AMERICAN SOCIETY FOR LASER MEDICINE AND SURGERY

2019 Late Breaking Abstracts

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

ENHANCED OPTICAL CLEARING OF *EX VIVO* PORCINE SKIN *VIA* HYPODERMIC NEEDLE ARRAY DEVICES

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Background: Optical cleaning agents (OCAs) have shown promise for reducing scattering within the skin, and thus, enhancing access to underlying tissues and organs for laser-based therapeutics and diagnostics. However, realization of this promise has been constrained thus far by the hydrophobicity and viscosity of typical OCAs, which limits their penetration and diffusion within skin when applied topically. Herein, we report preliminary results from efforts seeking to overcome these limitations through development of hypodermic needle array (HNA) devices that will provide a simple and minimally-invasive means for actively perfusing OCAs rapidly and uniformly throughout the desired tissue volume.

Study Design/Materials and Method: HNA devices based on arrays of 30 gauge hypodermic needles were fabricated *via* 3D-printing. Using a syringe pump to control delivery rate and volume, a 70% glycerol solution (FDA-approved OCA) was administered through the devices to *ex vivo* porcine skin. Clearing efficacy was characterized through measurement of light transmittance across the visible spectrum using a fiber optic spectrometer.

Results: Our preliminary results have shown that the HNA devices enhance transmittance up to 50% relative to topical administration of comparable OCA volumes. Current efforts are focused on developing better understanding of the delivery dynamics, and using this understanding to inform optimization of device design and delivery parameters to further improve clearing efficacy.

Conclusion: While further studies are required, our early results suggest that the HNA devices hold potential for significantly improving skin clearing efficacy, and thus, eventually broadening the indications for which laser-based therapeutics and diagnostics can be used. One key example in this regard lies in the in the Windows to the Brain concept, which seeks to couple transparent cranial implants with OCA-based scalp-clearing to provide new means optically accessing the brain on a chronically-recurring basis without need for recurring craniotomies or scalp retraction.

Basic Science & Translational Research – *Therapeutic, HIFU, Fat*

BIOCHEMICAL PERSPECTIVE OF FAT PHYSIOLOGY AFTER APPLICATION OF HIFEM FIELD TECHNOLOGY: ADDITIONAL INVESTIGATION OF FAT DISRUPTION EFFECTS IN A PORCINE STUDY

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Background: Multiple studies reported fat tissue reduction after application of the High-Intensity Focused Electromagnetic (HIFEM) technology, yet cellular level evidence of the exact mechanisms remains scarce. This study aims to verify or refute previous single-study histological evidence and further investigates the proposed mechanism of apoptosis induction.

Study Design/Materials and Method: The thighs of two large white pigs were treated with HIFEM for 30 minutes. Subcutaneous fat punch biopsies were collected from the application area before, immediately after and 8 hours post-treatment. Control samples were taken from the abdomen immediately after and 8 hours post-treatment. The samples were used for detection of pro-apoptotic DNA markers and for measurements of the level of free-fatty acids (FFA). A histopathologist examined the samples by electron microscopy. The pH levels of the fat tissue were also measured at the biopsy site.

Results: The levels of FFA in the treated fat tissue increased at both animals on average by 127.1% immediately post-treatment and by 134.1% eight hours post-treatment, indicating a rapid breakdown of lipids. In the same region, the average fat pH changed from 7.30 ± 0.12 at baseline to 6.60 ± 0.07 immediately post-treatment, and then to 7.19 ± 0.12 eight hours post-treatment. The levels of BAX, TXNIP, MMP9 and TNFα increased post-treatments; BAD levels remained constant. Apoptotic changes in adipocytes were confirmed by electron microscopy. Control samples showed constant levels of pH and pro-apoptotic markers. The FFA levels in the control samples increased by 41.6% and 51.4% immediately and eight hours post-treatment, respectively.

Conclusion: Through observation of the increase in pro-apoptotic markers, we managed to replicate the previously reported signs of elevated fat apoptosis induced by HIFEM. These effects were accompanied by increased FFA levels indicating a rapid lipolytic reaction, and by the reduced pH levels. Cell acidification has been shown by previous studies to be a preceding signal and one of the causes of cell apoptosis.

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Basic Science & Translational Research – *Therapeutic, Laser, Gastrointestinal*

EVALUATION OF PHOTO-THERMAL EFFECTS AND ABLATION EFFICIENCY INDUCED BY A 1940 nm DIODE LASER FOR EARLY GASTRIC CANCER

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Background: Laser is one of the most effective techniques in surgical procedure, due to its advantages of precise tissue removal and minimal invasiveness, as well as easy control and bloodless manner. Tissue ablation and coagulation functions of the laser have been used in the removal of tumor by providing photo-thermal effects. The main purpose of this study was to evaluate the photo-thermal effects and ablation efficiency of a 1940 nm laser on *ex vivo* porcine stomach tissue with various laser parameters.

Study Design/Materials and Method: The 1940 nm laser was applied to the surface of the stomach wall by controlling the powers (3-18W) and irradiation times (1–15s). We examined the photo-ablation and -coagulation effects of the 1940 nm laser on porcine model histologically *via* hematoxylin-eosin staining (H&E) and nitroblue-tetrazolium chloride staining (NBTC) respectively. Proportions of the ablation and coagulation were used to extract numerically the ablation efficiencies.

Results: The ablation and coagulation depths exhibit a tendency toward non-linearity with increasing power and irradiation time. However, in case of ablation efficiency, the longer the time, the better the efficiency at low power (3–9W), and the shorter the time, the better the efficiency at high power (12–15W) settings. Furthermore, the maximum value was generated in different irradiation times at each power setting.

Conclusion: A 1940 nm laser is a promising tool in gastroenterologic surgical procedures. Depending on the laser parameters, degree of tissue ablation and coagulation can be controlled, which facilitates precise and hemostatic surgery. Our study enables clinicians to determine the optimal-laser parameters by providing information of photothermal effects and ablation efficiency dependent on the laser parameters.

Basic Science & Translational Research – *Therapeutic, RF, Skin*

HISTOLOGICAL EXAMINATION OF SKIN TISSUE IN PORCINE ANIMAL MODEL AFTER SIMULTANEOUS APPLICATION OF MONOPOLAR RADIOFREQUENCY AND TARGETED PRESSURE ENERGY

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Background: This histological study investigates the difference between simultaneous application of monopolar radiofrequency with targeted pressure energy and consecutive application of the two energies, when applied on porcine skin tissue.

Study Design/Materials and Method: A non-invasive technology based on combined emission of radiofrequency heating and pressure energy was used. Simultaneous emission of the energies was applied to two pigs; two pigs were treated consecutively. All subjects received four 12-minute abdominal treatments (one per week). The 5th pig received no treatments and served as a control subject. Biopsies of the skin were obtained at the baseline, after 4th treatment and at the 1-month follow-up. Samples were fixed in formalin, embedded in paraffin, sectioned and stained with Orcein and Picrosirius red. Primary outcomes were to assess quantitative changes of collagen and elastin fibers, observe signs of angiogenesis and examine thickness of dermis. Inter-group differences between related means were statistically analyzed.

