± 2.2 and 43.6 ± 34.0 days. Aside of expected no other AE were observed.
Conclusion: Acne scars single session treatment using subcision and fractional ablative 2940 nm Er:YAG laser showed to be safe and efficacious treatment for acne scars. Patient's satisfaction with the results was very high and the adverse effects were expected and minimal.

ASSESSMENT OF FRACTIONAL CARBON DIOXIDE LASER AND NON-ABLATIVE LONG PULSED Nd:YAG IN KELOID

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Background: Keloids have beleaguered patients and clinicians alike. They can be aesthetically disfiguring, functionally debilitating, and emotionally distressing. Despite an array of therapeutic approaches, no single method provides complete benefit. Lasers have introduced new ways to manage keloids that may result in improved aesthetic and symptomatic outcomes and decreased keloid recurrence.
Study Design/Materials and Method: Thirty patients with keloid scars were enrolled in the study. Three keloidal areas in each patient were randomly assigned to treatment modalities. Four laser sessions, 4–6 weeks apart were performed utilizing three laser modalities. Evaluation was performed before and 1 month following the sessions. Two scar assessment scales, the Vancouver Scar Scale (VSS) and the Patient and Observer Scar Assessment Scale (POSAS) were used for clinical evaluation. Routine H & E, Masson's trichrome and orcein stains were used to evaluate the appearance and pattern of dermal collagen and elastic fibers. Image analysis was used to quantitatively assess the density of collagen and elastic fibers. Biochemical evaluation of tissue level of TGF-β I and TGF-β III was performed using ELISA studies.
Results: Both VSS and POSAS showed significant improvement following treatment with the three used modalities, difference between them was insignificant. Collagen fibers showed significant improvement as regards appearance and pattern while it was insignificant as regards density with the three used modalities, difference between used modalities was insignificant, Elastic fibers showed significant improvement as regards appearance and pattern with the three used modalities, as regards density improvement was only significant in fractional CO_2 modality. Level of TGF-β I showed significant reduction after treatment in all treatment modalities, while TGF-β III levels showed insignificant elevation in all treatment modalities, difference between used modalities was insignificant for level change of both TGF-βI and TGF-β III. Hypopigmentation with some cases treated by combined modality occurred.
Conclusion: Fractional CO_2 and non-ablative long pulsed Nd:YAG non-contact mode lasers are effective and safe treatment modalities for the treatment of keloids, combination in the same session did not add significant additional benefit to the use of fractional CO_2 alone and the side effects profile was higher, however combination in alternative sessions might broaden the mechanisms of actions inducing scar regression and clinical improvement.

EARLY INTERVENTION WITH PULSE DYE AND CO_2 ABLATIVE FRACTIONAL LASERS TO IMPROVE CUTANEOUS SCARRING POST-LUMPECTOMY – A RANDOMIZED CONTROLLED TRIAL ON THE IMPACT OF INTERVENTION ON THE FINAL COSMESIS

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Background: Despite impressive advances in scar treatment, the most effective method of treatment is early intervention, with integration of various laser modalities into scar treatment and scar prevention methods. Modalities include those targeting angiogenesis, collagen synthesis and inflammation. This study investigates the clinical effect of combination of Pulsed dye laser (PDL) and fractional ablative CO_2 laser (FACL) in preventing aesthetically displeasing scarring as well as improving appearance and symptoms of new post-lumpectomy surgical wounds.

Study Design/Materials and Method: A prospective randomized, controlled split scar study with PDL plus FACL vs no laser treatment on eighteen subjects The authors treated the half scar of all patients, utilizing a unique protocol of PDL (Syneron Candela, 7 mm, 0.45 milliseconds, 5–6 J/cm^2) followed immediately by FACL (Lumenis, line pattern, 15–20 milliseconds 5%) at a monthly interval for three consecutive treatments, starting 2–4 weeks following surgery. The treated *vs* the non-treated scar halves were evaluated by 3 investigators (two dermatologists and one plastic surgeon) and by the patients at 6 months post last treatment, utilizing the Patient and Observer Scar Assessment Scale (POSAS). The participants also rated overall satisfaction using a four-point scale.

Results: The mean POSAS scores at 6-months post-treatment were significantly lower (better cosmesis) for the treated half compared with the untreated half ($P < 0.01$). Satisfaction rates were significantly higher in the treated half ($P = 0.005$).

Conclusion: This study indicates that a 3 combined PDL + FACL, performed in the early stage of wound healing may have the potential to optimize scar formation in full thickness wounds post-lumpectomy.

PHOTOFRACTIONAL ON THE DÉCOLLETAGE: OUR APPROACH

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Background: Décolletage aging is a very common problem, epidermis and dermis become very thin and the skin is characterized by skin laxity, lines/wrinkles, hyperpigmentation, erythema, tactile roughness, atrophy, and telangiectasia. Many approaches have been proposed (injectables, PDT, chemical peels, energy-based procedures) to these issues but while aggressive ablative laser procedures have a high risk of adverse events, less aggressive approaches alone do not achieve outstanding outcomes. This study evaluates a combined same-day sequential use of IPL and non-ablative fractional resurfacing on the signs of aging of the décolletage.

Study Design/Materials and Method: In this single center, prospective, open-label, intra-individual controlled study, the full décolletage area of 22 adults has been treated for 4 times at 4 weeks intervals first by IPL immediately followed by non-ablative fractional. Five variables (fine lines, mottled pigmentation, telangiectasia, sallow complexion and tactile roughness) as well as a global score were scored at baseline and 6 months after the last session of treatment with a five-point scale and the results were compared to evaluate the improvement. Immediate responses as well as adverse events were monitored throughout the study period.

Results: Significant improvements from baseline to follow-up visit were noted on all variables. Mottled pigmentations, tactile roughness and fine lines showed an improvement higher than 1.5 points in the 5-point scale. Treatments were well tolerated. Post-treatment swelling remained visible up to 2 hours after the procedure. The erythema faded away in up to 3 days and the post-op dark/grey scabs spontaneously disappeared in an average of 5.2 days. No long-lasting adverse events were noted.

Conclusion: To our knowledge, this is the first report of the combination of IPL and 1565 nm non-ablative fractional for the rejuvenation of the décolletage. This same-day combined IPL-NAFL approach is safe and effective determining a significant skin rejuvenating effect of the décolletage.

RADIO-PEEL – SYNERGISM BETWEEN MICRONEEDLING FRACTIONAL RADIOFREQUENCY (RF) AND 20% TRICHLOROACETIC ACID (TCA) CHEMICAL PEEL

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Background: Microneedling fractional radiofrequency (FRF) and chemical peels are widely used for skin rejuvenation. we aimed at evaluating the efficacy and safety of FRF and trichloroacetic acid 20% (TCA20%) peel in different combinations for determining the optimal treatment protocol.

Study Design/Materials and Method: In this prospective clinical comparison of four protocols [FRF alone, TCA20% alone, TCA20% before FRF (TCAàFRF) and TCA20% following FRF (FRFàTCA)], the patients underwent 3.8 ± 1.2 succesive treatments of one protocol at 4- to 6-week intervals. The patients and 2 dermatologists evaluated improvement of pigmentation and dyschromia, erythema and blood vessels, laxity and wrinkling and skin imperfections using a global aesthetic improvement scale (GAIS) and a 1–5 scoring system. The patients rated their satisfaction, and reported adverse effects and reduced activity. Skin impedance and histological changes following the different protocols were also evaluated on 3 additional volunteers.

Results: Sixty-seven patients (age range 22–80) were studied. TCAàFRF caused skin impedance to decrease, yielding a more superficial and less efficient penetration of FRF energy. FRFàTCA produced more significant improvement in overall facial skin appearance (GAIS) and most evaluated skin parameters. Adverse effects and satisfaction rates were similar for all approaches.

Conclusion: FRFàTCA had the best synergistic effect on skin rejuvenation compared to FRF or TCA20% alone and TCAàFRF.

Clinical Applications – Multi-Specialty – *General Laser*

LASER THERAPY IN PEDIATRIC PATIENTS: AN ANONYMOUS ONLINE SURVEY OF PEDIATRIC DERMATOLOGY CENTERS IN THE UNITED STATES

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Background: Laser therapy is a common method for treating cutaneous lesions in pediatric dermatology patients. Examples of common applications for lasers include port wine stains, hemangiomata, complex vascular malformations, angiofibromata, traumatic tattoos, congenital melanocytic nevi, scar revision, warts, laser hair removal, and psoriasis. As there are a multitude of laser modalities currently available, in addition to wide variability in characteristics of cutaneous lesions (such as size, location, age of patient, and response to previous treatment), there are many factors to consider when selecting appropriate laser therapy. To our knowledge, there have been no well-established guidelines regarding laser therapy for cutaneous vascular and pigmented lesions in pediatric patients. Therefore, we seek to survey and collate data to better understand the methods of laser treatment used in pediatric dermatology practices and academic centers in the United States. Specifically, we plan to report survey results to better understand factors such as the types of lesions treated, laser modalities used, patient age limitations, treatment setting, anesthetic use, adjuvant medications, and time intervals between repeated treatments, to help establish standards of care for the use of lasers in the pediatric population.
Study Design/Materials and Method: An anonymous online survey will be distributed *via* REDCap to dermatologists who use lasers in academic centers and private practice settings in the United States.
Results: Pending finalization of data collection and analysis.
Conclusion: Our goals are to present this data at the ASLMS and ultimately plan to expand the survey into a publication in the literature pending finalization of data collection and analysis.

Clinical Applications – Multi-Specialty – *Neurology*

LASER THERAPY AND GRIMALDI'S MUSCLE SHORTENING MANEUVER ON SPASTICITY: A MOTOR CONTROL PERSPECTIVE

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Background: Since 2003 year until today we treated more than 300 patients with Traumatic Central Nervous System Injuries (TCNSI), using Non-Surgical Laser Therapy (NSLT) obtaining good results in terms of sensibility and movement. In order to increase muscle strength and to further explore new emerging synergies, we have also started using a physical therapy practice based on the most current knowledge about motor control, called Grimaldi's Muscle Shortening Maneuver (MSM). Spasticity, defined as the inability of CNS to shift Tonic Stretch Reflex Thresholds (TSRTs) outside the activation area of the muscle, is often the most disabling symptom and current therapies are still not able to heal it at all. The goal of our study is to suggest a new way of treatment of spasticity, supporting it with objective measurements of muscle thresholds.
Study Design/Materials and Method: In 2017–2018, 20 patients with traumatic or degenerative CNSI were enrolled. Lasers used were 808 nm, 10600 nm, and 1064 nm, applied with a first cycle of 20 sessions, four a day. Patients were subjected to Grimaldi's Muscle Shortening Maneuver (MSM) twice a day, eight sessions at all, working selectively on hypertonic muscles and their antagonists. Before treatment TSRTs (λs) of selected muscles were assessed through sEMG and electrogoniometry paired together. Muscle force of antagonist muscles was evaluated using some hand-held dynamometers. Modified Ashworth Scale (MAS) was also administered to all subjects. This type of evaluation was also administered prior to and after each maneuver and at the end of each cycle of laser treatment. Every cycle of both treatments was replicated in average each month.
Results: Results were considered positive if the instrumental assessment procedure showed modifications in λ values and subjects improved their motor control in functional tasks. Encouraging results suggest the real correlation between laser and MSM therapies and modifications of TSRT (λ) in spastic muscles. No correlation between MAS scores and λ values emerged reinforcing the idea of spasticity defined as loss of control of λ shifts. Follow-up is positive after two months.
Conclusion: Associating laser treatment and Grimaldi's Muscle Shortening Maneuver (MSM) seems to be effective on spasticity in patients affected by traumatic or degenerative CNSI.