Results: In the treated subjects, the amount of collagen and elastin fibers increased significantly ($P < 0.05$). At the follow-up, samples from subjects treated with the two energies simultaneously showed 59% and 64% more increase in collagen and elastin fibers, respectively, when compared to subjects treated consecutively. After the simultaneous application, on average 16.47% collagen increase and 8.63% elastin increase was observed, while the same parameters averaged 10.34% and 5.27%, respectively, after the consecutive application. No significant change was observed in the control subject. Thickness of the dermis increased in the pigs treated simultaneously (+848.8 μm/50.17%, $P < 0.05$). Slices examined after the 4th treatment and at the 1-month follow-up showed the upper part of dermis rich in blood vessels.

Conclusion: Results suggest that simultaneous application of the two energies produce significantly more profound changes in skin, when compared to consecutive treatment. Despite further research is needed, our findings represent potential for treatment of various skin conditions.

Basic Science & Translational Research – *Therapeutic, Skin, Drug Delivery*

JET-INJECTION-ASSISTED DRUG DELIVERY – HISTOLOGICAL CHARACTERIZATION OF CUTANEOUS DEPOSITION

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Background: Laser-assisted drug delivery has so far not been successful in improving treatment efficacy of nodular basal cell carcinoma. For effective delivery to deeper dermal layers, techniques that do not rely on passive diffusion have been hypothesized to propose a better alternative. In this histological study, we aim to investigate cutaneous delivery patterns using a new electronic pneumatic jet-injection device.

Study Design/Materials and Method: Delivery was investigated in 24 porcine skin samples (2 × 2 cm). A jet-injection device with a nozzle size of 200 micrometer delivered 80 μl tattoo ink (0.1 cc tattoo ink: 5.0 cc saline) with at pressures of 3.10 bar (n = 6), 3.93 bar (n = 6), 4.55 bar (n = 6), and 3.10 + 4.55 bar (n = 6). Depth, width, and depth of maximum width of ink deposition were evaluated on histological slides.

Results: Instant cutaneous delivery of tattoo ink was observed for all treatments. The deposition of tattoo ink varied with pressure settings; deeper dermal deposition was seen with higher pressure settings.

Conclusion: Jet-injection devices may provide a new way to secure instant and deep dermal delivery of drugs; such treatment may translate into more effective treatments for nodular basal cell carcinoma. Final results and statistics will be presented at the conference if accepted.

Basic Science & Translational Research – *Therapeutic, Skin, Fat, Miscellaneous*

OXYTOCIN LEVELS IN ISOLATED, FULL-THICKNESS HUMAN SKIN EXPLANTS AFTER MECHANICAL STIMULATION

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Background: The skin is an important interface and communication system of the body. Sensory stimulation of the skin including various forms of mechanical stimulation like pressure, vibration and touch, can trigger a wide array of physiological responses. Neuromodulators are assumed to play an important role is such responses. It is controversial to what extent neuromodulators like oxytocin are released indirectly by the central nervous system, or directly at the area of stimulation locally in the skin. The neuromodulator oxytocin has been suggested for many important physiological effects, including but not limited to change of thermal damage threshold of cells, fat loss, emotional attachment, and happiness. We investigated if oxytocin levels could be altered in isolated skin samples by mechanical stimulation.

Study Design/Materials and Method: We developed a system to mechanically stimulate human skin explants in a controlled manner with an electrically driven vibrational applicator attached to a computer-controlled XYZ-stage. Motion trajectory, vibrational amplitude and frequency and temperature of the applicator can be controlled. We exposed discarded, full thickness human skin explants, which were procured within a few hours after surgery, to mechanical stimuli of low and high frequencies for a specific duration of time.

Results: A significant increase of up to 2 times of oxytocin levels was found for a mechanical stimulation with high frequencies. Slow stimulation resulted also in a smaller increase of oxytocin levels. Various factors, like incubation time after stimulation, also affected measured oxytocin concentrations.

Conclusion: Mechanical stimulation of the skin can induce an increased concentration of oxytocin in isolated skin samples in absence of any central nervous system involvement. The possibility to use mechanical stimulation to induce an increase in oxytocin levels (and potentially other neuromodulators) warrants clinical studies to explore mechanical stimulation as a therapeutic intervention for new indications related to the wide array of the various physiological effects of neuromodulators.

Basic Science & Translational Research – *Therapeutic, Skin, Plasma*

HELIUM PLASMA SKIN REGENERATION – EVALUATION OF SKIN TISSUE EFFECTS IN A PORCINE MODEL AND COMPARISON TO NITROGEN PLASMA SKIN REGENERATION

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Background: Helium plasma skin regeneration (PSR) is a novel skin rejuvenation technology with significant differences compared to nitrogen PSR technology but that may exert similar skin tissue effects. Study objectives included comparison of acute and chronic skin tissue changes amongst the two plasmas in a porcine animal model.

Study Design/Materials and Method: In this study both helium and nitrogen plasmas were used to treat the dorsal skin of Yorkshire cross mini pigs with 20% and 40% power helium plasma single pass treatment (4 liter gas flow, continuous energy delivery, linear non-overlapping passes) compared to high energy nitrogen plasma double pass (PSR3) treatment (4.0 Joules, 2.5 Hertz pulse rate, overlapping horizontal, vertical passes). Maximum acute depth of injury and chronic reparative healing depth were assessed along with representative histology in each treatment paradigm.

Results: Depth of acute tissue injury 4 hours post-treatment varied among animals where high energy nitrogen plasma treatments exhibited greatest depth and where 20% and 40% power helium plasma treatments were each nearly identical among animals as a percentage of nitrogen plasma treatment depth. Depth of reparative tissue healing thirty days following treatment also varied among animals where high energy nitrogen plasma treatments exhibited greatest depth and where 20% and 40% power helium plasma treatments were similar within animals and not less than two thirds that of high energy double pass nitrogen plasma. Histological tissue evaluation after thirty days showed similar findings amongst the treatment paradigms with epidermal hyperplasia, flattening of rete ridges and with regenerative granulation tissue expanding the superficial and papillary dermis.

Conclusion: This study demonstrates similarity of acute and chronic helium and nitrogen plasma skin tissue effects, including maximum depth of effect and representative histological changes, in a porcine animal model.

Basic Science & Translational Research – *Therapeutic, Skin, Radiofrequency, Fat*

DESTRUCTION OF SUBCUTANEOUS FATTY TISSUE BY APPLICATION OF ELECTRICAL DC CURRENT

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Background: Electric DC current is used in various dermatologic applications including thermal cautery, electrolysis, and introduction of charged substances into the skin. In this experiment, we explored the feasibility of using an electric DC current to produce an electrochemically induced damage in the subcutaneous tissue.

Study Design/Materials and Method: An electric DC power supply (B&K Precision, Yorba Linda, CA) was used for the experiment. *Ex vivo* full thickness human abdominal skin explants were exposed to customized needle electrodes inserted into subcutaneous fatty tissue. Multiple voltage levels and exposure time combinations were tested up to a maximum of 30V and 5 minutes, respectively. The current was monitored during each tissue exposure. Tissue damage was assessed by histochemical analysis. During DC current application to the skin, heat generation was monitored by thermal imaging (Flir Systems, Wilsonville, OR).

Results: At low voltage settings and a DC current of approximately 3 mA, subcutaneous tissue destruction was observed in the absence of any significant heat production.

Conclusion: Application of low voltage direct current through needle probes has potential to be used for subcutaneous tissue destruction by electrochemical tissue effects.

Clinical Applications – Cutaneous – *Acne*

PHOTODYNAMIC THERAPY FOR PAPULOPUSTULAR ROSACEA

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Background: Current treatments for rosacea have limited success. Reports have shown promising results in rosacea patients treated with methyl aminolevulinate photodynamic therapy (MAL – PDT). The purpose of this study was to evaluate the efficacy of 5-aminolevulinic acid photodynamic therapy (ALA-PDT) in treating papulopustular rosacea.