Clinical Applications – Multi-Specialty – *Non-Fractional Ablative*

TREATMENT OF ACNE VULGARIS USING 1,565 nm NON-ABLATIVE FRACTIONAL LASER IN COMBINATION WITH ISOTRETINOIN AND TRADITIONAL CHINESE PRICKING BLOOD THERAPY

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Background: Isotretinoin is one of the first line medications for moderate-to-severe acne vulgaris (AV) but its side effect is a big concern for Asian patients.
Study Design/Materials and Method: The objective is to evaluate the efficacy and safety of the 1,565 nm non-ablative fractional laser (NAFL) in combination with isotretinoin and traditional Chinese pricking blood therapy (TCPBT) for treatment of AV. A retrospective analysis of 60 patients with moderate-to-severe AV who were treated at our hospital from 2015 to 2017 was performed. Four treatments were evaluated (n = 15 subjects per group): 1,565 nm NAFL alone, oral isotretinoin alone, double therapy (1,565 nm NAFL + isotretinoin) and triple therapy (1,565 nm NAFL + isotretinoin + TCPBT).
Results: The improvement rates of inflammatory papules and boxcar atrophic scars ranged from 60.0% to 93.3% in four groups, among which the triple therapy showed the highest improvement rates. The patients receiving oral isotretinoin alone, double or triple therapies showed a significant decrease in volume of boxcar atrophic scars as compared to baseline. The 1,565 nm NAFL only, double or triple therapy significantly decreased index of hemoglobin as compared to baseline. All four treatments significantly decreased indexes of pore sizes and wrinkles on AV lesions as compared to baseline. Furthermore, the triple therapy significantly decreased indexes of hemoglobin and red areas as compared to the other three treatments.
Conclusion: This study showed that the triple therapy with a combination of isotretinoin, 1,565 nm NAFL and TCPBT is more effective for treatment of AV as compared to isotretinoin, 1,565 nm NAFL alone or two therapies combined. It is recommended for further clinical evaluations.

Clinical Applications – Multi-Specialty – *Ophthalmology*

A RETROSPECTIVE STUDY TO ASSESS THE USE OF A RADIOFREQUENCY DEVICE TO TREAT DRY EYE SYMPTOMS ASSOCIATED WITH MEIBOMIAN GLAND DYSFUNCTION AND CONJUNCTIVOCHALASIS

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Background: Dry eye has multiple etiologies, but two of the most prevalent are Meibomian Gland Dysfunction (MGD) and Conjunctivochalasis(CCH). This study examines how a strategy that treats two prevalent conditions concurrently can provide patients with comprehensive and customizable relief from dry eye and expands upon previous reported data on 25 patients.
Study Design/Materials and Method: A retrospective chart review of 74 patients was conducted. Patients were included if they presented with symptoms of dry eye and were treated with a single 4 MHz Monopolar Radiofrequency (RF) System with a combination treatment approach to improve both MGD and CCH. MGD was treated using a 10 mm aesthetic handpiece to massage and heat the glands to a target temperature of 42^{00} degrees. CCH was treated in CUT mode using a surgical handpiece and micro insulated ball tip electrode to perform the plication treatment. Follow-up visit information was compared to Baseline to evaluate efficacy and safety of treatment.
Results: CCH was shown to decrease in 91.6% of patients. Standard Patient Evaluation of Eye Dryness (SPEED), Meibomian Glands Yielding Liquid Secretion (MGYLS), Non-invasive Tear Break-Up Time (NTBUT) and Schirmer test results showed statistically significant improvement ($P < 0.05$) as compared to baseline. SPEED, MGYLS, and Schirmer showed improvement in 78.3%, 50%, and 47.5% of instances respectively. Common side effects seen were tenderness and irritation which subsided within 2–5 days, and redness which subsided within 2–4 weeks.
Conclusion: A majority of the subjects in this study had previously been resistant to conservative treatments, presenting with substantial Meibomian Gland atrophy and dysfunction, yet had significant improvement with the use of a novel two-step approach using an RF device to treat dry eye symptoms.

CLINICAL STUDY TO ASSESS A RADIOFREQUENCY DEVICE IN THE TREATMENT OF DERMATOCHALASIS – "NON-SURGICAL BLEPHAROPLASTY"

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Background: Dermatochalasis has traditionally been treated with surgical blepharoplasty or non-surgically, with ablative procedures. While laser confers improvement, it is restricted to Fitzpatrick skin type due to the risk of prolonged hyperpigmentation. The quest for alternative non-surgical approach, which can be used on any skin type is attractive. Utilization of a radiofrequency device, equipped with a small tip with a broad needle, was evaluated for the treatment of dermatochalasis.
Study Design/Materials and Method: This study was designed to determine the clinical changes induced by a single radiofrequency treatment to the upper eyelid crease in patients with dermatochalasis to evaluate tissue tightening. 6 patients with unwanted loose tissue in the eye orbital area received a single treatment using a radiofrequency system. MRD (marginal reflex distance) was documented at baseline and at 1 and 3 months post procedure. Photographs were taken at baseline and 1 days post and 1 and 3 months post-procedure.
Results: At the time of submission, 4 patients had completed all treatments with a 1-month follow-up. Two blinded evaluators could correctly identify the pretreatment image compared to the post treatment image in an average of 100% of subjects. All 4 of the patients were graded to be at least "Improved" with an average of 2 subjects (50%) being "Very Much Improved". Patient satisfaction was "High" in all subjects who have completed the treatment protocol.
Conclusion: Non-surgical blepharoplasty utilizing a blunt tip to deliver radiofrequency to the upper eyelid crease may serve as an alternative option for the treatment of dermatochalasis.

Clinical Applications – Multi-Specialty – *Photobiomodulation*

PHOTOBIOMODULATION THERAPY REDUCED BLOOD PRESSURE RESPONSE TO MAXIMUM EXERCISE IN POLICE OFFICERS

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Background: Brazilian Police Officers (PO) are exposed to a stressor environment, being wide-open to higher cardiovascular risk. Arterial stiffness and endothelial dysfunction and impairment blood pressure response to exercise are markers of cardiovascular risk. Previous studies have shown that photobiomodulation therapy (PBMT) promotes increase in flow-mediated dilation (FMD). Thus, we hypothesized that PBMT would improve endothelial function and decrease blood pressure in response to maximum exercise in PO.
Study Design/Materials and Method: A clinical study with 18 PO patients were enrolled and divided into 2 groups: PBMT group (PBMT G n = 11, 39.4 ± 2 years; 91.9 ± 5 kg) submitted to CW Diode laser, parameters: $\lambda = 830$ nm, P = 50 Wm, D = 6.0 J/cm^2, A = 0.1 cm^2, Time = 6×13 sec, for 6 months were evaluated. Control group (CG, n = 7, 38.2 ± 3 years; 83.8 ± 3 kg) a matched group for age and weight remained, without any therapy. PBMT was applied twice weekly sublingually, with a maximum of three days between each application. Endothelial function by brachial artery FMD were studied. Systolic and diastolic blood pressures (BP) during cardiopulmonary exercise test were analyzed.
Results: After intervention, PBMTG increased FMD, whereas CG did not change (% of increase = 8.34 ± 1 and 0.33 ± 1 %, respectively, $P = 0.001$). BP response to maximum exercise decreased only in PO submitted to PBMT (pre *vs* post, SBP = 198 ± 6 *vs* 177 ± 4, $P = 0.02$; DBP = 106 ± 2 *vs* 90 ± 1 mmHg; respectively, $P < 0.001$) and no change in CG ($P = 0.19$).
Conclusion: Our data demonstrated that PBMT significantly augment the vascular reactivity in patients, which seems to explain, at least in part, the improved BP response to exercise in this group. In police officers, who are exposed to high levels of stress, PBMT would be an alternative therapeutic to prevent cardiovascular risk.

Clinical Applications – Multi-Specialty – *Photodynamic Therapy*

LIGHT DOSIMETRY CHARACTERIZATION OF AN OPTICAL SCALABLE APPLICATOR

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Background: Intraoperative photodynamic therapy (IOPDT) has been shown to improve survival in patients undergoing surgical resection of thoracic malignancies. The success of this therapy is governed by light dosimetry that is currently difficult to control. In order to provide predictable and reproducible dosimetry, we developed a prototype optical scalable applicator (OSA). The objective of this work was to characterize the optical performance of the OSA.

Study Design/Materials and Method: A prototype OSA was constructed from a flexible silicone mesh applicator, four isotropic light detectors, and four 5 cm cylindrically diffusing optical fibers (CDF) emitting 665 nm light at 1.5 W per fiber. The OSA was used to illuminate a 10.5 cm^2 area. The distribution of light was evaluated on the OSA surface or after passage through solid tissue-mimicking optical phantoms. High-resolution digital photographs and irradiance measurements were used to quantify the light dosimetry. OSA conformability was tested on a cylindrical phantom with 5 cm radius.

Results: Analysis of measured irradiance and digital images of the OSA showed steep light gradients outside the boundaries of the CDF-array. Within the CDF-array, beam profiles showed non-uniform light distribution at the OSA surface where irradiances ranged from 117 mW/cm^2 to 217 mW/cm^2. The digital images revealed that beam uniformity improved markedly after passage through the tissue-mimicking phantoms. Irradiances were 77 mW/cm^2, 46 mW/cm^2 and 10 mW/cm^2 at phantom-depths of 3 mm, 5 mm, and 10 mm, respectively. Conformability testing revealed isodose curves that decreased with increasing depth in the cylindrical phantom.

Conclusion: The OSA can provide effective light irradiances for IOPDT to prescription depths up to 10 mm. The OSA is conformable and scalable, thus facilitating its use on tissues with various topologies and geometries. We propose to use the OSA for IOPDT to improve loco-regional control of margins following resection of the primary tumor.

Clinical Applications – Multi-Specialty – *Picosecond*

A RETROSPECTIVE STUDY ON THE EFFICACY AND SAFETY OF PICOSECOND ALEXANDRITE LASER IN THE TREATMENT OF ACQUIRED BILATERAL NEVUS OF OTA-LIKE MACULES IN CHINESE

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Background: Acquired bilateral nevus of Ota-like macules (ABNOM) is very common in Chinese. The purpose of this study was to evaluate the efficacy and safety of 755 nm picosecond alexandrite laser in the treatment of ABNOM in Chinese.

Study Design/Materials and Method: 227 subjects diagnosed ABNOM from November 2015 to September 2018 were included in this retrospective study. A 755 nm picosecond alexandrite laser system was used to treat all subjects. The treatment parameters were: pulse duration of 750 ps, spot sizes of 2 – 4.5 mm and fluence of 1.26 – 6.37 J/cm^2. Subjects underwent a range from 1 to 4 treatment sessions. The treatment interval varies from 3 to 6 months. Clinical photographs were taken at baseline, prior to each treatment session, and at each subsequent visit. Images were evaluated independently by two dermatologists. A four-point grading scale, >90% clinically cleared; 60%-90% marked improvement; 30–60% moderate improvement; and 30%< no improvement, was used for the evaluation of lesion clearance. The total effective rate is defined as the number of subjects graded as clinically cleared and marked improvement out of all subjects. Clinical improvement and adverse events were assessed.