Study Design/Materials and Method: This was a prospective, randomized, double-blinded pilot study of subjects (ages 18–79) with a diagnosis of papulopustular rosacea. Participants were randomized to one of three groups (groups A, B, or C). Group A subjects had their faces treated with 20% 5-ALA and irradiated with a 417 nm blue light at 10 J/cm^2. Group B subjects were treated with vehicle and blue light. Group C were treated with vehicle only. Each subject received a total of 4 treatments with 2–3 week intervals between treatment sessions. An Investigator's Global Assessment Score (IGA), Inflammatory Lesion Investigator's Global Assessment (ILIGA), Clinical Erythema Assessment (CEA), Inflammatory lesion count (ILC), Patient Overall Assessment scale (POA), and photographs were taken at visits.

Results: Out of 30 subjects (nA = 10; nB = 10; nC = 10), 22 fully completed the study (nA = 7; nB = 9; nC = 6). Overall, IGA scores significantly improved ($P < 0.01$) with Group A improving the most with an average improvement of 2.9 ± 0.4 points ($P = 0.02$). ILGA scores significantly improved overall for Group A ($P = 0.02$) and there was not a significant improvement for Groups B or C ($P = 0.25$, $P = 0.13$ respectively). ILC, CEA, and POA improved overall for all groups (all respective $P \leq 0.01$) with Group A showing the most improvement ($P < 0.01$, $P < 0.01$, $P = 0.09$, respectively).

Conclusion: ALA-PDT appears to be a promising therapy for the management of papulopustular rosacea as participants in Group A showed the most improvement as compared to the other subgroups. A larger, randomized controlled trial is needed to further assess the use of ALA-PDT for rosacea.

TREATMENT OF MODERATE TO SEVERE ACNE AND POST ACNE SCARS WITH 650 MICROSECOND 1064 nm LASER COMBINED WITH LOW DOSE ISOTRETINOIN

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Background: Research indicates acne therapy using isotretinoin can lead to a delay in the repair of skin integuments (i.e., skin scar tissue), and therefore the use of laser and phototherapy in patients receiving retinoid therapy is relatively contraindicated. Traditionally it is believed that laser procedures should be postponed for at least 6–8 months after the end of systemic therapy with isotretinoin. However, a more current version of treatment protocols and the transition to lower dosages have made it possible to reduce the likelihood of side effects of the combination therapy, which presents a significant development for the treatment of post-acne scars and the prevention of their occurrence.

Study Design/Materials and Method: The study included 28 female (60.8%) and 18 male (39.2%) patients of skin types I–III, aged 18 to 29 years with moderate to severe acne (up to 20 papulopustular elements) complicated by atrophic scars. In all patients included in the study, genetic analysis revealed the polymorphism of the genes Col1A2, MMP3, ESR1, MMP1 MMP7, which can lead to the appearance of scars of this morphotype. IGA parameters before the start of therapy averaged 1.8 ± 0.2 points. The Dermatology Life Quality Index (DLQI) before treatment averaged 10.1 ± 1.3 points. All patients underwent combination therapy: systemic use of isotretinoin at a low dosage (0.2–0.3 mg/kg/day) for 6 months in combination with a course of laser therapy on the face with a Nd:YAG 1064 nm laser using a pulse duration of 650 microseconds, fluence 21 J/cm^2, spot diameter 6 mm. A total of 12 procedures were performed with a treatment interval of 2 weeks.

Results: Following therapy, the IGA parameters decreased by 72.2% and reached 0.5 ± 0.4 ($P < 0.01$) points, the average index of the DLQI index decreased to 2.8 ± 1.2 points ($P < 0.01$). During the study, the resolution of inflammatory elements was noted against the background of therapy occurred without any observed incidence of scarring. There was no incidence of increased sensitivity of the skin to the effects of laser radiation or deterioration of the processes of repair of the skin. Laser therapy was well tolerated by all patients.

Conclusion: The combination therapy of 1064 nm laser with a 650 microsecond pulse duration, and isotretinoin at a low dosage (0.2–0.3 mg/kg/day), is a safe and effective in treatment for patients with acne complicated by atrophic scars who are genetically prone to the formation of post-acne scarring. This therapy effectively stimulates the synthesis and reorganization of collagen without the risk of excessive tissue heating and pain. Pathological scarring common in patients with acne was not observed. Improvement of pre-existing scars was observed in many of the patients.

Clinical Applications – Cutaneous – *Complications and Legal Issues*

A SYSTEMATIC REVIEW OF OUTCOME REPORTING IN LASER TREATMENTS FOR DERMATOLOGICAL DISEASES

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Background: Although laser technology has expanded the armamentarium of treatment of 32 various skin diseases during the past years, heterogeneity in study outcomes hamper 33 comparability and appropriate evidence synthesis.The standardization of outcome reporting is crucial for interpretation and comparison of studies related to laser treatment of skin disorders. Summarizing outcomes in current literature should be a research priority, however, studies that report outcomes are lacking in the field of laser surgery. In

collaboration with the Cochrane Skin – Core Outcome Set Initiative (CS-COUSIN), a procedure has been proposed regarding the selection of outcomes for implementation in an international laser Registry (LEAD). As the first step in the development of the registry, we undertook a systematic review to identify outcomes, outcome measurement instruments, methods and definitions reported in recently published literature of laser treatments for skin disorders.
Study Design/Materials and Method: A systematic search was conducted and generated a total of 712 papers. We assessed 100 studies including all types of studies involving laser treatments for the skin. Two researchers independently extracted the type, definition, and frequency of all outcomes and used outcome measurement instruments.
Results: We identified 98 *verbatim* outcomes that were categorized into eight domains recommended by the COMET framework: appearance, long-term effects, physician and patient reported physical signs, satisfaction, health related quality of life, psychological functioning and adverse events. Heterogeneity in outcome reporting (e.g. categories and outcome measurement instruments) was high and definitions were insufficiently reported. There was a clear under representation of life impact domains, including satisfaction (28%) quality of life (4%) and psychological functioning (1%).
Conclusion: Identifying outcomes for registry use in cutaneous diseases will promote clinical researchers to use outcomes chosen by *consensus* that are relevant to patients and clinicians. Results of this review serve for a framework for the process of seeking international *consensus* on most important outcomes to be implemented in the LEAD registry.

Clinical Applications – Cutaneous – *Fat/Body Contouring*

CLINICAL STUDY TO ASSESS THE NON-INVASIVE 1060 nm DIODE LASER IN COMBINATION WITH A NON-INVASIVE RADIOFREQUENCY DEVICE FOR THE TREATMENT OF THE SUBMENTAL, ABDOMINAL OR FLANK AREA TO ADDRESS ADIPOSITY AND LAXITY

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Background: Non-invasive body contouring has become increasingly popular in the past decade due in part to technological advances and combination therapies. While surgical options are still available, patients are increasingly seeking a non-invasive solution to address their needs. The 1060 nm non-invasive diode laser has been approved for the reduction of unwanted fat, and the RF device being used has been approved for wrinkle reduction/tissue heating. It was theorized that the combination of these two devices could be beneficial in non-invasive body contouring by addressing both subcutaneous fat and laxity. This study was designed to determine the clinical changes induced by a 1060 nm diode combined with a radiofrequency device on unwanted fat and skin laxity
Study Design/Materials and Method: 20 patients with unwanted fat in the submental, abdominal or flank areas were treated with the non-invasive 1060 nm diode and the radiofrequency device (either sequentially in the same treatment day or staggered two weeks apart). The patients received 2 treatments with the diode laser, separated by 6 weeks and either 2 or 4 treatments with the radiofrequency device.
Results: At the time of submission, 20 of the 20 patients had completed all treatments and their 1-month follow-up visit (9/20 patients had upcoming 3-month follow-up visits remaining). Blinded evaluators could correctly identify the pre-treatment image compared to the post-treatment image in an average of 80% of subjects. 100% of the patients were graded to be at least "Improved" with an average of 35% of subjects being "Very Much Improved" and 35% being "Much Improved". Patient satisfaction was "High" in all subjects who completed the treatment protocol.
Conclusion: The non-invasive 1060 nm diode combined with a non-invasive radiofrequency device is a safe and effective in the treatment of unwanted fat and loose tissue.