Results: Out of 227 cases, the number of subjects who received one, two, three, and four treatment sessions are 137, 68, 13, and 9, respectively. The clinical cleared rate after one, two, three, and four treatments is 10.95%, 36.76%, 53.85%, 77.78%, respectively. The total effective rate after one, two, three, and four treatments is 37.23%, 76.47%, 84.62%, and 88.89%, respectively. All subjects experienced mild erythema and mild edema after treatment, which resolved within 24 hours. 26 subjects with transient hyperpigmentation and 1 patients with hypopigmentation were observed.

Conclusion: Our results suggested that picosecond alexandrite laser is an effective and safe treatment approach for acquired bilateral nevus of Ota-like macules in Chinese patients.

A STUDY TO EVALUATE THE SAFETY AND EFfiCACY OF THE 1064 nm PICOSECOND LASER WITH FRACTIONATED MICRO LENS ARRAY (MLA) FOR THE TREATMENT OF ATROPHIC ACNE SCAR IN ASIANS

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Background: Fractional 1,064 nm picosecond-domain laser has recently been applied for treatment of atrophic scars and given encouraging results. However, data on the safety and efficacy of this procedure in the dark-skinned patients are limited. This prospective, self-controlled study was conducted to evaluate the safety and efficacy of a 1,064 nm picosecond laser coupled with micro lens array (MLA) for the treatment of atrophic acne scars in Asians.

Study Design/Materials and Method: Twenty-six subjects of skin type IV and V with atrophic acne scars were enrolled. All subjects were treated on the six-monthly sessions with a 1,064 nm picosecond laser (spot size of 8 mm, fluence of 1.0 J/cm^2, repetition rate of 10 Hz) in combination with the MLA device for an average of 3 passes. Objective (measurement of scar volume using 3D photography and skin roughness analysis using ultraviolet A-light video camera) and subjective (clinical evaluation by two blinded dermatologists) assessments were obtained at baseline and at 1, 3, and 6 months after the final treatment.

Results: At the 6-month follow-up, 53.8% of the subjects were rated as having at least 50% improvement of the scars. The rate of improvement has significantly increased from the 1-month follow-up to the 6-month follow-up ($P = 0.013$). At the 6-month follow-up, the scar volume ($P = 0.024$) and the skin roughness ($P = 0.001$) have significantly improved, in comparison with the baseline. Mild post inflammatory hyperpigmentation (PIH) was observed in 15% of the subjects. All PIH was temporary and resolved on an average of 4 weeks.

Conclusion: The 1,064 nm picosecond laser with MLA is a safe therapeutic alternative for the treatment of atrophic acne scars in dark-skinned individuals.

CLINICAL STUDY WITH A DUAL WAVELENGTH PICOSECOND LASER FOR PERIOCULAR SKIN REJUVENATION IN CHINESE

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Background: Periocular skin sagging with fine wrinkles is common in middle-age Chinese women, especially in the upper eyelid. Most of them prefer to use non-invasive methods for instead of undergoing surgery. The objective of this study was to evaluate the efficacy and safety of a dual wavelength Picosecond laser which cause laser induced optical breakdown (LIOB) in attempting to address upper eyelid ptosis and periorbital wrinkles.
Study Design/Materials and Method: 34 patients with mild to medium upper eyelid skin droops and fine static wrinkles around eyes were recruited. All of them received 3 treatment sessions at 4-week intervals. In each session 1064 nm zoom handpiece,1064 nm fractional handpiece and 532 nm fractional handpiece were used in sequential order, the total pulses on both eyes area did not exceed 1000 pulses. Patients needed to wear eye shields during treatment. Global Aesthetic Improvement Scale Assessment (GAIS) and multi-lighting analyzed imaging system were used to assess the clinical improvement from baseline to final follow-up by two independent dermatologists. While dermal thickness and collagen intensity measured with ultrasound probe system and adverse events was recorded.
Results: 34 female patients (mean age 41.03 years, range 27–66 years-old) in total were enrolled into the study, with Fitzpatrick skin types III to IV. After treatment the upper eyelid ptosis and fine wrinkles significant improved (Excellent 9%, Very Good 29%, Good 44%, Poor 18%), mean periorbital dermal thickness from 1175μm to 1277μm ($P > 0.05$) and the dermal collagen intensity marked increase from 66.27 to 69.37 ($P < 0.05$). All patients tolerated the treatment well and subject pain scores were 0.5, no one was reporting any adverse effects.
Conclusion: This study proved that dual picosecond laser treating around the eye area showed a statistically significant improvement in upper lid ptosis and wrinkle reduction.

EFFICACY AND SAFETY OF PICOSECOND 755 nm ALEXANDRITE LASER FOR TREATMENT OF MELASMA IN ASIANS – A RETROSPECTIVE STUDY

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Background: Recently, melasma treatment with picosecond laser systems is rising in Asia c ommercial market. The purpose of this study was to evaluate the efficacy and safety of 755 nm picosecond alexandrite laser for treatment of melasma in Asians with follow-up to 12 months.
Study Design/Materials and Method: 27 subjects diagnosed with melasma from Dec 2016 to Feb 2018 were included in this study. A picosecond 755 nm alexandrite laser with the zoom handpiece at 0.82–1.18 J/cm^2 was used to treat all subjects. Treatment sessions varies from 2 to 9 with interval varies from 1 to 3 months. The follow-up period was at least 3 and up to 12 months. Clinical photographs were taken at baseline, prior to each treatment session, and at each subsequent visit. Evaluation of photographs was conducted by two independent dermatologists. Objective evaluation was conducted by using Melasma Area and Severity Index (MASI) and a 5-point Visual Analogue Scale (VAS): (1) clearance >81%; (2) between 61–80%; (3) between 41–60%; (4) between 21–40%; (5) less than 20% or no change/getting worse. Safety was assessed through the reporting of adverse events.
Results: The average MASI improvement was 5.34 ± 1.61 ($P < 0.001$) after completing 2 treatments with statistically significant. Similarly, patients with completing 3 treatments showed an additional MASI score improvement of 2.53 ± 3.68 MASI improvement over completing 2 treatment ($P = 0.015$). Further treatments can still provide more MASI improvement compared to completing 2 treatments ($P = 0.04$), however the improvement was not as significant as the first 2 treatments. Similar clinical improvement trend was also observed *via* VAS.
Conclusion: Our results suggested that picosecond 755 nm alexandrite laser provide long-term clinical benefits and safety for treatment melasma in Asians.

FRACTIONAL CO_2 LASER-ASSISTED BOTULINUM TOXIN TYPE A DELIVERY FOR THE TREATMENT OF PRIMARY PALMAR HYPERHIDROSIS: A CASE SERIES

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Background: Intradermal injections of botulinum toxin type A (BTX-A) has successfully treated patients with primary palmoplantar hyperhidrosis. However, common problems with local BTX-A injection for palmar hyperhidrosis include injection pain and reduced palmar muscle strength. The objective of the present study was to evaluate the safety and efficacy of fractional CO_2 laser for assisting the delivery of BTX-A for the treatment of palmar hyperhidrosis.
Study Design/Materials and Method: Three patients with primary palmar hyperhidrosis were treated on one palm with two treatment sessions at two-week interval, consisting of fractional CO_2 laser treatment and immediate post-operative topical application of BTX-A solution at a concentration of 4 Units/0.1 mL for a total of 50 units, while the other palm received no treatment and was served as untreated control. Quantification of sweat production based on palm sweating area (PSA) by using Minor's iodine starch test, and subjective assessment of sweat production by using visual analogue scale (VAS) were performed at baseline, 2 weeks after the 1st and the 2nd treatment, and 1, 2 and 3 months after the 2nd treatment.
Results: The average decrease in PSA of the BTX-A-treated palm was 51.6%, 88.5%, 67.8%, and 52.9%, compared with those of the baseline at 2 weeks after the 1st treatment, 1, 2, and 3 months after the final treatment, respectively. Meanwhile, the average decrease in PSA of the untreated palms was 1–2% throughout the period of the study. The VAS evaluated by the patients corresponded to PSA measurement. No adverse effect was observed in any patient.
Conclusion: Fractional CO_2 laser is a safe technique for BTX-A delivery on the palm area, and is prove to be effective for the treatment of primary palmar hyperhidrosis.

MICRONEEDLING ASSISTED AND MICROINJECTION DELIVERY OF TRANEXAMIC ACID FOR THE TREATMENT OF MELASMA

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Background: Tranexamic acid (TXA) is a novel treatment option for melasma. The aim of this study was to review and explore the efficacy and safety of intradermal delivery of TXA as a treatment for melasma.
Study Design/Materials and Method: A MEDLINE search was performed to identify articles which investigated intradermal delivery of TXA for the treatment of melasma.
Results: Seven prospective studies were identified, which demonstrated intradermal TXA efficacy as a treatment for melasma. In a prospective cohort study, 100 women were treated with weekly intradermal TXA for 12 weeks. Patients reported a significant decrease in Melasma Area and Severity Index (MASI) at 8 and 12 weeks compared to baseline. A randomized split-face controlled trial performed in 37 patients compared monthly TXA microinjections to nightly topical hydroquinone for 3 months. TXA injections were better at decreasing melanin value at 4 weeks; however, at 20 weeks there was no difference between the two groups. A prospective cohort study of 100 patients compared monthly TXA microinjections to oral TXA. Results showed a statistically significant decrease in mean MASI from pretreatment at each follow-up visit in both cohorts. There was no statistically significant difference between both methods of TXA administration. In a prospective cohort, 100 patients were randomly assigned to two groups. One cohort received intradermal microinjections of TXA every 4 weeks for 12 weeks while the other cohort received oral TXA 250 mg twice daily for two weeks. At the end of the study, both methods of administration were effective with a statistically significant decreased in mean MASI from pretreatment at each follow-up visit. Histologically, there was evidence of epithelium thickening, decrease in epithelial melanin pigmentation and densification of upper dermis collagen.
Conclusion: Studies suggest that delivery of TXA by microinjection or microneedling is a safe and effective treatment option for melasma. More studies are required to determine the optimal dosage and frequency.