MRI EVALUATION OF CHANGES IN GLUTEAL MUSCLES FOLLOWING TREATMENTS WITH THE HIGH-INTENSITY FOCUSED ELECTROMAGNETIC (HIFEM) TECHNOLOGY

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Background: Previous research using subjective evaluation documented that High-Intensity Focused Electromagnetic (HIFEM) technology induces changes in the gluteal muscles and improve the aesthetic appearance of buttocks. This study provides an objective assessment of the hypertrophic response of the gluteal muscles following HIFEM treatments using the magnetic resonance imaging (MRI).
Study Design/Materials and Method: Patient group consisted of 25 subjects (27.44 ± 4.91 years, average BMI of $20.78 \pm 1.55\,kg/m^2$) who received four 30-minute HIFEM treatments. MRI of pelvic region (from the iliac crest to the upper third of thighs) was obtained at the baseline and 30 days post procedures. The transversal T1 weighted images were acquired, and scanning protocol was set with regards to the optimal distinction of muscle tissue. Standardized photographs and weight measurements were taken. Any adverse events were also documented. MRI scans were manually segmented in order to reconstruct 3D volumes of m. gluteus maximus (gmax), m. gluteus medius (gmed) and m. gluteus minimus (gmin). Volumetric changes were calculated and statistically analyzed.
Results: Volumetric analysis revealed a significant increase in the size of the examined muscles. The average muscle volume enhancement in the gluteal area was $10.29 \pm 2.63\%$ ($201.62 \pm 49.07\,cm^3$). We observed a significant ($P < 0.05$) increase in the volume of all gluteal muscles; gmax increased by $10.59 \pm 3.37\%$ ($134.69 \pm 38.65\,cm^3$), gmed by $9.82 \pm 2.33\%$ ($49.42 \pm 11.78\,cm^3$) and gmin by $9.79 \pm 3.10\%$ ($17.51 \pm 6.38\,cm^3$). Horizontal fragmentation of the muscle changes revealed a more profound hypertrophic effect in the upper buttock region (at the level of/above femoral head). This translated into a visible buttock lifting, also captured by patient photography. No adverse events were observed. Weight changes were insignificant.
Conclusion: MRI analysis revealed simultaneous enhancement of all three gluteal muscles 1-month post-treatments while showing no adverse events. This represents the first objective evaluation of tissue structural changes which may explain the aesthetic improvement previously reported by other authors.

Clinical Applications – Cutaneous – *Laser-Assisted Delivery*

FACTORS AFFECTING HISTOLOGIC DEPTH OF PENETRATION IN NEEDLING- AND LASER-ASSISTED DRUG DELIVERY

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Background: Needling- and laser-assisted drug delivery are emerging techniques to treat scars, aging skin, and actinic keratoses. It is unknown how the timing of topical drug application, before versus after needling/laser treatment, affects the depth of penetration. We conducted an ex-vivo study to compare the histologic depth of penetration among microneedling, roller needling, and CO_2 laser treatments both before and after application of ink.

Study Design/Materials and Method: Excess skin harvested from abdominoplasties was tested with: (A) Ink and consecutive microneedling, roller needling, or CO_2 treatment at 30 min, 1 hour, 2 hours, 3 hours, 4 hours, and 6 hour increments. (B) Microneedling, roller needling, or CO_2 treatment and consecutive ink application at 30 min, 1 hour, 2 hours, 3 hours, 4 hours, and 6 hour increments. The specimens were stained with hematoxylin and eosin, and histologic depth measured.

Results: Ink applied before microneedling reached the greatest mean depth of penetration when compared to ink applied after the microneedling as well as any treatments with roller needling or CO_2 laser ($P < 0.05$). Furthermore, there was a time-dependent increase in penetration that plateaued at 3 hours with microneedling. Conversely, there was a time-dependent decrease in penetration with CO_2 laser.

Conclusion: Ink applied before microneedling exhibited the greatest depth of penetration compared to treatment with roller needling or CO_2 laser. The depth of penetration is time-dependent with microneedling and plateaus around 3 hours.

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

CLINICAL ASSESSMENT OF A REAL TIME, NON-INVASIVE, *IN VIVO* SKIN CANCER DIAGNOSTIC DEVICE BASED ON LASER SPECTROSCOPY AND DEEP LEARNING ALGORITHM USING AESTHETIC LASERS

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Background: There have been several optical-based techniques for *in vivo* skin cancer detection and screening such as multi-spectral imaging and Raman spectroscopy. However, they adopt high cost lasers and imaging sources and have relatively insufficient accuracies for actual clinical use. In this study, a real time, non-invasive, *in vivo* skin cancer diagnostic device has been developed with high diagnostic accuracy based on non-discrete molecular laser induced breakdown spectroscopy (LIBS) and deep learning algorithm using pre-existing aesthetic lasers as its excitation sources.

Study Design/Materials and Method: A single-site study was designed to evaluate the effectiveness and safety of the aforementioned diagnostic device. A conventional Q-switched 1064 nm laser was used to induce micro plasma from the suspicious skin lesion. Real-time analysis was performed on the plasma light spectrally, to extract elemental and molecular information of the suspicious lesions. The algorithm was validated by collecting and assessing emission spectra from 33 skin cancers and 55 benign lesions on 29 subjects. Three different laser irradiations were applied to each lesion and the corresponding spectra were averaged for the analysis of each lesion.

Results: Algorithmic analysis is the process of comparing the acquired spectra to a previously collected spectral database (derived from 5302 emission spectra of cancerous and benign lesions) and determining similarities. Device results were compared with the histopathology results. Analysis achieved a sensitivity of 97.0% and specificity of 87.3% in discriminating skin cancers from benign lesions in a blind setting.

Conclusion: A novel skin cancer diagnostic device based on non-discrete molecular LIBS and deep learning algorithm demonstrated to be a promising, low-cost tool for the detection of skin cancers with superior diagnostic accuracy compared to other previous optical-based diagnostic techniques.

Clinical Applications – Cutaneous – *Pigment*

BIOLOGICAL EFFECT OF A HIGHLY FOCUSED, SCANNED, NEAR-INFRARED LASER ON DERMAL PIGMENT

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Background: Selective photothermolysis relies on absorption of light by a target along with the proper choice of pulse duration to achieve selectivity. However, absorbing structures above or below the target in the skin are also affected as evidenced by treatments on dark skin type patients, where the epidermis becomes the unintended target. A novel device was developed which enables three-dimensional spatial placement of the treatment zone in tissue, creating high fluence in a localized region at the intended depth in skin while minimizing the fluence in other regions.