OPEN-LABEL, PROSPECTIVE, MULTICENTER STUDY TO EVALUATE A NOVEL MULTI-WAVELENGTH 532 nm AND 1064 nm Nd:YAG PICOSECOND PULSE DURATION LASER AND A MICRO-LENS ARRAY HANDPIECE ATTACHMENT FOR THE TREATMENT OF MODERATE AND SEVERE ACNE SCARS

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Background: Treatment modalities for acne scarring include ablative laser skin resurfacing, dermabrasion, chemical peels, and more recently fractionated delivery of picosecond lasers has been shown to be safe and effective for this indication. The objective of this study was to evaluate a multi-wavelength 532 nm/1064 nm Nd:YAG picosecond laser with an investigational micro-lens array (MLA) attachment that fractionates both wavelengths for improvement of acne scars.
Study Design/Materials and Method: A total of 43 subjects with moderate to severe acne scars were enrolled in this open-label, prospective, multicenter, pivotal study, with 38 completing all study treatments and at least one follow-up visit. Subjects received up to 6 laser treatments, spaced 6 weeks apart, and were followed 6 and 12 weeks post their final study treatment. The primary endpoint was a responder, defined as when at least two of the three blinded dermatologist reviewers correctly identified the order of baseline and follow-up visit images and the subject achieved at least a one-point improvement in the Acne Scar Assessment Scale (ASAS) grade assigned by the investigator. Investigator assessments also included skin quality and Global Aesthetic Improvement Scales, while subject satisfaction assessments were also recorded. Safety was measured by recording subject discomfort scores and adverse effects.
Results: Blinded reviewers correctly identified the baseline image in 37 of the 38 image sets (97.4%) and observed an improvement in ASAS grade of 1 point or more (1.53 ± 0.54) in 37 of 38 subjects. The treatment responder rate achieved was 94.7% (36 of 38; 95% CI: 82.7% – 98.5%). The average GAIS score was 1.7 ± 0.7 (95% CI:1.5–2). Subject satisfaction was high with 76% being very satisfied/satisfied. Subjects experienced transient self-resolving side effects following treatment and reported an average treatment discomfort score of 5.5 ± 2.0 (0–10 scale). No serious side effects were reported.
Conclusion: The 1064 and 532 nm picosecond-domain laser incorporating an MLA handpiece was found to be safe and effective for the treatment of facial acne scars. The treatments were well-tolerated and the subjects experienced little to no downtime.

SAFETY AND EFFICACY OF PICOSECOND ALEXANDRITE LASER IN THE TREATMENT OF NEVUS OF OTA IN ASIANS WITH SKIN TYPE IV: A CASE SERIES

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Background: Nevus of Ota, a bluish hyperpigmentation on the face is caused by the entrapment of melanocytes in the upper third of the dermis. This hamartoma of dermal melanocytes is a congenital disorder with its onset at birth or around puberty. The gray patches are distributed within the ophthalmic and maxillary branches of the trigeminal nerve. This may appear unilaterally or bilaterally and may not only involve the skin, but the ocular and oral mucosal surfaces as well. Widely used treatment for Nevus of Ota is Q-switched Nd:YAG laser. The use of picosecond lasers have proven to be positive in improving clinical conditions in different cases of hyperpigmentation.
Study Design/Materials and Method: This study is a case series with 8 Filipino patients, ages 9–53 with skin type IV. No medications used/monotherapy/wash out period of 6 months. Informed consent/pre-procedure photos and VISIA analysis of the patients were taken before every treatment and a month after the last. A total of 5–10 treatments were done with 4–8 weeks interval. Photos and VISIA parameters were compared and analysed.
Results: There were significant improvements in the percentile rankings of the pre and post-treatment VISIA analysis. Pre and post-treatment photos showed marked reduction in the nevus.
Conclusion: Based on the results obtained, we therefore conclude that the picosecond alexandrite laser is a safe and effective treatment of Nevus of Ota in Asians with skin type IV.

TREATMENT OF REFRACTORY MELASMA IN ASIANS WITH FLAT AND DIFFRACTIVE LENS PICOSECOND ALEXANDRITE LASER

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Background: Melasma is one of the most challenging conditions to treat with both drugs and devices. Low fluence Q-switched Nd:YAG has been widely used with good results in lighter skin types. However, in darker skin type Asian, especially in sunny climates there have been inconsistent results. The introduction of the picosecond Alexandrite laser in our practices in 2014 with the flat optic and the diffractive lens array provided us with an opportunity to explore the use of this device and optic to treat melasma. The diffractive lens array produces an array of localized epidermal injuries, vacuoles, while the flat optic only produces focal areas of epidermal necrosis
Study Design/Materials and Method: 60 patients were evaluated and diagnosed with melasma. They were all treated with the picosecond Alexandrite laser. From 10 October 2014 to 10 February 2015, 19 patients were treated with the flat optic (1.2- 2 J/cm^2) and from 2 February 2015 to 13 March 2018. 41 patients were treated with the diffractive lens array (0.41 J/cm^2, 8 mm). Treatments with both optic were performed with one pass at two week intervals for six treatments. Melasma Severity Index (MSI) was used to evaluate the patients before treatment and at 3 and 6 months after the final treatment session. Statistical analysis to compare difference in both Groups was done using SPSS version 16.0- t-test.
Results: At six months after the last treatment there was a 63.95% improvement in the MSI scores for patients that were treated with the flat optic. While a 76.72% improvement in the MSI scores was observed in the patients that were treated with the diffractive lens array ($P < 0.05$, SPSS, t-test). But there was no significant difference when compare means MSI score at six months in both group ($P > 0.05$, SPSS, t-test). There was 63.16% rebound melasma and 21% macular hypopigmentation at six month in the flat optic group but only 12.2% rebound melasma with no hypopigmentation in the diffractive optic group.
Conclusion: There are a number of devices that are promoted to treat Melasma. Most have proved marginally successful and some exacerbate this problem. This investigation highlights the utility of a picosecond Alexandrite with a flat and diffractive lens array to successfully treat a large percentage of Asian patients in a sunny climate.

Clinical Applications – Multi-Specialty – *Practice Management*

HOW TO MARKET YOUR PHOTOMEDICINE – AESTHETIC PRACTICE

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Background: Licensed physician board certified in family medicine, geriatrics, emergency medicine, and forensic medicine. Over thirty years of clinical office and hospital based experience including the use of photobiomodulation and aesthetic laser medicine. Office practice includes daily treatment of patients requiring photobiomodulation therapy and/or aesthetic laser medicine as part of their clinical treatment plan.
Study Design/Materials and Method: Presentation is based upon clinical knowledge, education, training and experience of over 30 years developing a board certified family medicine office which includes integrative medicine practices of energy medicine and photobiomodulation therapy. Using cutting edge technology including website development, facebook, instagram, blogging. Have designed a system of practice promotion and practice branding.
Results: Development of a well branded cutting edge energy medicine family practice office in the Baltimore/Washington area well recognized for photobiomodulation and aesthetic medicine.
Conclusion: This presentation would provide clinicians both new and established a road map for the successful additional of energy medicine to their practice or the expansion of their practice using energy medicine and photobiomodulation.

INCREASE IN DERMATOLOGY RESIDENT ACGME REQUIRED COSMETIC PROCEDURES AT UNIVERSITY SITES AFTER ESTABLISHING A COSMETIC CENTER

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Background: Exposure to aesthetic procedures during dermatology residency is central to patient safety. The Dermatology Review Committee of the American Council of Graduate Medical Education (ACGME) requires dermatology residents observe or participate in 15 laser, 10 botulinum toxin, and five soft-tissue augmentation cases. Academic dermatology programs providing cosmetic procedures can offer longitudinal training at university sites. Herein, we examined whether a cosmetic dermatology center within an academic health center (AHC) increased resident involvement in ACGME required cosmetic cases at university clinics.
Study Design/Materials and Method: ACGME dermatology resident logs from 2014–2018 from one AHC were retrieved. The number of soft-tissue augmentation, botulinum toxin, ablative, non-ablative, and vascular laser cases performed at teaching sites were identified by location and staff appointment.
Results: From 2014 to 2018, 1034 cosmetic cases logged by 25 residents resulted: 110 ablative, 43 non-ablative, 336 vascular, and 30 pigmented lesion laser, 211 soft-tissue augmentation, and 304 botulinum toxin. A year before a cosmetic center (2014), 56% of teaching cases occurred at university sites as compared to 89% in 2017. University cases increased by 35% in the center's first year and 40% one year later. The ratio of university to private cases was 1.4 two years prior and 6.3 two years thereafter.
Conclusion: The development of an academic cosmetic center increased aesthetic case volume within teaching sites. This suggests academic programs with a cosmetic division can capture cosmetic teaching cases. The center allows residents to author abstracts and presentations on cosmetic dermatology. As the cosmetic center becomes increasingly interdisciplinary, dermatology can take lead, as it has the least procedural overlap with other aesthetic specialties. Future studies are needed to determine how this volume increase influences aesthetic education, practice plan, and patient care.

MEDICAL/LEGAL THE GROWING RISK IN ENERGY MEDICINE

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Background: Board certified in family medicine, geriatrics, emergency medicine and forensic medicine with over 30 years of professional experience practicing in both hospital medicine

settings and office settings. Energy medicine for over 15 years has been an important part of the care and treatment of patients in both the hospital setting and office setting. Complications of energy medicine applications have been increasingly observed as the number of patients being treated by energy medicine devices has exponentially increased in recent years. Dr. Baker has served as a medical/legal expert in energy medicine malpractice cases for both the defendants and plaintiffs. Dr. Baker has served as a medical/legal consultant for over 30 years of his medical practice. Dr. Baker has lectured, written and taught about medical practice legal issues.
Study Design/Materials and Method: Based on 30 years of clinical experience, knowledge, training and education Dr. Baker will present and discuss cases involving application of energy medicine technology with a review of significant medical/legal issues that arise.
Results: Based on over 30 years of clinical experience serving as a medical legal expert Dr. Baker will identify areas of risk in applying energy medicine technology. Dr. Baker will discuss actual cases in which patients were treated with energy medicine experiencing adverse outcomes. Dr. Baker will present recommendations for improving clinical practice and documentation of energy medicine applications.
Conclusion: Energy medicine is a growing new science with exciting opportunities to treat medical and aesthetic conditions for the benefit of our patients. As the number of energy medicine procedures has increased a growing number of adverse reactions have been identified by patients and their treating clinicians. This abstract is designed to identify those areas of risk to the patient and to recommend solutions to practicing clinicians.

MICROWAVE THERMOLYSIS REDUCES GENERALIZED AND SOCIAL ANXIETY IN YOUNG ADULTS WITH AXILLARY HYPERHIDROSIS

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Background: Hyperhidrosis (HH) is associated with impairments in quality of life and elevated anxiety. Microwave thermolysis is a newer treatment that reduces sweating, yet effects on QOL and emotional symptoms have not been examined. We hypothesized that microwave thermolysis would reduce sweat severity, improve QOL, and reduce anxiety in young adults suffering from axillary HH in a prospective clinical trial.
Study Design/Materials and Method: We enrolled 24 young adults (M age = 23.57 years, 54% female) with elevated scores on the Hyperhidrosis Disease Severity Scale. All participants received one session of microwave thermolysis, and 83% received two sessions. Participants completed measures of sweat severity, quality of life (QOL), generalized anxiety, social anxiety, social avoidance, and anxious/depressive mood symptoms at baseline; post-first treatment; and following second treatment.
Results: At baseline, all participants had severe sweating; 87.5% had impaired QOL, 75% had elevated social anxiety, 50% with generalized anxiety, 48% with social avoidance, and 38% with anxious/depressed mood. Paired samples t-tests indicated significant improvements from baseline to first procedure, including decreased sweating ($t(21) = 5.68$, $P < 0.001$), improved QOL ($t(23) = 4.97$, $P < 0.001$), and decreased generalized anxiety ($t(23) = 8.11$, $P < 0.001$), social anxiety ($t(22) = 4.55$, $P < 0.001$), mood symptoms ($t(21) = 3.81$, $P = 0.001$), and social avoidance ($t(22) = 3.12$, $P = 0.005$). After second treatment, further improvements were noted in sweating ($t(18) = 3.28$, $P = 0.004$) and QOL ($t(18) = 3.83$ $P = 0.003$), and a marginal trend for generalized anxiety ($t(19) = 1.96$, $P = 0.064$).
Conclusion: There were significant improvements in sweat severity, skin-specific QOL, generalized anxiety, social anxiety, anxious/depressive symptoms, and social avoidance. The majority of the psychosocial benefit appears to emerge after one treatment of microwave thermolysis, whereas the level of sweat severity and QOL continued to show further improvements after a second treatment. Results would suggest that young adults with axillary hyperhidrosis are likely to experience significant benefits in reducing sweat severity and improving psychosocial functioning after only one treatment session of microwave thermolysis.