Study Design/Materials and Method: We developed an animal model of hyperpigmentation by tattooing a light-skinned Yucatan pig with a synthetic melanin tattoo. Treatments were performed on the tattooed areas with a prototype laser based on a high numerical aperture focused, scanned 1064 nm Q-switched fiber laser. Biopsies were taken before and immediately post-treatment. Fontana Masson-stained histology and electron microscopy of the tissue sections before and after treatment were compared. Treatments were also performed on stable PIH on the back of a skin type IV human subject, and biopsies were taken. Histology with H&E, Fontana Masson, and TUNEL (apoptosis detection) staining were compared between an untreated control and the treated lesion.

Results: Fontana Masson stained histology of the tattooed pig showed the presence of dermal melanin, validating the animal PIH model. Electron microscopy of the pig skin showed destruction of melanin-containing macrophages in the dermis post-treatment and no damage to tissue in the immediate vicinity. TUNEL-stained histology on human PIH lesions showed apoptosis in the melanin- containing cells in the dermis but no injury to the epidermis.

Conclusion: The new 3D spatially selective laser platform has been shown to allow precise targeting of tissue structures in the treated volume of the skin while sparing tissue around it. It

may have the potential to treat dermal benign pigmented lesions even in dark skin types. Additional studies are ongoing to explore its use for other indications.

TREATMENT FOR INFRAORBITAL DARK CIRCLES USING PICOSECOND ALEXANDRITE LASER WITH DIFFRACTIVE LENS ARRAY IN ASIANS

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Background: Infraorbital dark circles (DC) refer to conditions that represent dark shadowing in the lower eyelid. Pigmentary type DC, in the past, was one of the most challenging pigmentary indications to be treated by nanosecond technology because the unpredictable thermal injury from nano- to milli-second light-based devices tends to cause post inflammatory pigmentary alteration. The objective of this study was to evaluate the efficacy and safety of picosecond alexandrite laser with diffractive lens array for infraorbital dark circles in Asians.
Study Design/Materials and Method: 48 patients with pigmentary type DC were retrospectively reviewed and evaluated. All subjects were Fitzpatrick skin type III or IV. A picosecond alexandrite laser was used to treat all patients with zoom hand piece with spot size ranged from 3.5 to 4.5 mm for one to two passes, followed by either 6, 8, 10 mm diffractive lens array for one to two passes. Each patient was treated for 4–8 sessions with a one-month interval. Clinical photographs were taken at baseline and prior to every treatment session. Images were evaluated independently by two dermatologists using a quartile scale.
Results: The darker the lesion was; the more clearance could be achieved. 94% of the patients had 50% or greater clearance. Only 6% of the patients received less than 50% improvement. 69% of the patients had 75% clearance or one-month. Transient hyperpigmentation was observed in 5 patients and resolved in 1–2 months. Transient hypopigmentation was observed in 2 patients and resolved after 2–3 months.
Conclusion: A picosecond 755 nm laser with diffractive lens array can serve as a safe and effective treatment option for pigmentary type dark circle in Asians.

Clinical Applications – Cutaneous – *Rejuvenation*

A PROSPECTIVE PRE-PIVOTAL STUDY TO EVALUATE THE SAFETY AND EFFICACY OF A DERMAL MICRO-CORING DEVICE FOR THE TREATMENT OF MODERATE TO SEVERE FACIAL WRINKLES

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Background: A number of minimally invasive, nonsurgical treatment techniques have been used to improve moderate to severe facial wrinkles, including lasers, radiofrequency, ultrasound, chemical peels and dermabrasion. We introduce a novel skin micro-coring device that removes tiny cores of skin from the dermis in a very precise and controlled fashion to stimulate new collagen production without the use of energy.
Study Design/Materials and Method: This is a prospective multi-center IRB approved pre-pivotal study to evaluate the safety and efficacy of an automated high throughput 2nd generation micro coring system for the treatment of moderate to severe wrinkles of the face and neck (submental) area. 20 female subjects were treated in 3 clinical sites. Safety was assessed based on the occurrence and severity of adverse events recorded by the PI during the study visits, and the 14 days diary completed by each of the subjects. Efficacy was assessed based on Lemperle wrinkle scale, GAIS and Subject Satisfaction Scales at 90 days.
Results: After one treatment, 85% Improvement in Moderate/Severe Wrinkles: treatment areas which improved 1 or 2 grades on the Lemperle scale. 90% Overall Improvement: Investigators who rated the treatment improved to very much improved on the GAIS scale. 100% Overall Subject Satisfaction: Subjects who were satisfied to extremely satisfied on Satisfaction Scale assessed by subject. 1.2 average pain during treatment (0–10 scale Wong-Baker scale). No AEs or SAEs: Subjects tolerated treatment well.
Conclusion: Removal of skin at the micro scale without energy is a safe and effective treatment resulting in an improvement of one or more grades on the Lemperle Wrinkle scale.

THE USE OF NON-INVASIVE DEVICES AND MICROBIOPSY PUNCHES (0.33 mm) TO OBJECTIVELY MEASURE CHANGES IN HUMAN FACIAL SKIN AFTER FACIAL REJUVENATION TREATMENT

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Background: While patient reported outcomes and blinded observer rating scales are subjective and unreliable, they have been extensively utilized to evaluate cosmetic office based treatments including ablative lasers. Here, we aim to objectively assess the effectiveness of 1470 nm/2940 nm laser treatment for facial skin rejuvenation using non-invasive devices and minimally invasive microbiopsy punches.
Study Design/Materials and Method: Twelve patients received 1470 nm/2940 nm laser treatments for facial rejuvenation. Assessments were executed before treatment, seven days, three weeks, and three months post-treatment. VISIA images were taken to measure spots, wrinkles, textures, pores, UV spots, brown spots, red areas, and porphyrins. Microbiopsies (0.33 mm in diameter) were collected for histological and gene expression evaluation of tissue rejuvenation. Non-invasive skin measurements, high resolution ultrasonography, optical coherence tomography (OCT), transepidermal water loss (TEWL) and BTC 2000 were utilized to measure epidermal/dermal thickness, blood flow, surface roughness, wrinkle depth, attenuation coefficient, elasticity, laxity, and viscoelasticity.
Results: The non-invasive skin assessment were able to detect significant changes after treatment in a variety of parameters. Significant improvement were seen in UV spots at 3 weeks and 3 months ($P < 0.05$) and brown spots at 3 months ($P < 0.05$). At 3 months, elasticity was significantly improved ($P < 0.05$). Attenuation coefficient decreased significantly at 3 weeks ($P < 0.05$) and lastly, blood flow at 0.6 mm depth increased significantly at 3 weeks ($P < 0.05$). Epidermal hyaluronic acid expression assessed by immunostaining and expression of inflammatory genes IL-1 beta was greater in day 7 post-treatment biopsies compared to untreated or 3 months post-treatment. There were no statistical changes in collagen or elastin related genes between groups.

Conclusion: Non-invasive devices can be effectively used to provide objective measurements of skin structure, pigmentation, blood flow and elasticity to assess the effectiveness of facial skin rejuvenation treatments. Further, microbiopsies can objectively evaluate facial skin rejuvenation without scarring.