Clinical Applications – Multi-Specialty – *Radiofrequency*

COMBINATION THERAPY OF FRACTIONAL RADIOFREQUENCY MICRONEEDLE SYSTEM AND TOPICAL APPLY OF POLYLACTIC ACID FOR ACNE SCAR: A RANDOMIZED CONTROL SPLIT-FACE STUDY

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Background: Various treatments such as chemical peels, surgical excision, dermabrasion, and tissue augmentation with fillers have been tried for the treatment of acne scars. However, until now there is no treatment of choice.
Study Design/Materials and Method: Polylactic acid was treated with 250W ultrasound device for 4 ~ 8 hours after addition of 6 cc distilled water. And 3 cc of non-cross-linked HA was added to make a total of 9 cc. And microneedle cylinder shaped is specially made to be able to inject materials. It has a solenoid structure with a length of 1.5 to 2.1 mm, a diameter of 200μm, and an insulating 21 pin. Total 42 patients with acne scar on the both cheek were treated. The mixture was applied to the acne scar on one side of the face prior to FRM treatment. And the other side was treated FRM treatment with normal saline as control. All patients received three treatment sessions at 4 to 6 week intervals.
Results: The combination therapy group showed significantly better efficacy than control group in smoothness of the scars (combination 2.78 and control 2.00 $P = 0.000$), pore size (combination 2.50 and control 2.11 $P = 0.008$), overall improvements (combination 2.72 and control 2.00 $P = 0.001$) and except brightness (combination 2.33 and control 2.11 $P = 0.946$). The combination therapy group showed higher patient satisfaction of acne scar improvement (combination 7.54 and control 7.01 $P = 0.005$).
Conclusion: In this study, combination therapy of FRM and polylactic acid has more cosmetic effect on the acne scar. So it can also be used as a good treatment modality.

EVALUATION OF A NOVEL 1064 nm DIODE LASER FOR THE TREATMENT OF LOWER EXTREMITY LEG VEINS

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Background: Leg veins are a common cosmetic concern. Over 15 years, the 1064 nm Nd:YAG laser has become the chosen laser therapy for leg veins. This longer wavelength reaches

deeper and larger veins, and combined with improved cooling techniques, can successfully treat lower extremity leg veins. A new novel 1064 nm diode laser, which has a small (3×5 mm) spot size, effective cooling, uses high fluences (up to 300 J/cm^2 given in a relatively short pulse to reach a power of up to 1 kW) is presented. The objective is to evaluate the safety and efficacy of the novel 1064 nm diode laser for leg veins on the lower extremities.
Study Design/Materials and Method: 15 female subjects, aged 18–60, of skin types II–V, were recruited to this single center study. The treatment included 2 sessions 6 weeks apart and follow-up visits at 3 and 6 months. The results were evaluated by photographs and an investigator classification of the treated vascular lesions appearance.
Results: 15 subjects of average age 52.8 years, completed 2 treatment visits and the 3-months follow-up visit. Photos demonstrated improvement in vascular lesions. Vascular lesions classification was reduced by 1 score from baseline score of 2.9 to an average score 2 at 3 months. No significant or unexpected adverse events were detected.
Conclusion: This study demonstrated that the novel 1064 nm diode laser is safe and effective for the treatment of leg veins and spider veins at 3 months.

THE EFFICACY OF A COMBINED THERAPY: CALCIUM HYDROXYLAPATITE BASED FILLER AND ENERGY-BASED DEVICE FOR TREATMENT OF ACNE SCARS

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Background: Current treatment options for acne scars include energy-based devices (EBD), chemical-based modalities, physical surgical-based and non-surgical options. To evaluate the efficacy and safety of combining diluted Calcium hydroxylapatite based filler with EBD for acne scar treatment.
Study Design/Materials and Method: The medical records of all acne scar patients treated in our center between the years 2013–2016 were reviewed. Two objective dermatologists and the patients assessed the aesthetic improvement (baseline *vs* 6 months post-last treatment) of the acne scars by using a global assessment scale (GAS) on 0–5 scale. The patients rated their satisfaction, numbered the days of downtime post-treatment and reported side-effects
Results: 352 patients were treated. 8% were treated with the injection of diluted Calcium hydroxylapatite. while the rest were treated with EBD +/− CaHA: 46% with ablative fractional CO_2 laser, 28% with radiofrequency (RF) bipolar device and 18% with 1540 nm non-ablative fractional laser. The median number of treatments was lower in the FACL treated patients in compare to the other EBD (FACL − 3.3 ± 1.1, NAFL − 5.4 ± 1.7, RF − 5.1 ± 1.5). The integrated median GAS of the 2 dermatologists' was the highest for the FACL treated patients (3 ± 0.5, $P < 0.001$). Treatment combination of EBD with CaHA, in different treatment sessions, was found to be more effective ($P < 0.05$). Patients treated with FACL reported the longest down time (median − 7 days) and more side effects, with the most common being hyperpigmentation.
Conclusion: The combined use of diluted Calcium hydroxylapatite based filler injection followed by fractional ablative CO_2 laser in separate treatment sessions is a promising treatment option for the treatment of acne scars.

TREATMENT OF ATROPHIC ACNE SCARS USING RF MICRO-NEEDLING AND GALVANIC ENERGY

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Background: Acne has a prevalence of over 90% among adolescents and may result in atrophic acne scars which may have a negative psychological impact on social life and relationships. Treatment of acne scars with radiofrequency has been shown to enhance collagen remodeling in the dermis by heating and remodeling/destroying the existing unevenly arranged collagen and promoting new collagen formation. In this study we evaluated the efficacy and safety of a novel device which combines the benefits of RF microneedling and galvanic energy to treat atrophic acne scars.
Study Design/Materials and Method: This was a prospective, open label study. 23 participants with mild to severe atrophic acne scars were enrolled. The participants underwent 3 to 4 treatments at 3-week intervals. Efficacy of treatment was evaluated 3 months after the last treatment using the ECCA acne scar grading system and by the Investigator global assessment (IGA) scale. Treatment safety and tolerance were also evaluated.
Results: Three months after the last treatment, significant improvement in atrophic acne scars was noted. ECCA scores decreased significantly from 78.85 ± 21.7 to 40 ± 17.3 ($P < 0.001$). According to the IGA, 65.2% (15/23) of participants had moderate improvements and 34.8% (8/23) had slight improvements. Immediate response effects included minimal discomfort during the treatment and transient erythema and edema. All treatments have been performed without any anesthesia and the pain was minimal with a mean 10-point VAS pain score of 1.92 ± 0.46. No other adverse events were reported. Post-treatment downtime ranged from 0.5 to 2 days. Most patients (86.9%, 20/23) indicated that they were 'extremely satisfied' or 'satisfied' with the treatment. Patient self-assessments of the degree of improvement paralleled the physicians' evaluation.
Conclusion: Galvanic energy combined with RF micro-needling is an effective, tolerable and safe method for treating atrophic acne scars.

Clinical Applications – Multi-Specialty – *Tattoo*

COMPARISON OF PICOSECOND AND NANOSECOND LASER TREATMENT FOR TATTOO REMOVAL IN CHINESE

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Background: For many years, quality-switched (QS) laser technology functioning on the principle of selective photothermolysis was used to remove tattoo pigment. In the last two years, the availability of the picosecond 755 nm and 1064/532 nm lasers in China provided additional tattoo removal options. The objective of this study is to evaluate and compare the safety and effectiveness of the 755 nm picosecond laser, 1064/532 nm picosecond laser and 1064/532 nm nanosecond laser in removal of tattoos in Chinese.

Study Design/Materials and Method: A total of 10 subjects were recruited in the study, each with one previously untreated tattoo. Each tattoo was divided equally into 3 parts for a total of 30 tattoos treated. Each part was respectively treated with the 755 nm picosecond laser, 1064/532 nm picosecond laser and 1064/532 nm nanosecond laser. Tattoos were photographed for evaluation at baseline and at two months after a single treatment, to evaluate for the extent of tattoo pigment removal, degree of pain and adverse effects.
Results: The 755 nm picosecond laser and 1064/532 nm picosecond laser appears to reduce tattoo pigment more effectively and rapidly than the 1064/532 nm nanosecond laser for tattoos after a single treatment ($P < 0.05$). There was no significant statistical difference between the two picosecond lasers for black tattoo removal ($P > 0.05$). On the whole, the picosecond laser appears to be more effective than the nanosecond laser for tattoo pigment removal with milder adverse reactions. No statistical differences were observed in pain degree amongst the three laser types.
Conclusion: Our results show that the picosecond laser is more effective than the nanosecond laser in tattoo removal, and has less adverse effects. The 1064/532 nm and 755 nm picosecond lasers were comparable in removal of black tattoos with similar degree of pain for subjects, and demonstrates respective wavelength advantages that are unique in the treatment of other tattoo colors.

Clinical Applications – Multi-Specialty – *Ultrasound*

MICROFOCUSED ULTRASOUND WITH VISUALIZATION TREATMENT PLANS AND COMFORT MANAGEMENT IN REAL-WORLD PRACTICE

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Background: Microfocused ultrasound with visualization (MFU-V, Merz North America) is a non-invasive procedure that is FDA-cleared to lift skin on the neck, eyebrow and under the chin as well as to improve lines and wrinkles on the décolletage. This case series assessed customized treatment plans using MFU-V to treat the lower face and submentum and to assess a comfort management option in real-world clinical use.
Study Design/Materials and Method: Ten patients received MFU-V treatment of the lower face and submentum. Prior to treatment, patients received 800 mg ibuprofen orally and topical 20% lidocaine/5% prilocaine was applied to all treatment areas. Patients also had a fixed 50% oxygen and 50% nitrous oxide mixture (CAREstream America, Inc.) as an analgesic, which was self-administered, as needed, throughout the procedure. Patients verbally rated their discomfort for each treatment area using a 10-point scale (1 = Alert, smiling to 10 = Closed eyes, moaning/tearing).
Results: The lower face and submentum was treated in nine patients over 3 consecutive days. MFU-V treatments were individualized for each patient and incorporated the use of the 4–4.5, 7–3.0, and/or 10–1.5 MHz transducers (TDs). The number of lines delivered with each transducer was customized based upon degree of skin laxity, tolerability, skin texture and quality. Patients completed an increased amount of overall lines compared to the standard recommendations with continuous or intermittent use of self-administered oxygen and nitrous oxide mixture during treatment. Subject-reported mean pain scores per treatment site were: face (4.5 mm TD): 4.1; face (3.0 mm TD): 2.4; submentum (4.5 mm TD): 4.2; submentum (3.0 mm TD) 4.4. No serious adverse events were reported.
Conclusion: This is the first case series to report the use of a fixed oxygen and nitrous oxide mixture as an analgesic during MFU-V treatment, which may facilitate a more intensive treatment course with MFU-V. This treatment modality is well tolerated and safe.

OPTIMIZING PATIENT OUTCOMES THROUGH A CUSTOMIZED APPROACH OF MICROFOCUSED ULTRASOUND WITH VISUALIZATION TREATMENTS: *CONSENSUS* GUIDELINES FROM AN EXPERT PANEL

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Background: Microfocused ultrasound with visualization (MFU-V; Merz North America, Inc.) is FDA-cleared for the lifting the skin of the brow, neck, and submentum, and for improvement of lines and wrinkles of the décolleté. Basic treatment maps and guidelines have been developed; however achieving optimal outcomes in clinical practice requires a customized approach. The objective of the present guidelines is to provide a framework to develop a customized treatment plan informed by key patient characteristics and proper use of MFU-V to assess skin anatomical features.
Study Design/Materials and Method: Consensus guidelines and recommendations were developed by a global panel of expert aesthetic physicians. Key discussion topics included patient factors that contributed to outcomes; customization of the number of treatment lines, energy settings, and treatment depths; approaches for restorative *vs* preventative *vs* maintenance treatments; and safety considerations.
Results: Use of MFU-V is the most important factor for selecting transducers/treatment depth and planning the number of lines at each depth. Higher density treatments are associated with ideal outcomes. Treatment intervals should be tailored to age, with older patients requiring more frequent treatments to maintain results driven by continued collagen production. Because neocollagenesis is valuable to all patients, MFU-V can be applied for both preventative and restorative treatments. In addition to proper technique, the most important factors associated with positive outcomes are management of patient expectations and proper diagnosis.
Conclusion: Supported by a large body of literature, a well-characterized mechanism of action, and high reported patient satisfaction, MFU-V is considered by the expert panel to be a key foundational aesthetic treatment and the gold standard for nonsurgical lifting and tightening of the skin. These consensus guidelines extend the available evidence and clinical data to provide a framework for physicians to fully customize their treatment approach with MFU-V, leading to ideal outcomes that are integral to the overall aesthetic treatment plan.

Clinical Applications – Multi-Specialty – *Urology*

TREATMENT OF PROSTATODYNIA IN YOUNGER PATIENTS WITH SUB-ABLATIVE Er:YAG INTRAURETHRAL LASER

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Background: This prospective study was aimed at comparing the clinical outcomes between the use of the Er:YAG laser, administered in long sub-ablative pulses applied at the level of

the male prostatic urethra, to the use of the standard treatment of oral tadalafil, for the treatment of prostatodynia symptoms in young patients.
Study Design/Materials and Method: A prospective study, composed of two groups of patients: the Laser, composed of 16 patients between 31 and 47; and the Control, 20 patients between 30 and 45 . Both groups affected by Prostatodynia, with characteristic symptoms: perineal pain, dysuria and urinary frequency. Laser group patients received two sessions of Er:YAG intraurethral laser in sub-ablative mode, separated by 4 weeks, two laser sessions in two months. Control group treated with tadalafil, 5 mg/day, two months.
Results: All the evaluated symptoms showed a statistically-significant improvement in the follow-up at one month and three months in both groups. VAS showed a fall from severe to minimal or absent, and from moderate to minimal to absent. Urinary symptoms of dysuria and frequency, evaluated by the "QLDUS Questionnaire" and by I-PSS, a statistically-significant improvement in both groups at the month of follow-up, more evident at three months. Q-max measured by uroflowmetry showed clear improvement in both groups, from 2 to 5 ml/sec, maintained after three months. Of the 16, 13 remained asymptomatic and with a normal Q-max at six-months follow-up; of the 20 patients treated in the control group, only 10%, 2 patients, were asymptomatic at six months of follow-up.
Conclusion: The multiple treatments proposed show that a clear knowledge of the problem has not yet been reached. Laser light in sub-ablative pulses of Er:YAG, may represent an option in the therapeutic arsenal with that we have today.

Clinical Applications – Multi-Specialty – *Vascular*

1064 nm LASER SYSTEM WITH CONTACT COOLING FOR TREATMENT OF RETICULAR LEG VEINS AND TELANGIECTASIAS

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Background: Superficial telangiectasias are commonly treated by pulsed dye and Nd:YAG lasers, while sclerotherapy is the treatment of choice for reticular veins of the lower extremities. We evaluated 1064 nm laser pulses with a unique chilled-water sapphire contact cooling plate applied pre-and post-treatment for treating both types of leg veins.
Study Design/Materials and Method: Subjects with vessels up to 3 mm diameter were treated with the 1064 nm handpiece (adjustable spot sizes 3-15 mm) of a laser system combining Nd:YAG and 595 nm pulsed dye laser wavelengths. Standardized clinical photography was performed for blinded evaluation and investigator assessment, using a 5-point global scale of 0 = no response to 4 = 76–100% for overall improvement of smoothness, color and height of leg veins following treatment. Pain scores were self-reported.
Results: 14 subjects (13 females; mean age 46 years) with Fitzpatrick Skin Types II–V underwent a single treatment to 27 leg veins with diameter of 0.2–2.6 mm. A single pass, with 3, 5 or 7 mm spot size, fluence 100–200 J/cm^2, 15–40 millisecond pulse duration and contact cooling, was delivered along the length of the vessels. Mild erythema was common, with vessel contraction and edema observed immediately following treatment. Mean pain score was 3.1 ± 1.8 (0 = no pain to 10 = worst pain). Investigator assessment at one-month post-treatment demonstrated some degree of improvement to all 27 treated veins, with mean improvement of 2 (26–50% improvement). Eight veins (29.6%) showed greater than 50 percent improvement, while two subjects experienced grade 4 (75–100%) improvement.
Conclusion: A single treatment resulted in modest to significant improvement particularly in reticular veins and blue venulectasias, with minimal complications and discomfort. This laser system may provide an alternative therapy for treatment of leg veins, particularly in case of needle phobia or allergy to sclerosants.

A PROSPECTIVE STUDY OF 1,500 CASES OF VARICOSE VEINS TREATED WITH ENDOVENOUS LASER ABLATION WITH UP TO 1-YEAR FOLLOW-UP

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Background: Varicose veins are a major medical condition, affecting 23% of adults worldwide. Endovenous thermal ablation is considered a grade 1A recommendation for the treatment of saphenous incompetence. The objective of this study was to analyze the outcome of 1,500 cases treated with endovenous laser ablation (ELA) in a dermatology clinic with up to 1-year follow-up.
Study Design/Materials and Method: This is a prospective study from November 2010 to July 2018, with 1,500 limbs presenting varicose veins, arising from great, small, anterior accessory great saphenous vein and perforator vein incompetence, that were treated with ELA with one year follow-up. The devices used were a 1,470 nm laser, delivered through a radial fiber, together with a robotic fiber pullback device and a 1,320 nm laser with a fiber pullback device. Microphlebectomy was performed in 85% of the cases. Follow-up visits were performed within the first week of treatment, and 2 months and 12 months following treatment. Treatment efficacy was determined by Ultrasound and CEAP and VCSS (Venous clinical severity score). Side effects evaluated were Endovenous Heat Induced Thrombosis (EHIT), Deep Venous Thrombosis (DVT), infection, phlebitis, skin hyperpigmentation, paresthesias and fractured endovenous laser fiber.
Results: ELA was performed in 984 patients; a total of 1500 vessels were treated. Patients included 740 females (75%) and 244 males (25%), with a mean age of 52 years (range: 18 – 89). Baseline varicose vein classifications included 0.4% CEAP 6, 1% C5, 3.3% C4, 19% C3, 74% C2 and 2.3% C1. Mean length treated were (cm): GSV 50; SSV 22,5; AASV 21. Mean fluence used was 3040 jul. Mean treatment time was 51 minutes. All patients were able to resume their daily routine immediately after the procedure, some even returning to work after the treatment. CEAP improvement was 96%. VCSS was 4.17 before treatment, and it improved until 0.49 the first week and 0.15 at 12 months. There were 21 cases (1.4%) of recanalization during one year follow-up. There were no cases of either DVT, phlebitis or infection. There were 28 cases (1.8%) of grade 1 or 2 EHIT. Fractured endovenous laser fiber occurred in 5 cases. In 112 cases (8.3%), there was hyperpigmentation which was caused by either laser, foam or microphlebectomy.
Conclusion: Endovenous laser ablation is an effective, safe and highly tolerated procedure that allows patients to return to their daily routine immediately. The 1-year recurrence rate is very low (1.4%) and the side effects are rare, minor and extremely well tolerated.

RANDOMIZED, SINGLE-BLINDED, CROSS-OVER STUDY OF A NOVEL WOUND DRESSING VERSUS

CURRENT CLINICAL PRACTICE AFTER PERCUTANEOUS COLLAGEN INDUCTION THERAPY

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Background: Skin rejuvenation procedures have become common with sophisticated technologies with reduced downtime and related risks. Recently, microneedling has been paired with radiofrequency to create Fractional Radiofrequency Microneedling (FRFM) to induce neocollagenesis. Frequently, topical products are applied immediately after the needling. This procedure is known as percutaneous collagen induction therapy (PCIT). Postoperative topical wound care is critical for prompt rapid and safe healing, with moist wound healing deemed of primary importance for fast and correct scarring process. An ideal dressing enables a moist environment, reduces post-procedural inflammatory response in the first stages of wound healing. The objective of this study is to evaluate whether an innovative silicone-based wound dressing is superior than standard of care therapy in decreasing severity and duration of treatment-site acute inflammatory reactions post PCIT.
Study Design/Materials and Method: An RF Microneedling device was used for the full-face FRFM procedure. Subjects ($n = 20$) applied treatment (film–forming wound dressing) and control (petroleum–laser ointment) immediately after the procedure and daily; they were evaluated immediately post-procedure (baseline assessment), at 2, 3 and 7 days post-procedure. Digital and 3D pictures (Miravex, Ireland) were taken at each assessment.
Results: All patients healed properly without reporting adverse reactions to any of the studied products. Erythema at each study visit was significantly reduced with the use of the novel wound dressing ($P < 0.001$). A statistically significant difference in favor of the innovative wound dressing also emerged with respect to the patient-rated product properties ($P = 0.008$), such as feel on skin, drying time and stickiness.
Conclusion: The novel wound dressing reduced signs of acute inflammation following PCIT when compared to standard of care, without reporting adverse events and resulting in a more favorable outcome from a patient perspective.

Early Career Clinical and Scientific

1927 nm FRACTIONAL THULIUM LASER COMBINED WITH PHOTODYNAMIC THERAPY FOR PHOTODAMAGED SKIN OF THE DÉCOLLETÉ – A RANDOMIZED AND BLINDED COMPARATIVE TRIAL

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Background: 1927 nm thulium laser is a non-ablative fractional laser that can be combined with PDT for treatment of photodamaged skin. However, the evidence on combination of thulium laser and PDT so far is limited. In a randomized, controlled study, we investigated thulium laser, PDT, and combination of thulium laser + PDT for improving skin photodamaged of the décolleté, clearance of actinic keratoses (AKs) and local skin reactions (LSR).
Study Design/Materials and Method: An intra-individual, randomized controlled trial with blinded evaluations, including patients with photodamaged of the décolleté. The décolleté area was divided into 4 similar study areas and randomized to a single treatment with thulium laser, PDT, thulium laser + PDT, or no treatment (control). Thulium laser (fractional thulium laser) was delivered at 5W and 20 mJ/mb, 8–16 passes alone or immediately before application of MAL-cream. PDT was performed with 20% MAL-cream incubated for 3 hours under light-occlusive dressing, followed by illumination with red diode light at 37 J/cm^2. Protoporphyrin IX fluorescence photographs were captured before and after illumination. Clinical LSR were evaluated at 4–14 days after treatment. Photodamage improvement was evaluated clinically, in blacklight (350-410 nm) and by imaging systems, including reflectance confocal microscopy (RCM), optical coherence tomography (OCT).
Results: Twelve patients (Fitzpatrick skin type I–III) are to be included in the study. In an interim analysis of 6 women (aged 54–76 years), thulium laser + PDT induced more intense LSR consisting of moderate erythema, flaking and bronzing effect compared to thulium laser and PDT alone at 4-7 days follow-up. All LSR reactions were tolerable and cleared within 2 weeks after treatment. Three-month follow-up study results will be presented in their entirety at the 2019 American Society for Laser Medicine & Surgery Conference.
Conclusion: Combination of thulium laser + PDT resulted in tolerable and enhanced LSR that may additionally improve skin photoaging of the décolleté compared to thulium laser alone and PDT alone.