TOPICAL TIMOLOL EXPEDITES HEALING AFTER CO_2 LASER RESURFACING

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Background: Topical timolol has recently been reported to improve healing of recalcitrant, chronic wounds. Skin wounding created by CO_2 laser resurfacing could be considered a form of acute burn injury. Given that beta-blockade has been shown to improve outcomes in burn wounds and expedite healing of chronic wounds, this study was performed to see if application of topical timolol immediately after laser resurfacing would also enhance re-epithelialization and promote rapid healing.
Study Design/Materials and Method: The volar forearms of a 68-year-old Fitzpatrick Type II female was subjected to confluent CO_2 laser ablation. All treatment sites underwent standard post-laser twice daily wound care. One of the two spots on each forearm received topical application of 1 drop (0.05 mL) of timolol 0.5% gel forming solution. All wounds were imaged on a weekly basis. Transepidermal water loss (TEWL), an indicator of skin barrier function and a proxy for wound healing and epithelialization, was measured weekly.
Results: There was a statistically significant difference between the mean TEWL between the timolol-treated site and control for both right and left forearms. The rate of healing, as measured by the decrease in TEWL, was faster for the timolol-treated site compared to the control site for both the right and left sides. The decrease in TEWL approached that of normal skin for both the timolol-treated and control sites with the latter showing a much slower rate of change and lagging behind timolol.
Conclusion: Topical application of timolol following fully ablative laser resurfacing significantly expedited wound healing compared to conventional wound care alone. Additional studies are needed with greater sample size across different individuals, preferably in split-face fashion, to see if our results are reproducible in the actual clinical scenario of cosmetic facial laser resurfacing.

Clinical Applications – Cutaneous – *Scar*

A PROSPECTIVE, CONTROLLED, MULTI-CENTER, PILOT STUDY TO EVALUATE THE EFFICACY OF MICRO-EXCISIONAL SKIN REMODELING WITH MICRO-CORING DEVICE IN THE TREATMENT OF ACNE SCARS AND STRIAE

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Background: Scar treatment is important in clinical medicine. Challenging scars include atrophic facial acne scars and abdominal striae. These scars often exhibit features of hypopigmentation and atrophy. Additional therapies are needed that consistently improve these subtypes of human scars. Dermal micro-coring is a new excisional mechanical technology that has been studied for skin laxity and rhytids. These micro excisions physically remove small cores of skin with immediate physical hole closures. After micro-coring treatment there are quantitative and directional reductions in area of skin. This study is the first to investigate this novel technology for the treatment of scars acne and striae on and off face.
Study Design/Materials and Method: This is a prospective, multi-center, IRB-approved pilot study evaluated the effectiveness of a micro-coring device for micro-excisional scar rehabilitation by using 22 gauge needle at densities 5% or 10% in subjects. 20 subjects were be treated in 2 clinical sites. Before and after photographs with Manchester scar scale, POSAS, optical coherence tomography (OCT) and histology of the treated areas and adjacent untreated skin were evaluated.
Results: 20 subjects with atrophic facial acne scars or striae (alba, rubra or distensae) on abdomen received three treatments with micro-coring technology. No unanticipated adverse events were recorded. OCT revealed immediate skin closure within minutes of treatment. Histology of 4 subjects showed decreased fibrosis. Both investigators and subject scores improved.
Conclusion: Pilot study shows micro-excisional device for scar rehabilitation both on and off face for acne scars and striae is safe and effective novel treatment therapy. High overall subject improvement and satisfaction. Micro-coring technology gives us new technique which improves challenging scars both on and off face.

PERSISTENT IMPROVEMENT AT THREE YEAR FOLLOW-UP IN A PATIENT WITH LOCALIZED DEEP MORPHEA TREATED WITH BOTH INJECTED AND LASER-ASSISTED TOPICAL POLY-L-LACTIC ACID

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Background: Morphea is a rare fibrosing disorder that can cause significant cosmetic disfigurement and many correction techniques may lead to suboptimal results. Here in, we report a novel case of localized deep morphea that was successfully treated with fractionated CO_2 laser in combination with topical and injected PLLA.
Study Design/Materials and Method: A 44-year-old female with biopsy proven localized deep morphea presented with a depressed sclerotic plaque with shiny hypopigmentation on her left lateral shoulder. She received four treatments separated by approximately three months time of both superficial and deep fractional CO_2 laser treatment (pulse energy 80 mJ, density 5% and pulse energy 50 mJ, density 10%) followed by immediate application of 0.3–1 cc of topical PLLA as well as 0.2–1 cc of injected PLLA.
Results: She tolerated her treatments well without any adverse effects. One month after her treatments, significant cosmetic improvement was noted. She was seen for follow-up three years following her final treatment and the site retained its cosmetic improvement without the need for repeated treatments.
Conclusion: Fractional CO_2 in combination with PLLA is a promising treatment modality in cases of cosmetically disfiguring morphea. Immediate formation of microscopic treatment zones (MTZs) removes fibrotic tissue and releases skin tightness. Delayed wound healing then occurs *via* collagen production. Furthermore, vertical channels of ablation created by the CO_2 laser can then be used for laser-assisted drug delivery. PLLA, unlike other typical volume-based fillers, stimulates collagen production and results have been reported to last 18–36 months or longer. In our case presented here, correction was performed with excellent patient satisfaction and continued improvement at three year follow-up with no reduction in perceived efficacy. In summary, we highlight that PLLA filler may be used in combination with fractionated CO_2

laser for sustained cosmetic improvement in morphea by synergistically increasing new collagen synthesis.

RADIOFREQUENCY MICRONEEDLING AND POLY-L-LACTIC ACID AS A TREATMENT FOR ATROPHY AND CREPING IN QUIESCENT SCLEROTIC CUTANEOUS GRAFT-VERSUS-HOST-DISEASE

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Background: Chronic graft versus host disease (GVHD) often occurs after bone marrow transplant and can result in sclerotic skin lesions, causing significant morbidity. Sclerotic GVHD can be successfully mitigated with immunosuppressants but despite systemic treatment may result in significant atrophy and creping of the skin in previously involved sites. These skin changes are often physically disfiguring and psychologically distressing to patients. We investigate if bipolar radiofrequency microneedling combined with injected poly-L-lactic acid (PLLA) would provide a safe and effective benefit in a patient with well-controlled sclerotic GVHD with resultant atrophy and creping of the arms.

Study Design/Materials and Method: Given radiofrequency, microneedling and PLLA are accepted treatments for atrophy, this pilot investigation involving one patient is considered IRB exempt. A 55-year-old female with a history of acute myelogenous leukemia, treated with allogeneic stem-cell transplant, developed sclerotic GVHD, subsequently well controlled with oral tofacitinib. She was consented for treatment of resultant upper arm atrophy and creping with bipolar radiofrequency microneedling followed by a cooling period and ensuing subcutaneous injection of PLLA (3 milliliters per arm). The localized scleroderma quality of life instrument (LoSDI), a validated tool in evaluating effects of cutaneous sclerosis, was administered before and 6 weeks after the procedure.

Results: Physical examination revealed mild improvement in atrophy and decrease in creping of the skin with one treatment. The LoSDI showed improvement in areas related to perceived appearance of the skin. Other than pain and bruising, no adverse effects were noted.

Conclusion: While repeat treatments with long term follow-up are planned, and future investigation in larger numbers of patients is necessary to more thoroughly evaluate this treatment regimen, there may be a role for radiofrequency microneedling with PLLA as a safe and effective treatment in quiescent sclerotic GVHD, for skin atrophy and creping.