595 nm PULSED DYE LASER FOR THE TREATMENT OF ERYTHEMA DURING ISOTRETINOIN THERAPY

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Background: The use of energy-based devices during or immediately after isotretinoin therapy is a controversial topic. Specifically, for pulsed dye laser (PDL), a single report of keloid formation has led to others considering ongoing isotretinoin therapy as a contraindication to the use of PDL. Even a recent expert consensus on lasers during and after isotretinoin therapy did not specifically address the use of PDL citing the above noted case report. Given that PDL is known to decrease erythema, and that patients with severe acne can be left with generalized facial erythema during and for several months after isotretinoin therapy, further study is warranted to assess the safety and efficacy of PDL during isotretinoin therapy.
Study Design/Materials and Method: 3 patients currently on isotretinoin therapy for acne were treated with a 595 nm PDL. The indication for treatment was generalized facial erythema. The settings used were as follows: 7-10 mm spot size, 8 J/cm^2 fluence, 6 msec pulse width. Erythema was re-evaluated at 1 month after treatment. Assessment for complications such as keloid formation were assessed from a range of 1–3 months.
Results: All treated patients had significant improvement in erythema at follow-up. No patients developed adverse side effects to include keloid formation.
Conclusion: PDL can provide significant improvement in generalized erythema for patients on isotretinoin for acne. No complications to include keloid formation were noted in this case series. A shorter pulse width (0.45 msec) was used in the prior reported case of keloid formation (which notably occurred 2 weeks post-treatment). The longer pulse width in this case series was well tolerated. The use of PDL for generalized facial erythema during isotretinoin therapy may provide great benefit for the appropriately selected patient.

A SPLIT FACE STUDY OF POST NON-ABLATIVE LASER THERAPY WITH STUDY TOPICAL *VS* BLAND MOISTURIZER

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Background: There is evidence that a topical product containing tripeptides, hexapeptides and ancillary active ingredients (hereafter referred to as the study topical) might stimulate neocollagenesis and neoelastogenesis by modulating the damaged extracellular matrix. We present a split face double blinded study comparing the impact of the study topical versus a bland moisturizer when used pre and post-procedure with a 1927 nm thulium non-ablative fractional laser (NAFL).

Study Design/Materials and Method: A total of 20 eligible subjects received two treatments to the entire face approximately one month apart with a 1927 nm Thulium NAFL (fluence 10 mJ, levels 5 to 10, 4 to 6 passes). One half of the face was randomized to treatment with the study topical and the other half to treatment with bland moisturizer. Subjects were instructed to use the assigned topical product at least twice daily starting at the screening visit pre-procedure and continuing until the end of the 60 days study. Blinded investigators performed assessments of post-procedure healing and photodamage measures including lentigines, skin tone and texture, pore size and radiance. Subject satisfaction was assessed.

Results: There were no significant differences in healing between the two groups. At Day 30 the study topical showed greater improvements than the bland moisturizer in all photodamage measures ($P = 0.04$). At Day 60 the study topical showed a trend towards greater improvements in all metrics, except for radiance (tied) ($P = 0.20$). Overall subjects were more satisfied with the study topical *vs* the bland moisturizer ($P = 0.01$).

Conclusion: The study topical appeared to improve overall photodamage outcomes at 30-day assessments when compared to the bland moisturizer on the opposite side. Overall healing was not vastly different between the groups. Subjects preferred the use and feel of the study topical over the comparator, particularly immediately after the procedure.

ANALYSIS OF INFANTILE HEMANGIOMAS TREATED WITH PULSED DYE LASER AND TOPICAL TIMOLOL

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Background: Various treatment modalities are used to limit the proliferation of infantile hemangiomas (IH). One such treatment option, pulsed dye laser (PDL), works by decreasing superficial proliferation and inducing rapid involution of IH. We hypothesize that PDL may be beneficial in both the synergistic treatment of IH with topical timolol as well as in the treatment of those IH that have failed timolol therapy.

Study Design/Materials and Method: This is a retrospective study of all patients with IH that were treated with PDL at our practice between 2015 and 2018 inclusive, who were previously or concomitantly treated with topical timolol. Three blinded physician assessors reviewed before and after photographs in order to assess degree of clearance.

Results: Thirty patients met inclusion criteria. Female patients comprised 80% of cases. Fitzpatrick skin types ranged from I through IV. One-third of patients had failed timolol prior to PDL. All patients were laser-naïve at time of presentation. The mean age at presentation for PDL was 22.2 weeks, median 12 weeks. The settings ranged from spot sizes 7 to 10 mm, fluence 7.5 to 10.5 J/cm^2, and pulse duration 0.45 to 1.5 ms. The mean number of PDL sessions performed to achieve clearance or satisfactory improvement was 9.3, while the median was 7. Fifty-seven percent of cases were on the face. Nearly all cases were superficial, with only 7% (2 cases) mixed IH. Improvement was noted in 100% of cases, with complete clearance in 17%, moderate-to-significant improvement in 67%, and minimal-to-moderate improvement in 17%. No scarring or ulceration were noted.

Conclusion: PDL is a safe and effective option in the treatment of IH that are slow to respond to or that have failed topical timolol. Pediatricians and pediatric dermatologists should consider referral of such patients for laser treatment.

FRACTIONAL LASER-ASSISTED DELIVERY OF TOPICAL CIDOFOVIR IN THE TREATMENT OF RECALCITRANT PLANTAR WARTS

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Background: The treatment of recalcitrant plantar warts is challenging and current therapies are often unsatisfactory [1]. However, intralesional cidofovir has demonstrated complete clearance of plantar warts in up to 98% of patients and therefore is a promising option for use in treatment-resistant warts [2]. Nevertheless, patients with symptomatic, large verrucous nodules and tumors still present a therapeutic challenge. Ablative fractional lasers (AFLs) enable topical drugs to penetrate the stratum corneum and target lesions located within the epidermis and dermis. This technique, also known as laser-assisted drug delivery (LAD), has been utilized in the treatment of numerous cutaneous lesions [3]. Several AFLs, including erbium:yttrium-aluminum-garnet (Er:YAG) lasers, are emerging as therapies for recalcitrant warts, with clearance rates between 47% and 100% [4]. Er:YAG followed by topical podophyllotoxin induced complete response in 89% of patients with plantar warts [5]. We report two cases of refractory plantar warts successfully treated with Er:YAG and topical cidofovir.

Study Design/Materials and Method: Two patients with recalcitrant plantar warts were treated with laser-assisted 3% cidofovir delivery. Treatment was initiated with 2940 nm Er:YAG laser at a density of 11%. Following laser treatments, 75 mg/mL cidofovir was applied topically to the treated areas and covered with an occlusive dressing for 1 hour. Patient 1 has received 6 treatments using this protocol and patient 2 has received 4 treatments thus far.

Results: Both patients demonstrated a substantial decrease in the size of their verrucous lesions. Furthermore, there was a significant improvement in symptoms.

Conclusion: Plantar warts pose a significant challenge to treat effectively and most conventional treatments provide unsatisfactory results. AFLs are used to improve drug delivery for various dermatological applications. We report two cases of Er:YAG assisted drug delivery of topical cidofovir in the treatment of recalcitrant plantar warts with promising results. Future studies are needed to further validate this treatment modality and develop a safe protocol. REFERENCES: 1. Vlahovic, T.C. and M.T. Khan, The Human Papillomavirus and

Its Role in Plantar Warts: A Comprehensive Review of Diagnosis and Management. Clin Podiatr Med Surg, 2016. 33 (3): p. 337–53. 2. Broganelli, P., et al., Intralesional cidofovir for the treatment of multiple and recalcitrant cutaneous viral warts. Dermatol Ther, 2012. 25(5): p. 468–71. 3. Togsverd-Bo, K., et al., Intensified photodynamic therapy of actinic keratoses with fractional CO_2 laser: a randomized clinical trial. Br J Dermatol, 2012. 166(6): p. 1262–9. 4. Nguyen, J., et al., Laser Treatment of Nongenital Verrucae: A Systematic Review. JAMA Dermatol, 2016. 152(9): p. 1025–34. 5. Wollina, U., Er:YAG laser followed by topical podophyllotoxin for hard-to-treat palmoplantar warts. J Cosmet Laser Ther, 2003. 5(1): p. 35–7.

LASER-ASSISTED DRUG DELIVERY OF A NOVEL, LONG-ACTING TRIAMCINOLONE SUSPENSION IN HYPERTROPHIC SCARS

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Background: Laser-assisted drug delivery of varying forms of triamcinolone (suspension, ointment, cream, etc.) have been employed clinically by laser surgeons seeking to reduce hypertrophy in burn, trauma, and surgical scars with varying degrees of success. In addition, laser surgeons often deliver poly-L-lactic acid to improve the appearance of atrophic scars. A novel drug, poly lactic-co-glycolic acid impregnated with triamcinolone crystals has been introduced to the market. Given the size of the molecule (45 microns) and size of the fractional CO_2 laser channels (120 microns), this suspension serves as a promising treatment option for hypertrophic scars.
Study Design/Materials and Method: We present a clinical case series of a novel long-acting triamcinolone suspension in hypertrophic burn and trauma scars. Photographs were taken before treatment and 8 weeks after treatment.
Results: Clinical photos demonstrating improvement in hypertrophy in burn and trauma scars before and after treatment with laser-assisted drug delivery of poly lactic-co-glycolic acid impregnated with triamcinolone crystals.
Conclusion: Laser-assisted drug delivery of poly lactic-co-glycolic acid impregnated with triamcinolone crystals improves the hypertrophy of burn and trauma scars. The size of the microspheres and suspension delivery likely optimizes the features best suitable for drug delivery and prolonged localization.

REVIEW OF NEW CLINICAL APPLICATIONS FOR 308 nm EXCIMER LASER IN SKIN

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Background: The 308 nm excimer laser, a type ultraviolet B energy, was invented by Nikolai Basov in 1970. It is now widely used in the field of dermatology since 1997, and it is U.S. FDA approved for psoriasis, vitiligo, atopic dermatitis and leukoderma. The majority of its clinical applications for dermatologic conditions have been discovered in the past three decades.
Study Design/Materials and Method: Review of studies searchable on Pubmed, ClinicalKey and Medline from 2008 to 2018 describing the clinical uses of excimer laser to determine efficacy and adverse effects, as well as new clinical applications.
Results: A total of 68 published articles meeting our search criteria were found; 33 clinical trials, 3 meta-analyses, 5 prospective studies, 3 retrospective studies and 24 case reports/series. The excimer laser was used in the treatment of 19 different dermatologic conditions. The majority of the articles were studying the use of excimer laser on vitiligo and psoriasis. Other studied dermatologic conditions include alopecia areata, atopic dermatitis, CD30+ lymphoproliferative disease, mycosis fungoides, lichen planus, idiopathic guttate hypomelanosis, nevus depigmentosus, pityriasis alba, leukoderma, dyschromatosis symmetrica hereditaria, striae distensae, folliculitis, prurigo nodularis, granuloma annulare, langerhans cell histiocytosis, morphea and lichen sclerosus. The clinical efficacy and tolerability for excimer laser therapy in 19 different dermatologic conditions will be summarized.
Conclusion: The 308 nm excimer laser produces therapeutic responses with minimal side effects in a wide array of dermatologic conditions. Larger scale studies are needed to research long-term safety profile of this treatment modality.

SOUND LEVELS AND SAFETY IN COSMETIC LASER SURGERY

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Background: Measure the sound levels produced by various lasers commonly used during routine outpatient cosmetic surgery to determine whether or not their use exceeds exposure levels set forth by the US National Institute for Occupational Safety and Health (NIOSH) and the US Occupational Safety and Health Administration (OSHA).
Study Design/Materials and Method: Using two different meters, the sound levels of lasers commonly used in cosmetic surgery were recorded during various procedures for several indications: tattoo removal, treatment of lentigines and pigmented lesions, facial erythema and vascular lesions, hair removal and resurfacing of acne scars and photoaging.
Results: All but five lasers had a maximum sound level below 85 dBA, the limit proposed by NIOSH. The loudest laser examined was a fully ablative 2940 nm Er:YAG during facial resurfacing, with an average maximum sound level of 101.5 decibels (dBA). Two other lasers used for resurfacing exceeded 85 dBA including a fractional ablative 1064 Nd:YAG with an average maximum of 97.8 and a different fully ablative 2940 nm Er:YAG which had an average maximum of 96.3 nm. The two other lasers that exceeded 85 dBA were picosecond lasers used to treat black tattoos, including a 1064 nm Nd:YAG with an average maximum of 93.7 dBA and a 755 nm alexandrite with an average maximum of 93.6 dBA.
Conclusion: Although some lasers in cosmetic surgery may be perceived as being quite loud, they remain safe. Even the loudest laser studied would have to be used for nearly two hours before exceeding the OSHA recommended exposure limit. Even physicians who spend a large amount of time using lasers in clinical practice should be reassured that these devices are not likely to produce noise-induced hearing loss (NIHL).

SUCCESSFUL TREATMENT OF PROFESSIONAL EYEBROW TATTOO WITH PICOSECOND DUAL WAVELENGTH, NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER

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Background: Professional eyebrow tattooing is becoming an increasingly popular cosmetic procedure which poses its own treatment challenges for the laser surgeon when it comes to removal of undesired outcomes, particularly in dark-skin patients. We report 2 cases of patients with different skin types (II, IV) who were successfully treated with picosecond laser after professional eyebrow tattoo (one patient after tattoo microblading procedure).
Study Design/Materials and Method: Patient 1 (skin type IV) underwent 3 sessions (spaced 4–6 weeks apart) of dual-wavelength picosecond Nd:YAG laser at 1,064 nm of professional black eyebrow tattoo. Patient 2 (skin type II) underwent 1 session Nd:YAG laser using the 1,064 nm and 532 nm wavelength of microbladed brown/black ink tattoo. The perfluorodecalin (PFD) patch was applied in both cases
Results: There was mild and transient localized erythema and edema immediately following each laser treatment. Some epidermal crusting was noted for 3–5 days following each treatment. Eyebrow hair growth was not affected and no adverse events were reported. Patient 1 had an approximately 75% clearance of the black ink eyebrow tattoo with three treatments. Patient 2 had 50 −75% clearance after one treatment.
Conclusion: The 1,064 nm wavelength of the picosecond Nd:YAG laser was safely used to clear black and brown ink eyebrow tattoos in two patients who underwent cosmetic eyebrow tattoo, one of whom was skin type IV. Use of picosecond laser provides several treatment advantages to Q-switched laser when treating professional eyebrow tattoos. 1) It requires less number of treatments, and therefore decreased opportunity for scarring (which is more common with microblading compared to traditional tattoo methods) 2) shorter pulse durations are able to more effectively target the smallest tattoo particles for more effective clearance. 3) It is safer to use in dark-skin (Type IV or greater) patients who have had cosmetic facial tattoos due to its ability to select for the smaller tattoo particles over melanin.

SYNERGY BETWEEN THE TREATMENT OF ERBIUM LASER FRACTIONAL AND THE APPLICATION OF PLASMA RICH PLATELET TO THE FACIAL SKIN REDENSIFICATION

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Background: To realize that the combination of different treatments for collagen induction, as they are Laser and Platelet-rich plasma, allows a greater stimulation of the fibroblast for facial rejuvenation, with better effect to reduce wrinkles, acne scars, brown spots and signs of aging
Study Design/Materials and Method: A research of 40 patients randomly divided into 4 groups. Group one and two were treated with Er:YAG 2490 nm laser, the only difference was that Platelet-rich plasma was applied in the second group but not in the first. Groups three and four underwent Er:Glass laser ablative of 1565 nm, half of the group received Platelet-rich plasma and the other half only laser for skin rejuvenation. Additionally, the VISIA study was taken the day of the treatment application and approximately a month after therapy.
Results: The groups treated with PRP had a better outcome in the percentage of wrinkles shown in the VISIA study, as well as an age apparently younger subsequent to the application of the laser.
Conclusion: Platelet-rich plasma is a tool that facilitates the regenerative part of facial rejuvenation, which can intensify the outcome of laser technology.

Nursing/Allied Health – Case Studies

COMBINATION OF FRACTIONAL PICOSECOND 1064 nm LASER AND ABLATIVE FRACTIONAL CO_2 LASER FOR TREATMENT OF THE MATURE BURN SCAR ON LEFT LOWER EXTREMITY

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Introduction/Overview: Burn scars represent a major challenge for cosmetic dermatologist. The introduction of ablative fractional CO_2 lasers (CO_2-AFL) for burn scar treatment shows promising results. Whilst recent studies have focused on atrophic acne scars following fractional picosecond 1064 nm laser. Little is known about the effects of combination of CO_2-AFL and picosecond technology in lower extremity mature scar. A 24-year-old female presented with a large area patch after burn on left lower extremity for more than 20 years, especially the scar extended over thigh and knee. Different appearance of scars was received fractional picosecond 1064 nm laser and ablative fractional CO_2 laser, respectively during the same procedure.
Analysis: The structural changes of scar including smoothness, pigmentation as well as height.
Discussion: It is an attempt to provide perspective approach of mature burn scar reshape for some patients who had scars in more complex locations.
Conclusion: Fractional picosecond 1064 nm laser may have wider clinical applicability, with no or little social down-time and with efficacy comparable to conventional fractional ablative techniques.
Patient Feedback: The structural changes of scar including smoothness, pigmentation as well as height were improved significantly for only once combined laser treatment after 6-months follow-up. No adverse effects including postinflammatory hyperpigmentation (PIH) and prolonged erythema or hypopigmentation were noted.

HOME-USE PHOTOBIOMODULATION DEVICE FOR ACCELERATED HEALING OF HARD TO HEAL WOUNDS WITH VARIOUS ETIOLOGIES: A CASE SERIES

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Introduction/Overview: Photobiomodulation (PBM), previously known as low-level laser therapy, has been shown to accelerate healing of acute or chronic wounds. In the following case series, we present our preliminary experience with a recently approved consumer home-use PBM device (Health-Canada), as an adjuvant to standard treatment.
Analysis: This series of 12 cases (8:4 male:female, 43–84 years old) included 3 abdominal wounds, 5 diabetic foot ulcers (DFU), and 4 complicated wounds, were treated from May to August 2018. The PBM treatment (808 nm, 250 mW peak power, 15 KHz, 5 J/min, ray size $4.5 \times 1.0\,cm^2$) was applied over the wound bed, wound margins, and over nearby lymph nodes by the patients themselves. The abdominal wounds achieved complete epithelialization after 5–6 treatments at the clinic over a period of 9–21 days. Three of the DFUs closed within 2 weeks after 4–6 treatments and the other 2 achieved 50% size decrease

in 1 week. Finally, 4 complicated wounds were improved or completely resolved with pain alleviation including (1) post-surgical large dehiscence wounds following treatment of compound fracture with planned amputation; (2) Groin wounds in a patient with renal cell carcinoma, (3) a seroma wound with 4.5 cm tunnel after surgical breast cancer removal accompanied with breast tenderness, (4) a recurrent venous ulcer, extremely painful not responding to combination pain medication.
Discussion: Hard-to-heal wounds are a burden for patients, caregivers, and costly for the healthcare system. Based on our previous experience and the cases presented here, self-applied PBM, led to accelerated healing and rapid pain alleviation over standard care alone. Moreover, the treatment encouraged patient's involvement in own care.
Conclusion: This home-use PBM device can easily be integrated as an adjuvant treatment to standard care at the clinic or home for various wound types.
Patient Feedback: Patients found routine easy to follow and painless, and in wounds that involved pain reported pain reduction after 1–3 treatments.

MULTI-MODAL APPROACH WITH BODY CONTOURING TREATMENTS ON A TRANSGENDER FEMALE

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Introduction/Overview: 39-year-old Caucasian transgender woman with gender dysmorphia presented to clinic with multiple cosmetic concerns 6 months post sex reassignment therapy including vaginoplasty and self-administered estrogen *via* intramuscular injection. Patient has taken oral tenofovir and emtricitabine for pre-exposure prophylaxis and potential HIV exposure for 3 years. Patient has no other pertinent prior or current medical history or surgeries. Patient is otherwise healthy with a normal BMI.
Analysis: Patient stated she had rapid weight gain, skin laxity and striae in isolated areas of body such as upper inner thighs, posterior flanks and abdomen that remain despite exercise and diet after sex reassignment therapy. Patient stated she wears supportive garments in all seasons of the year and is uncomfortable and lacks confidence in feminine clothing. Patient wants to contour her masculine V-line body shape to have more feminine features along with the stubborn fat that recently developed.
Discussion: Discussed multi-modal approach to treat concerns. Baseline photographs and weight taken to measure treatment efficacy. Methods of treatment for abdominal and posterior flank subcutaneous fat included a single treatment of cryolipolysis to each area followed with 3 treatments of high intensity frequency ultrasound every 2 weeks. Prior to each treatment with HIFU, patient was treated with a bipolar radiofrequency device heating the skin to 43°C for 7 to 10 minutes in the treatment area. HIFU and cryolipolysis was avoided for inner thigh as the area had more laxity and striae and would benefit more from a heat-based method such as monopolar radiofrequency to tighten the skin in addition to reducing fat.
Conclusion: Significant improvement in reduction of subcutaneous fat seen from baseline photographs after 12 weeks.
Patient Feedback: 8 to 12 weeks after cryolipolysis treatment, patient stated was able to stop wearing constrictive supportive garments and was feeling more confident in feminine clothing. Patient continued to see significant improvement from additional treatments with HIFU and radiofrequency.