Clinical Applications – Cutaneous – *Vascular*

PORT WINE STAIN TREATMENT OUTCOMES HAVE NOT IMPROVED OVER THE PAST THREE DECADES

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Background: Since the early '80s the pulsed dye laser has been the standard treatment for port wine stains (PWS). In the last 3 decades, a considerable amount of research has been conducted to further improve clinical outcomes, given that a fraction of PWS patients proved recalcitrant to laser treatment. Whether all the research actually led to increased therapeutic efficacy has not been systematically investigated.

Study Design/Materials and Method: The literature was systematically searched for all available PWS trials since 1986. Studies with a quartile percentage improvement scale were included. A mean clearance per study was calculated and a 5-study simple moving average was created to assess the trend in mean clearance over time. Moreover, we separately analysed the subgroup with multiple treatment sessions in previously untreated patients.

Results: Sixty-two studies were included (28% of eligible studies) comprising 5,873 PWS patients. Of all patients, 22% achieved 75–100% clearance. Although a few studies reported remarkably good outcomes in a subset of carefully selected patients, there was no upward trend in mean clearance over time in the total group or the subgroup

Conclusion: The efficacy of PWS therapy has not improved in the past decades, despite research efforts and numerous technical innovations. With an unwavering patient demand for better outcomes, the need for development and implementation of novel therapeutic strategies in order to clear all PWS is as valid today as it was 30 years ago.

PRECLINICAL *IN VIVO* EVALUATION OF VASCULAR EFFECTS OF PULSED DYE LASER IN COMBINATION WITH OXYMETAZOLINE

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Background: Oxymetazoline is a medication with vascular effect approved for topical treatment of persistent facial erythema associated with rosacea. Due to the dynamic effect of this agent on the vasculature, oxymetazoline may be a useful adjunct for pulsed dye laser (PDL) treatments.

Study Design/Materials and Method: A dorsal window chamber was surgically installed on 18 mice. Each animal was applied to one of the following experimental groups: saline alone (negative control), oxymetazoline alone (10 μL applied on daily basis), PDL alone [saline applied five minutes before PDL irradiation (10 mm spot size, 1.5 ms pulse duration, 7 J/cm^2 delivered to epidermal side of the window), or oxymetazoline + PDL (10 μL oxymetazoline applied five minutes before PDL and then on daily basis). To monitor vascular architectural and functional changes, brightfield and laser speckle imaging were performed for seven days.

Results: With application of oxymetazoline, inconsistent changes were observed in vessel diameter. PDL alone at study settings resulted in an initial decrease but subsequent recurrence of flow at seven days post-irradiation. With oxymetazoline + PDL, a noticeable difference in vascular effects were observed at seven days: an increase in probability of vascular shutdown and a difference in vascular architecture (an increase in tortuous microvasculature that is suggestive of replacement of native larger vessels with smaller vessels *via* angiogenesis).

Conclusion: Oxymetazoline + PDL may enhance cutaneous vascular shutdown and should be explored as a combined treatment option for cutaneous vascular conditions including rosacea and port wine birthmarks.

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

SAFETY AND EFFICACY OF HYBRID FRACTIONAL LASER (1470 nm and 2940 nm) FOR SYMPTOMS OF GENITOURINARY SYNDROME OF MENOPAUSE: PROSPECTIVE MULTI-CENTER STUDY: 6 MONTH INTERIM ANALYSIS

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Background: Genitourinary syndrome of menopause (GSM) is a new terminology to describe symptoms occurring secondary to vulvovaginal atrophy. Vaginal symptoms associated with GSM include vaginal dryness, discharge, itching and dyspareunia. Energy based devices including laser and radio-frequency devices have demonstrated positive results in treatment of GSM. This is the first multi-center prospective study to evaluate the safety and efficacy of hybrid fractional laser utilizing simultaneous delivery of 2940 nm Erbium and 1470 nm Diode wavelengths to treat symptoms of GSM.

Study Design/Materials and Method: Prospective, multi-center study at 5 centers in U.S. 53 peri- and post-menopausal females (mean age 59 ± 6.5) with at least 2 self-reported symptoms of GSM were enrolled. To date, 36 subjects completed 3 and 6 month follow-up. This abstract reports findings of those subjects. Baseline demographics and pelvic exam data were recorded. Vaginal Health Index Scale (VHIS), Female Sexual Function Index questionnaire (FSFI), and Day-to-day Impact of Vaginal Aging questionnaire (DIVA) scores were collected at baseline, treatment and follow-up visits. Vaginal Maturation Index (VMI) was collected at baseline and follow-up visits. Histological samples were collected at 4 sites from 2 randomly picked subjects at baseline, 3, 6 and 12-month follow-up visits. Subjects received 3 treatments at 4-week interval (settings: 1470 nm – 200–600 μm [density 6–15%], 2940 nm – 200–300 μm [density 7–14%]). Follow-up visits were conducted at 1, 3, 6 and 12 months following the third treatment.

Results: FSFI scores demonstrated significant improvement in all domains at 3 and 6 months with percent improvement of 50–133%. DIVA scores demonstrated significant improvement in all domains at 3 and 6 months ($P < 0.05$), with percent change of 30–82%. Maturation index improved at 3 and 6 months compared to baseline with decrease in percent of parabasal cells and increase percent of superficial cells. Overall VMI improved at 3 and 6 months. VHIS statistically improved in all domains (elasticity, epithelial integrity, lubrication) with a percent improvement of 52–119%. Significant histological changes were observed with 114% increase in epithelial thickness at 6 months and 62% change at 3 months. Overall increase in tissue cellularity was observed. No adverse events reported.

Conclusion: The 3 and 6-month data demonstrates that the hybrid fractional laser, with simultaneous delivery of 2940 nm Erbium and 1470 nm Diode wavelengths, is safe and efficacious treatment for GSM with statistical improvements in vaginal health, sexual function, and quality of life.

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

EFFICACY AND SAFETY OF VAGINAL CO_2 LASER IN PATIENTS WITH URODYNAMIC STRESS URINARY INCONTINENCE

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Background: Vaginal laser has recently been introduced as an optional treatment for urinary stress incontinence (USI). The limited studies that were published are lack of urodynamic assessment, and most of them demonstrated significant subjective improvement. The objective of this study was to assess the efficacy and safety of vaginal CO_2 laser in women with urodynamic USI.

Study Design/Materials and Method: This was a prospective multicenter study. Patients were eligible to participate only if they had urodynamic proven stress incontinence and their incontinence was graded as mild or moderate (by Sandvik score). Vaginal application of pixelated CO_2 laser. Every patient had three sessions of vaginal CO_2 laser treatment, 4–5 weeks apart, and follow-up at 3, 6 and 12 months since treatment began. We used 1-hour pad test (ICS protocol), questionnaires including PFDI-20, PFIQ, Patient Global Impression of Improvement (PGI-I) and a 3-day urinary diary. Urodynamic assessment was repeated at 6 months. We present an interim analysis of 6 months follow-up.

Results: 33 women completed follow-up for 6 months. The patients' mean age was 52.5 (range: 35–73), 36.4% were menopausal, parity was 2.6 (0–4), 13.6% were smoking and their mean BMI was 27.9 (18.4–37.2). No serious adverse events were recorded. Pad test showed significant weight reduction at 3 months and 6 months follow-up. PGI-I increased gradually to 75% at 3 months and dropped to 57% at 6 months. Patient's bladder symptoms (PFDI) improved significantly between 1 to 6 months and accordingly quality of life (PFIQ) improved significantly. Stress test with full bladder was negative in 68% at 6 months, however urodynamic assessment was negative for stress incontinence only in 33%.

Conclusion: Vaginal CO_2 laser was found safe and efficacious treatment for patients with urodynamic USI. The time dependent efficacy strengthens the need to test our treatment protocols and to assess long term follow-up.

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

LASER SKIN REJUVENATION OF FEMALE EXTERNAL GENITAL ORGANS WITH A 650 MICROSECOND Nd:YAG 1064 nm LASER

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Background: The labia majora area and the perineum are covered with skin similar to that of the rest of the body. So, it develops similar aging signs including loss of elasticity and often hyperpigmentation. Fractional CO_2 laser and RF technology have been used to tighten skin in this area however these technologies are typically associated with substantial treatment and post-treatment discomfort. This study was conducted to evaluate the safety and efficacy of a 650 microsecond pulsed Nd:YAG 1064 nm laser for the skin tightening and skin lightening in the female external genital organs area.

Study Design/Materials and Method: 25 female subjects aged 40 to 50 years with Fitzpatrick skin types I to III underwent 5 treatments in 4 week intervals with a 650 microsecond pulsed Nd:YAG 1064 nm laser (Aerolase, Tarrytown, NY). Subjects were evaluated after each treatment and 12 weeks after the last one. Prior to treatment, all genital organs area and surrounding skin was cleaned with chlorhexidine and pap smear test was performed. Five to eight passes of non-overlapping pulses with a 6 mm spot size at a fluence of 21 to 25 Joules/cm^2 were applied over the labia majora, labia minora and surrounding skin areas. Subjects were evaluated for potential erythema, edema, burns, blisters and pain sensation. Photographs were taken before and after treatments.
Results: All subjects reported feeling a deep sensation of warmth and skin tightening but no treatment pain. No anesthetics were used. No complications were observed, including hyperpigmentation, burns, blisters, scars. Skin tightening and skin lightening was observed on most of the subjects. 84% of subjects were satisfied or very satisfied with the results of treatment. Many reported improved quality of sexual activity
Conclusion: 650 microsecond pulsed Nd:YAG 1064 nm laser is safe, gentle and effective for the rejuvenation of skin in female external genital organs area with no discomfort or downtime associated with the treatment. Further studies are recommended.

Early Career Clinical and Scientific

1064nm Nd:YAG LASER WITH A 650ms PULSE DURATION FOR THE TREATMENT OF MELASMA: A CLINICAL EVALUATION

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Background: The effective treatment of melasma remains a therapeutic challenge. The 1064nm Nd:YAG laser with a 650-microsecond pulse duration is safe for all skin types and is more tolerable then conventional long-pulsed Nd:YAG lasers. We aim to evaluate the efficacy and safety of the 1064nm Nd:YAG laser with a 650-microsecond pulse duration for the treatment of melasma.
Study Design/Materials and Method: Patients were treated with the 1064nm Nd:YAG laser with a 650-microsecond pulse duration. The energy mode ranged from 3 to 4, which corresponds to a fluence of 11 to 14 J/cm2 with a 6mm spot size, and 3 passes were performed per treatment session. Each treatment session was scheduled approximately 3-4 weeks apart, and photographs were taken prior to each treatment.
Results: Some patients experienced initial darkening for 1-4 weeks prior to improvement. Lightening of hyperpigmentation was seen as early as 3 weeks after the first treatment session. Final results are still ongoing and pending additional recruitment.
Conclusion: The 1064nm Nd:YAG laser with a 650-microsecond pulse duration may be a useful laser modality in the treatment of melasma. Advantages include minimal downtime, no pain, no required cooling system, and the ability to treat all skin types. Melasma continues to be a therapeutic challenge. A multimodal approach including strict sun protection, bleaching creams, and peels remains the best approach. The 1064nm Nd:YAG laser with a 650-microsecond pulse duration is an additional treatment option in our armamentarium.

EVALUATING THE CLINICAL EFFICACY OF PLATELET-RICH PLASMA FOR SCARRING ALOPECIA USING OPTICAL COHERENCE TOMOGRAPHY

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Background: Scarring alopecia describes permanent hair loss caused by significant inflammation and subsequent hair follicle destruction. Current therapies are limited by efficacy and side effects. Platelet-rich plasma (PRP) is used for tissue regeneration and wound healing in many specialties including dermatology. Research suggests a beneficial role in hair growth, specifically non-scarring alopecias. The role of PRP in scarring alopecia treatment is not well understood. We investigated the clinical efficacy of PRP for scarring alopecias as evaluated by optical coherence tomography (OCT), a novel, non-invasive imaging modality to quantitatively monitor hair regrowth.
Study Design/Materials and Method: Three PRP sessions were performed every 6 weeks; patients received approximately 9mL PRP as intradermal scalp injections each session. Clinical response was evaluated using serial photography, dermoscopy, OCT, and physician/patient-reported qualitative scales. OCT was used to monitor nine scalp locations, including the frontal hairline, temple, crown and vertex.
Results: Two patients with scarring alopecia were enrolled. One patient with scalp dermatomyositis demonstrated significant improvement in epidermal thickness, scale, erythema, pruritus and hair shedding three weeks after receiving the first session of PRP. Twelve weeks after the last PRP session, she appeared “much improved” compared to baseline as rated by both patient and physician. OCT measurement of active hair follicles increased on the left temporal scalp by 24.5%; however, decreases were noted at midline (-9.9%) and right temple (-16.0%). The second patient suffered from radiation-induced scarring alopecia; OCT demonstrated an average 69.7% increase in active hair follicle count from baseline to twelve weeks post-treatment. She reported being “improved” after PRP treatment. Additional cases will be accrued and analyzed in the final results.
Conclusion: PRP may be an effective therapy for scarring alopecia, demonstrating an increase in hair follicle count post-treatment. OCT is a reliable quantitative imaging modality that can be used in the outpatient setting to longitudinally monitor hair regrowth after PRP.

NOVEL APPROACH OF REGROWING HAIR WITH FRACTIONAL NON-ABLATIVE 1565nm LASER

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Background: Various types of alopecia exist and many approaches are being used and studied for treatment including: injectables, low level laser therapy and oral medications but still the results are not optimal and the time to get visible improvement is relatively long. Our approach evaluates a treatment with NAFL in both men and women for various alopecia types by re- activating the growth cycle of hair follicles using the method of fractional photothermolysis.
Study Design/Materials and Method: In our clinic over 100 patients were treated throughout 2017–2018. Patients presenting various types of alopecia (e.g. androgenic, areata, telogen effluvium) underwent up to 8 treatments at 2-3 week

intervals. A total of 30 patients were treated with laser therapy alone, 50 patients underwent a combined course well-known methods of treating alopecia, such as minoxidil, PRP, and drugs. The device that was used is a 1565 nm fractional non-ablative laser (Lumenis Ltd.). The treatment was tailored per case corresponding to the number of hair follicles and the patients age. Immediate responses as well as adverse events were monitored throughout the treatment and following treatment visits.

Results: Results could be noticed 2 weeks following first treatment. In all patients, full or partial restoration of hair growth was achieved in 2-3 months. The hairs appeared thicker and longer. All treatments were carried out without any application of anesthesia and were well tolerated and acceptable by the patients. No adverse effects were reported.

Conclusion: Non-ablative 1565 nm laser can be used as monotherapy and in combination with traditional methods of therapy to provide optimal results with the synergistic effect. Fractional laser alone can stimulate hair growth in various types of alopecia and provide safe treatment with fast and sustainable outcomes.